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TECHNOLOGY TRUST: THE IMPACT OF ANTHROPOMORPHIC SYSTEM INFORMATION ON THE ACCEPTANCE OF AUTONOMOUS SYSTEMS USED IN HIGH-RISK APPLICATIONS

by

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Autonomous systems provide the military with advanced capabilities permitting the execution of increasingly dangerous and difficult missions. A human in the loop is still required to decide how and when to deploy these technologies. The research problem this dissertation addresses is a user's rejection of new technology in high-risk applications due to a lack of trust in the use of the technology. This is a problem because users' lack of trust in new technology, designed to support users in high-risk situations, will prevent the use of the technology. The purpose of this dissertation is to investigate the effect of information presented about a new technology as well as the effect of the level of automation offered by the new technology on the perceived trust (i.e., as measured by the perceived usefulness, ease of use, and intent to use). An experiment was conducted that manipulated the level of automation and the presentation of information in three systems. The results indicated that, in high-risk scenarios, it is not possible to develop trust in technology without the system presentation of operational information. The study results also indicated that the level of automation was not a factor in developing technology trust in high-risk scenarios.

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ABSTRACT

Autonomous systems provide the military with advanced capabilities permitting the execution of increasingly dangerous and difficult missions. A human in the loop is still required to decide how and when to deploy these technologies. The research problem this dissertation addresses is a user's rejection of new technology in high-risk applications due to a lack of trust in the use of the technology. This is a problem because users' lack of trust in new technology, designed to support users in high-risk situations, will prevent the use of the technology. The purpose of this dissertation is to investigate the effect of information presented about a new technology as well as the effect of the level of automation offered by the new technology on the perceived trust (i.e., as measured by the perceived usefulness, ease of use, and intent to use). An experiment was conducted that manipulated the level of automation and the presentation of information in three systems. The results indicated that, in high-risk scenarios, it is not possible to develop trust in technology without the system presentation of operational information. The study results also indicated that the level of automation was not a factor in developing technology trust in high-risk scenarios.

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LIST OF ACRONYMS AND ABBREVIATIONS

AI	Artificial Intelligence
ANOVA	Analysis of Variance
AUV	Autonomous Underwater Vehicle
BLUE	Best linear unbiased estimator
DOD	Department of Defense
EOD	Explosive Ordnance Disposal
GUI	Graphical User Interface
HAI	Human Automation Interaction
HAL	Hardware Algorithms Links
HCI	Human Computer Interaction
IID	Identically and Independently Distributed
IIT	Information Integration Theory
IT	Information Technology
IU	Intent to Use
KW	Kruskal–Wallis
LEON	Littoral Explosive Ordnance Neutralization
LOA	Level of Automation
MW	Mann–Whitney test
NIWC	Naval Information Warfare Center
PEOU	Perceived Ease of Use
PU	Perceived Usefulness
RCO	Rapid Capability Office
ROV	Remotely Operated Vehicle
SAE	Society of Automotive Engineers
SUS	System Usability Score
TAM	Technology Acceptance Model
TRL	Technology Readiness Level
USMC	United States Marine Corps
UUV	Unmanned Underwater Vehicle

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I. INTRODUCTION

In the movie, *2001: A Space Odyssey,* Stanley Kubrick (1968) presented a sentient computer named HAL that terrified audiences with the prospect of a future run by autonomous machines. The premise is that a computer becomes self-aware and no longer trusts the judgment of its human creators. HAL begins to view humans as a virus and a threat to mission success that must be eliminated. Recent developments in the field of artificial intelligence have created a reality that is not far removed from the computer envisioned as HAL.

Norbert Wiener (1960) said, "We had better be quite sure that the purpose put into the machine is the purpose which we desire." The societal impact of advanced technologies such as autonomous systems on human-machine relations has for long interested science fiction writers, futurists, and scholars. Futurist and key innovator in the field of artificial intelligence, Ray Kurzweil (2005) discussed the implications of the human entanglement with technology in an event he calls "the singularity." The singularity is a "future period during which the pace of technological change will be so rapid, its impact so deep, that human life will be irreversibly transformed" (Kurzweil, 2005, p. 24). Humans, Kurzweil believes, will become so dependent on technology that we will lose our ability stop or control its progress. He postulates that the singularity is inevitable and a result of the current exponential pace of growth in human-created technology.

Advanced system developments create a challenge for many system operators, especially in high-risk, dangerous situations, who must trust new autonomous or semi-autonomous systems to perform as predicted by their developers. The challenge, in part, is to provide users with the kind of system information that will help them address concerns about the trustworthiness of these new advanced systems to help them resolve highly risky, dangerous situations, such as explosive ordinance removal and disposal.

The general concept of trust is difficult to operationally define and quantify, and this is especially true in the context of technology trust. When reviewing trust literature, the discussions tend toward the topics of risk, expectation, and predictability (Castelfranchi

& Falcone, 2010). A potential reason that trust is difficult to quantify is found in the subjective nature of the human experience with technology systems that is based on the information about the systems presented to them as well as the level of automation of the systems. For example, someone purchasing a new car must deal with multiple issues of system trust. One issue is trust in the car itself, and another is how much the information provided to the purchaser by the car dealer affects their trust in the car and its new system features such as collision avoidance, lane departure control, or self-driving, fully autonomous operation. Different purchasers may have different levels of trust in the car, and its systems, as well as in the information provided by the car dealership. One dealership may simply place a car on its lot, while another may take a more in-depth approach by having a salesperson learn the system information regarding the semi-autonomous or fully autonomous features of the car. For a transaction to occur, a new car buyer needs to develop trust in both the car and its system features, and the system information provided by the dealer.

The ability to trust or distrust is improved by experience with a new system. This statement is based on statistical probability that demonstrates that repeated experience increases the ability to accurately predict a future outcome of a given new system. One technique for increasing trust in lieu of experience is through familiarity (Luhmann, 2000). An interesting technique for improving familiarity is found in the concept of anthropomorphism (assigning human attributes to nonhuman entities), which is an associated technique used to increase familiarity in nonhuman entities (Waytz et al., 2010), including new systems.

The focus of the current study is researching the variables that can affect a user's level of trust in technology. Balliet and Van Lange (2013) found that trust is most important in situations of high risk when there is a mutual conflict of interest between the trustor and the trustee. Examining this type of trust is not possible with technology since technology does not possess volition or the ability to reciprocate emotion. A second issue related to the effect of human experience on technology trust is that it simply seems more *natural* to trust a person than to trust a technology (Lankton, 2015). The past general research on trust issues highlights that it can be extended to the context of users trust in technology.

Fred Davis (1985) researched technology acceptance as an individual's positive attitude toward a given system. In his technology acceptance model, Davis identified that acceptance is a behavioral response that leads to system use. The concept of *acceptance* as a behavioral response to technology is extended to technology trust in the research conducted by Pavlou (2003). The current study extends this past research by exploring the complex relationship between how humans utilize system information to help them develop trust in technology used in situations of extreme risk, and how those general trust-based conceptualizations can be operationalized and measured in terms of their effect on trust in technology.

A 2016 Defense Science Board summer study on autonomy (David & Nielsen, 2016) identified technology trust as core to the Department of Defense's (DOD) success in the broader acceptance of autonomous systems. The report underscored, by implication, the importance of technology trust and that the U.S. military depends on emerging technological solutions, and that the acceptance of those solutions depends on service members' ability to perform a desired task. Any technology intended for use in a high-risk, dangerous military scenario, that is, any scenario where failure can lead to human death, would have increased scrutiny due to the potential ramifications of failure. The increasing level of complexity in autonomous solutions makes it challenging to provide sufficiently useful information to scrutinize and establish trust in technology that has become increasingly difficult to trust. Because of this, the presentation of system information and level of automation are both investigated in terms of their effect on trust.

The 2012 Defense Science Board reported on the role of autonomy in DOD systems (Murphy & Shields, 2012) with the purpose of achieving a goal of automating military roles by replacing humans with machines wherever possible. However, the report also recognized the influence of risk on slowing the transition of this potentially useful new technology. Because military service is amongst the most dangerous professions there is, automation using advanced technology carries significant implications concerning both success and failure. Therefore, the current study also focuses on the factors that contribute to the perceived risk of using a new technology in highly dangerous military scenarios.

The two concepts of *level of automation* and *system presentation* form the independent variables of the current study. The effect of these independent variables on a user's perceived *trust* in technology, in situations of extreme *risk*, is studied. These concepts that led to the six primary research hypotheses tested in the current study are conceptually and operationally defined and reviewed in the following chapters.

A. RESEARCH PROBLEM

The general problem addressed in the current study is technology rejection in high-risk applications due to a lack of trust in the technology. This is a problem because technology can reduce risk and save lives. Additionally, the recent increase in the use and deployment of sophisticated technologies by other countries is a disruptive threat to the United States' technological superiority. The 2016 U.S. Defense Science Board Study on Autonomy (David & Nielsen, 2016) indicates that a rapidly changing technology landscape requires DOD laboratories to increase the speed at which they adopt new technology with increased *levels of automation*. Furthermore, this study concluded that due to declining budgets, it is imperative that the DOD establish new methods for rapidly adopting and efficiently deploying autonomous technologies whenever possible. The David and Nielsen (2016) study states that "the decision for DOD to deploy autonomous systems must be based both on trust that they will perform effectively in their intended use and that such use will not result in high-regret, unintended consequences. Without such trust, autonomous systems will not be adopted except in extreme cases such as missions that cannot otherwise be performed."

The U.S. Defense Science Board Task Force on Autonomy (Murphy & Shields, 2012) further identifies the need for the DOD to develop *system presentation* techniques that explicitly establish trust in autonomous systems. The current study defines *system presentation* as the act of using information to explain technology. The Task Force reports that the military demands of conflict have forced the deployment of developmental capabilities that military services are not equipped to adopt. This lack of adoption is caused by inadequate trust associated with less than effective system presentation techniques that result in troops not being able to understand how to use available equipment.

B. RESEARCH PURPOSE

The purpose of the current study is to research the effect of system presentation and levels of automation on trust in technology. This is important because autonomous systems can save the lives of military personnel by increasing the distance between human and combat-related threats such as improvised explosive devices. The requirement for establishing trust prior to adopting technology used in dangerous military roles is high and documented by Murphy and Shields (2012). The complexity of the problem is also high as noted by Pak et al. (2017) who identified that broad differences in the abilities of individuals makes it challenging to measure what influences trust in automation. The current study intends to extend and advance current theory in trust in autonomous systems by introducing a situation of extreme risk.

C. ORGANIZATION

Chapter II of this dissertation establishes a theoretical framework for system presentation techniques including a new system presentation condition that utilizes an anthropomorphic hierarchy of system information.

Chapter III investigates and reviews existing literature to establish a baseline definition of trust, which is accomplished by reviewing the process that users go through to obtain the system knowledge necessary to establish trust in a system. Next, human-to-human trust is investigated to identify the key factors and attributes of the general concept of trust. Existing theory on human-computer interaction and human-autonomy interaction is reviewed to establish an understanding of what it means to trust technology. The chapter concludes with a review of the current research on technology trust relevant to measuring the influence of the theoretical framework.

Chapter IV explains the experimental design. Experimentation is conducted to analyze the influence of the theoretical framework established in Chapter II. The current study incorporates the context of an ongoing DOD effort to review and select a series of autonomous systems for a new operational mission. The data are collected from DOD active-duty technology end users giving it high external validity. This work investigates

how system presentation influences technology trust and acceptance. The primary product of this chapter is the experimental design that generated the research data obtained.

Chapter V provides a summary of the key hypothesis testing results. The dissertation concludes with Chapter VI, where the key conclusions and recommendations are presented.

D. SUMMARY

This introduction provided an overview of the issues associated with technology trust and the acceptance of autonomous systems within the DOD. The current study is driven by the recent increase in the use and deployment of sophisticated technologies by other countries that is identified as a disruptive threat to the United States' technological superiority (David & Nielsen, 2016). To address this problem, research is conducted to advance scientific knowledge in the field of trust and how it influences the acceptance of advanced technologies within the military. This work contributes to the literature in areas of trust in autonomous systems, technology acceptance, and technologies intended for use in high-risk applications where failure or improper application can lead to physical harm.

II. CONCEPTUAL FRAMEWORK

Humberto Maturana said, "To understand autonomous systems, we must understand the organization that defines them" (Maturana & Varela, 1987). The following section defines a concept for organizing technology information that includes trust. It begins with the rationale and is followed by a description of the categories used to establish the theoretical framework for the current study.

A. RATIONALE

The complexity of modern technology makes it difficult to establish a framework capable of explaining technology and how its presentation and level of automation influence users' trust in the technology. A framework that improves a technology user's ability to recall information could help improve his/her ability to assess the trustworthiness of disparate systems. Additionally, such a framework could capture a user's interaction with technology and subsequently serve as a source of experience-based information regarding the technology. The impact of experience-based information on the development of trust in high-risk scenarios, such as nuclear waste disposal and chemical plant operation, is documented as highly valuable in the article by Siegrist and Cvetkovich (2000).

The use of anthropomorphism during system presentation is empirically demonstrated to increase a trustor's ability to understand and accept complex technology by Waytz et al. (2014). The relationship between anthropomorphism and the components of technology is derived from a study by Card et al. (1983) that produced the *human processor model.* This model was designed with the express purpose of making engineering calculations of human performance as they relate to the performance of a computer processor. The concepts of anthropomorphism and the human processor model are described in the following sections. Following these introductions, the current study's system presentation framework is described.

B. ANTHROPOMORPHISM

This section describes how the anthropomorphism of technology information is conceptualized in the current study. The current study uses the anthropomorphism of system information as a presentation framework for improving the level of trust between humans and the technology they may use. Anthropomorphism is documented in the literature as a concept that significantly affects human-technology trust (Gong, 2008; Green, 2010; Hancock et al., 2011; Hoff & Bashir, 2015 Kiesler et al., 2008; Pak et al., 2012; Schaefer et al., 2016; Waytz et al., 2014). It is defined as the attribution of human characteristics and attributes to nonhuman entities, including technologies. The degree to which information is anthropomorphized is subjective and explored in multiple studies due to its significance for establishing trust or distrust (Epley et al., 2007; Waytz et al., 2014; Fink, 2012; deVisser et al., 2016; Schaefer et al., 2016). The meta-analysis on trust in automation conducted by Schaefer et al. (2016) presents three areas that influence trust in automation: (a) the human element, (b) automation, and (c) the environment. This work appears to be in harmony with the empirical evidence presented by Hoff and Bashir (2015) on the factors that influence trust in automation. Both Hoff and Bashir (2015) and Schaefer et al. (2016) agree that the development of trust in technology is significantly enhanced by the anthropomorphizing of system information presented to users.

In the meta-analysis on trust in automation, Hoff and Bashir (2015) found that "in order to promote greater trust and discourage automation disuse, designers should consider increasing an automated system's degree of anthropomorphism, transparency, and ease-of-use." Schaefer et al. (2016) similarly conducted a meta-analysis of the factors influencing the development of trust in automation and identified critical gaps in trust literature that implied that future technology trust research should focus on anthropomorphism. Waytz et al. (2014) further discussed the need for humanlike mental models to consider technology as a trustworthy teammate. There are reported cases (Pak et al., 2012) where the tendency to anthropomorphize technology leads to situations where humans give a higher degree of trust to a technology than is warranted, and the inverse of this situation also exists in the development of a lack of trust in a human teammate caused by the introduction of technology with more capability and reliability. The work conducted by Waytz et al. (2014)

includes a study that found test subjects are quicker to forgive a trustee's mistakes and stay calm in high-stress situations when the trustee is a technology with humanlike attributes.

A theory on the influence of anthropomorphism on technology trust is presented in the essay titled "The Uncanny Valley" more than 40 years ago by Masahiro Mori, a robotics professor at the Tokyo Institute of Technology (Mori, 1970). In a review of this essay (Mori et al., 2012), Mori describes a future where humanoid robots are indistinguishable from biological humans, creating a world where human-to-human and human-technology trust is the same. He hypothesized a short period of time during the evolution of robots where technology can create robots that are nearly human but are not quite there. Miro felt such robots would cause deep revulsion leading to a large, but short, drop in the trust associated with the technology. This drop in the progression of trust between humans and technology is called the uncanny valley and is caused by the strange and unsettling nature of a robot that is *almost* human. A common example used to explain the uncanny valley effect is found in early computer animation. The first movies that used computer animation are considered a breakthrough in storytelling. However, the audience was generally uncomfortable with the appearance of the characters (Gellar, 2008). The characters in early computer animation are close to human but something is just not right. Gellar noted that multiple critical reviews described that the *creepiness* of the characters was due to the unrealistic eyes, with one review being titled "Cold Eyes, Warm Heart." While the audience could appreciate the story, it had no affinity for the characters. Any effort to understand trust or distrust in technology can benefit from considering the affective response associated with anthropomorphism.

Lankton et al. (2015) researched the influence of using humanlike terms and systemlike terms to describe technology. For example, the term *benevolence* is humanlike and the systemlike corollary is *reliability*. This study determined that the *usefulness* of Facebook is considered more humanlike than MS Access software (.45 vs .29, $p < 0.05$). Its authors argued that these results are because Facebook holds a higher social presence than MS Access. Gefen and Straub (2003) offered that individuals will perceive and respond to technology that has a high social presence as a surrogate for humans. The following hypothesis results from the prior research reviewed:

Hypothesis 1: Presenting autonomous systems information using humanlike, anthropomorphized information will increase its perceived usefulness and perceived trustworthiness.

The following section introduces the concept of an anthropomorphic system presentation capable of influencing trust in technology. Detailed information on how anthropomorphism influences trust in technology is presented, and the subsequent section introduces concepts for describing technology as categories of the human body.

C. HUMAN PROCESSOR MODEL

The *human processor model* (Card et al., 1983) is a cognitive modelling method for measuring human performance and is illustrated in Figure 1. This model is found in the literature of human-computer interaction (HCI) and demonstrates the integration of anthropomorphism of system information presentation. Rather than anthropomorphizing technology based on humanlike appearance, this model introduces a framework where human functionality is explained through technology. In the model presented by Card et al. (1983) a human is "described by a set of processors, memories, and their interconnections together with a set of principles of operations."

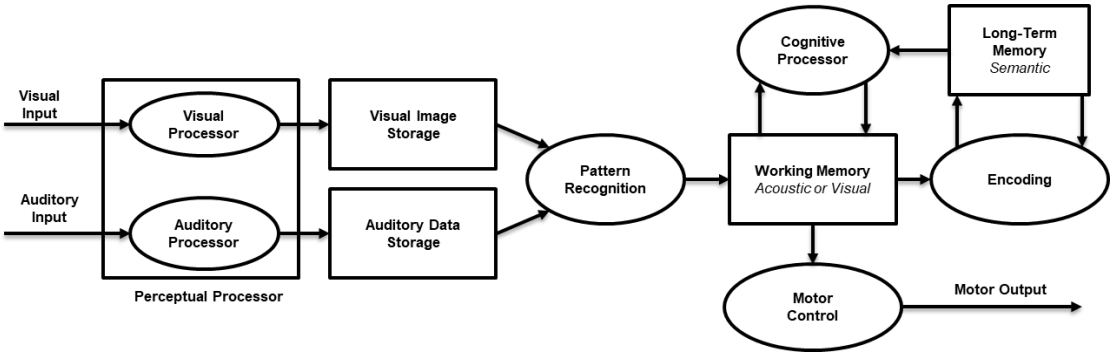

Figure 1. The Human Processor Model. Adapted from Card et al. (1983).

The *cognitive processor* shown in the human processor model connects to two memories. The two memories of this model correspond to information that is reason-based or experience-based. The first memory presented by Card et al. (1983) is long-term

(semantic) memory, which represents information that is not directly related to the current episodic experience. The illustration also presents a second memory defined as the working memory (visual or acoustic), which is used to process experience-based (relational) information. These distinctions are important because they describe two possible unique presentations of information.

The model by Card et al. (1983) that categorizes human capabilities in terms of technology correlates and introduces the basis for establishing the current study's system presentation framework. The current study flips the direction of the framework provided by the human processor model. Where the Card et al. model intends to measure human performance as it relates to technology, the current study intends to explain technology as it relates to human functionality. The next section integrates the concepts presented by the human processor model into an anthropomorphic system presentation framework that incorporates trust.

D. INFORMATION INTEGRATION THEORY

The intent of the proposed framework is to reduce the cognitive load required to develop trust in complex technologies without a complete understanding of the technology's technical innerworkings. The information integration theory (IIT) developed by Norman H. Anderson (1996) describes how a person evaluates and integrates complex information from multiple sources to develop a single response. In the case of the current study, the IIT is a theory relevant to understanding how system information influences a response in the form of a prediction of how much to trust a given technology.

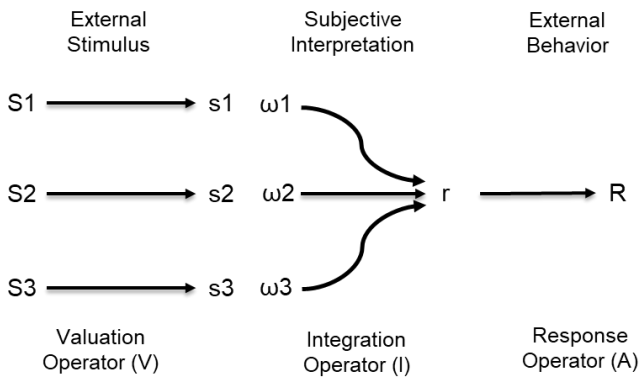

Figure 2. Information Integration Theory. Adapted from Anderson (1971).

The response (*R*) of the IIT is extensively studied, and empirical data demonstrate that individuals are subject to persuasion and place different weights (ω) on different pieces of information stimulus (*s*) (Anderson, 2008). This theory indicates that the individuals subject to persuasion (less confident) produced lower-level responses as an output of the integration process (*I*). The same can be said for individuals that are not subject to persuasion but interpret the source of information as not reputable or in violation of their value system. Regardless of the source, information that persuades an individual to go against their value system will decrease the level of a response. It is common knowledge that in order to influence a broad response, it is best to use information from multiple *reputable sources* that appeal to an individual's value system. This is revealed by the tendency to trust healthcare advice from a Doctor of Medicine (MD) working at a prestigious hospital over the opinion of an anonymous source posting advice on an internet forum. The title of MD is a shared value and represents an authority of reliable information. The process of referencing multiple reputable sources provides a basis for building credibility and developing trust.

The current study proposes that a framework for system information presentation will improve an individual's ability to conduct the cognitive algebra necessary to develop trust in technology. It further posits that presenting technology as a reputable source of system information will result in a reduction of variations described by the IIT as subjective interpretations. The effect of reducing variations is an algebraically more uniform IIT

response (*R*) to complex external stimulus. The result of a uniform response across multiple individuals is increased agreement toward the adoption (or rejection) of emerging technologies such as autonomous systems.

E. HAL

This study proposes the anthropomorphic hierarchy of system information illustrated in Figure 3. This is perhaps the most unique contribution of the present research to the arena of influences on technology trust. For this reason, it is described in some detail in what follows.

The main anthropomorphic categories are hardware, algorithms, and links (HAL). The HAL anthropomorphic hierarchy of system information, or HAL information for short, categorizes data that should improve the ability to organize system information and should, therefore, influence technology trust. Based on the research reviewed, the HAL information represents a framework capable of improving a human's ability to integrate complex technical information and develop an improved trust response.

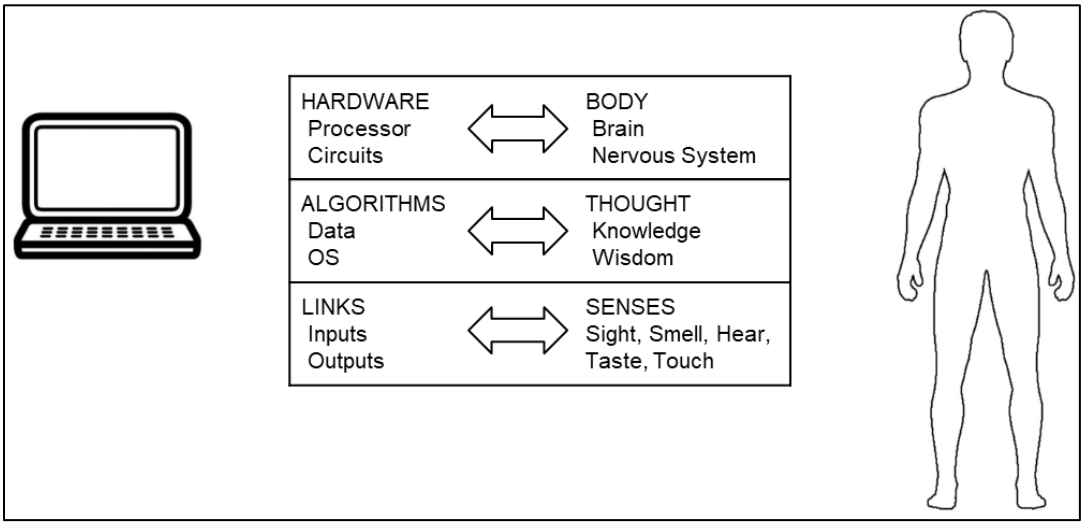

Figure 3. Anthropomorphic Technology Hierarchy

The HAL anthropomorphic hierarchy of system information is established as technology-invariant categories. This concept intends to reduce the cognitive load required

to process the complex information associated with emerging technology such as autonomous systems. The HAL invariant categories permit comparing and evaluating technologies that possess little to no humanlike features or attributes. Examples of the HAL categories are illustrated in Figure 4 for human-to-human, human-to-automation interaction, and human-to-computer interaction.

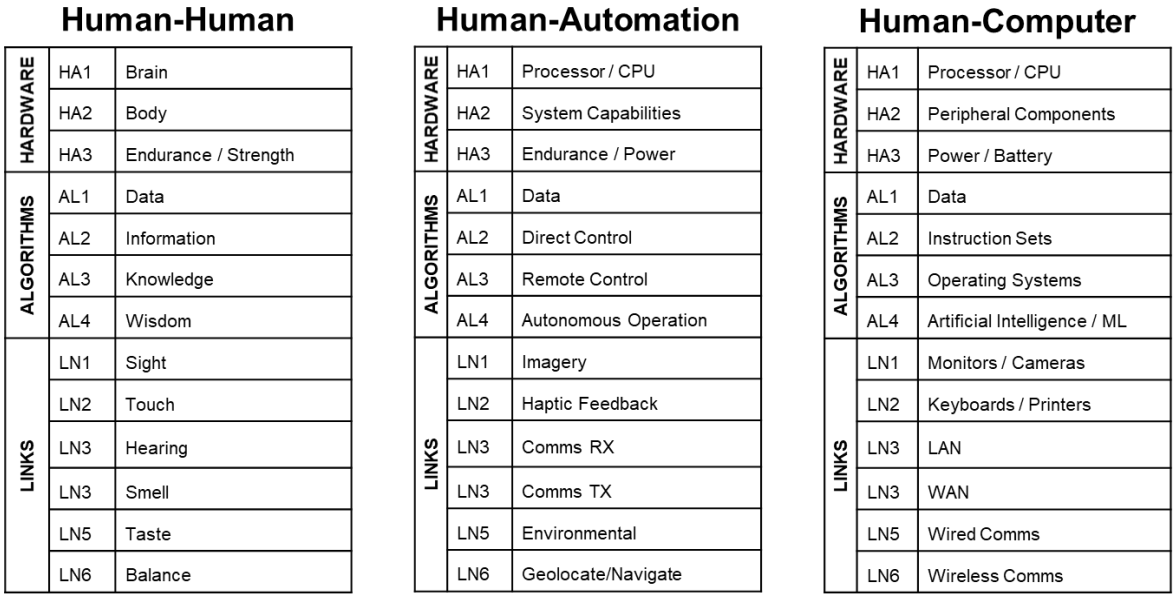

Figure 4. HAL Conceptual Framework

1. Hardware

The invariant nature of the hardware categories of HAL are explained by comparing the human body to the hardware components of technology. For example, the first hardware variable (HA1) in the human-human interaction heading of Figure 4 represents the human brain. Card et al. (1983) described that the human brain uses both long-term and working memory in order to develop a response to external stimulus that permits interaction with the world. Next, the HA1 category of human-computer interaction represents a central-processing unit (CPU) or processor that requires a digital memory containing an operating system (a program) in order to provide a response to external stimulus. Without neural activity (a program), the hardware systems in both human-human

and human-computer interactions fail to function. A second comparison is made for HA2 between the human body and the system capabilities of an autonomous system. The human body (excluding the brain) is represented by the nervous system, muscles, bones, and limbs. This is compared to autonomous technology that is represented by the hardware of wiring, motors, chassis, and peripherals components (e.g., articulating arms, printers).

2. Algorithms

The algorithm category of HAL defines the process and rules used to respond to external inputs. The human-human interaction algorithms category shown in Figure 4 is developed following principles drawn from the *DIKW pyramid* (data, information, knowledge, wisdom). The DIKW pyramid is a knowledge management principle found in the literature and credited to both Zeleny (1987) and Ackoff (1989). Gamble and Blackwell (2001) provide the following descriptions of DIKW as it relates to the algorithm levels of HAL:

(1) *Data* refers to chunks of facts about the state of the world.
(2) *Information* is defined as data endowed with meaning and purpose.
(3) *Knowledge* is described as information connected through relationships.
(4) *Wisdom* is the ability to make judgments and decisions without thought.

The algorithm variables of HAL are also system invariant and developed as a corollary to the DIKW pyramid. For example, in human-computer interaction, the lowest form of *data* is a binary (bit), which is either a one or a zero and is represented by HAL algorithm variable AL1. The *information* (AL2) level of a computer algorithm represents an instruction set that is specific to the processor's hardware. Next in the DIKW pyramid is *knowledge* (AL3), which for a computer represents a collection of hardware-specific processor instructions used to form an operating system. The highest level of the pyramid represents *wisdom* (AL4), which is represented by forms of artificial intelligence or programs capable of learning and making decisions without human input.

The invariant nature of HAL is further illustrated for human-automation interaction, which follows the same hierarchy as human-human and human-computer

interaction. For example, in human-automation interaction, the *data* (AL1) variable represents a collection of resources used for decision making such as sensor data. The next level in the pyramid is *information* (AL2), which correlates to the direct control of a system. In a direct control scenario, the human operator is physically located next to the system and commands all input/output functionality. An example of a direct control system is a human operator who starts and stops a machine used to press or bend steel. Next in the pyramid is *knowledge* (AL3), which for automation is represented by the remote operation of a system. In remote operation, the human is located some distance away from the system and controls some, not all, of the operation. In this situation the human operator is not able to rely on their own senses and must make decisions based on feedback provided by the technology. The final state of the hierarchy is *wisdom* (AL4), which represents autonomous operation. In autonomous operation the human operator has little to no control over the system and is responsible only for initiating a task.

3. Links

The links category of HAL defines the inputs and outputs that connect a system to the external world. This category does not follow levels of hierarchy like the algorithm's category, and all link variables are considered equivalent in value. The link variables fall under one of two transmission modes, simplex or duplex. A *link input* prompts the *algorithm* decision-making process using available *hardware* in the form of a *link output*. For example, the human senses represent link inputs and include sight, hearing, smell, touch, and taste. There are also link outputs such as motor control. An example of the human input output cycle is shown in Figure 5 for a process that occurs when a human hears the word, "hello." This represents an auditory link input that is received, processed, and sent to the brain for pattern recognition. The brain processes the information (algorithmically) and decides on an appropriate response to the auditory input stimulus. In this example, the long-term memory is used to deduce a response of "hello." The brain informs the body (hardware) to employ speech processing to say the word "hello" as a link output. This cycle represents a simplified version of the human processor model presented by Card et al. (1983).

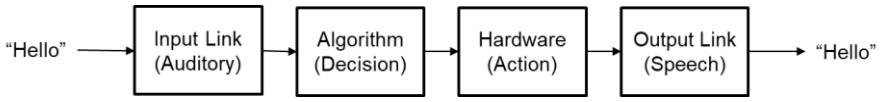

Figure 5. HAL Input / Output Cycle

F. SUMMARY

Figure 6 illustrates a process of trust that incorporates the HAL conceptual framework. The development of trust begins with an inquiry that involves risk. The inclusion of risk in the inquiry process is inherent to the establishment of trust (Castelfranchi & Falcone, 2010). In this illustration the process of discovery is based on the system presentation using HAL information. Figure 6 is developed in detail in the literature review chapter of the current study.

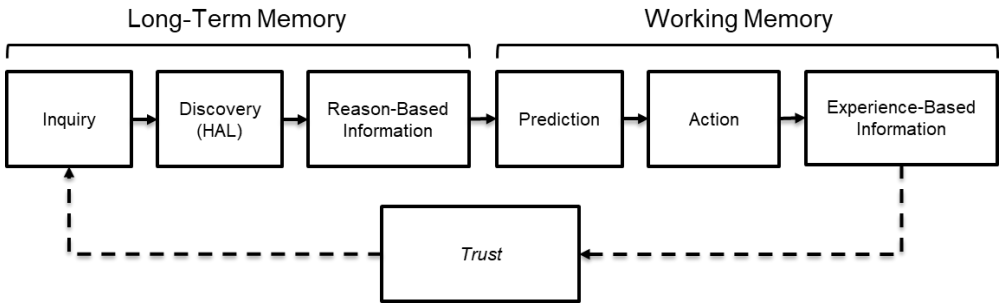

Figure 6. HAL Conceptual Framework of Technology Trust

In reference to the human processor model, the combined processes of inquiry, discovery, and reason-based information all depend on long-term memory. Once initial (reason-based) information is processed, a prediction is made toward abandoning the inquiry or advancing the relationship as an action. The process of making a prediction, acceptance, and experience-based information all depend on the working memory. The feedback loop indicates a trust response that results from the new knowledge developed through the integration of reason-based and experience-based information. The trust response is used to further inform the inquiry process. The current study experimentally manipulates system presentation using HAL as a treatment and measures its effect on the development of trust.

This chapter described a framework for manipulating system presentation through the introduction of technology-invariant anthropomorphic HAL categories. The goal of HAL is to improve technology understanding and influence trust in autonomous systems deployed in high-risk military scenarios. The human processor model (Card et al., 1983) validates the development of anthropomorphic categories of technology. The three HAL categories are summarized as (1) the hardware that represents system capabilities, (2) the algorithms that define how the hardware responds to stimulus, and (3) the links that describe how the system interfaces with the external world. The IIT (Anderson, 1971) explains the influence of HAL in promoting a uniform response to the introduction of complex technology thereby increasing the speed of adoption. The IIT also demonstrates the value of HAL as a reputable source of system information capable of increasing technology trust. Based on the research reviewed, the current study offers the following hypothesis:

Hypothesis 2: Presenting any technology using human-like information will increase its perceived usefulness (and therefore, trustworthiness).

The literature review in Chapter III develops the variables used to develop an experimental design capable of testing the influence of the HAL theoretical framework on developing trust in autonomous systems. The experimental design chapter (IV) presents the procedures used to exercise HAL through participation in the selection and evaluation of systems used in a high-risk military scenario.

III. LITERATURE REVIEW

This chapter presents a literature review of the concepts relevant to technology trust. Multiple definitions of trust are found in the literature, and the lack of a widely accepted definition of trust is confounded by the current study's focus on trust in technology. Rather than borrow a definition of trust that aligns with technology, the current study intends to establish a coherent and valid definition of technology trust by linking widely accepted concepts.

The purpose of this literature review is to increase knowledge in technology trust in situations of extreme risk. An ontology of the literature review illustrating links between concepts is shown as a Feigl diagram (Feigel, 1970) in Figure 7.

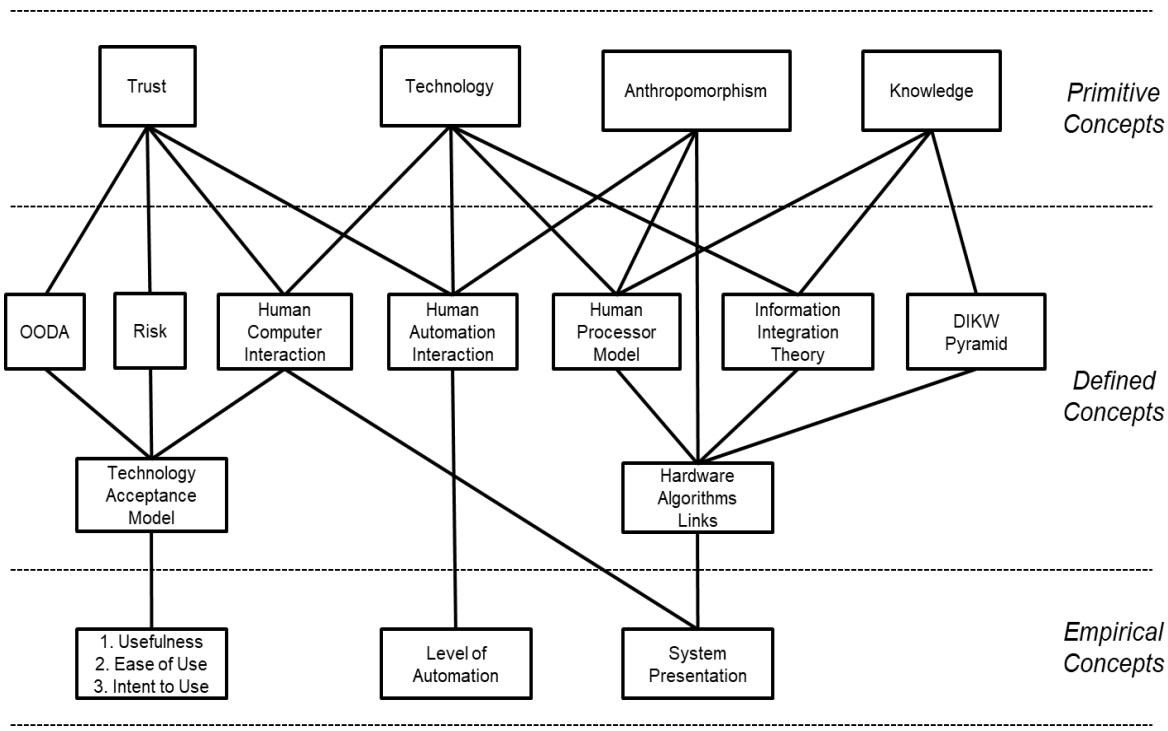

Figure 7. Diagram of Theoretical Concepts

The literature review begins with the primitive concept of *knowledge*. As shown in the ontology, knowledge is linked to multiple defined concepts that establish the HAL conceptual framework. The intent of HAL is to provide a methodology for presenting system information. Three defined knowledge concepts are used to develop HAL. The first concept is the human processor model (Card et al., 1983), which is an anthropomorphic approach for measuring and comparing human performance to the performance of a computer. This concept is important to HAL because it provides insights on how humans relate to technology. Next reviewed is the information integration theory (Anderson, 1996). This theory presents how multiple sources of information are combined (integrated) to influence a single affective response. This theory is important because it validates HAL as a collection of system information capable of influencing an affective trust response. The third and final knowledge concept reviewed is the DIKW pyramid (Zeleny, 1987), which describes the relationships between data, information, knowledge, and wisdom. The DIKW concepts are used organize technical data into the HAL hierarchy of system information.

The next primitive concept reviewed is *trust*. This review is conducted by first developing a framework of interpersonal (human-human) trust. This framework of interpersonal trust is then used to guide a review of human-technology trust. Three human-technology trust concepts are presented. The first concept reviewed is human-computer interaction (HCI). The HCI section reviews how manipulating the presentation of system information can influence the development of trust in technology. The next human-technology trust section reviewed is human-automation interaction (HAI). This section reviews how varying the level of automation can influence the development of trust. The third and final human-technology concept reviewed is the technology acceptance model (TAM). The TAM is a highly cited and extensively researched method for predicting the acceptance of a technology based on a user's affective response (Davis, 1985). This section reviews how TAM can be used to measure technology trust. The chapter concludes by presenting a conceptual framework for technology trust and highlighting existing research gaps.

A. KNOWLEDGE

Siegrist and Cvetkovich (2000) describe the correlation between the process of obtaining knowledge and the process of developing trust. This section briefly reviews the epistemologies, or the process for how a person comes to know something, in order to develop an operational definition of technology trust.

The French Philosopher Rene Descartes was an early rationalist who believed that we can only know something through reason, and that the only thing we can truly know is that we have consciousness (Markie, 2004). Descartes presented a methodology for knowing what is real that minimizes a construct needed for the establishment of technology trust. In his work, he established a dualism by reducing our understanding of the world to the two areas of consciousness and matter, and by doing so minimized the value of our senses. Our sense perception, he believed, is easily prone to error due to subjective interpretation. He believed that the senses are meant to simply get us around in the world rather than lead us to the truth. To test any hypothesis of trust in technology, the current research identifies constructs that permit the measurement of human interaction and perception of technology.

John Locke later introduced empiricism that, contrary to rationalism, states all knowledge must be obtained through experience. The empiricists claimed that the senses are the only way to true knowledge, and that experience is much more accurate than anything the mind could ever reproduce through memory or reason. The theories presented by rationalism and empiricism both stand to contribute to the conceptual formation of trust through the application of reason-based knowledge and experience-based knowledge.

A further review reveals that modern philosophers reject the idea that knowledge is obtained exclusively through either rationalism or empiricism (Vanzo, 2013). The philosopher Immanuel Kant is credited as providing a synthesis between the two positions saying that human knowledge depends on both a priori and a posteriori knowledge (Thagard, 2005). Kant noted that reason cannot create a sensory experience, and that it is only through reason that we can accurately analyze the stimuli received through the senses.

Figure 8 leverages Kant's theories on rationalism and empiricism, and presents links between the consciousness, existence, and experience.

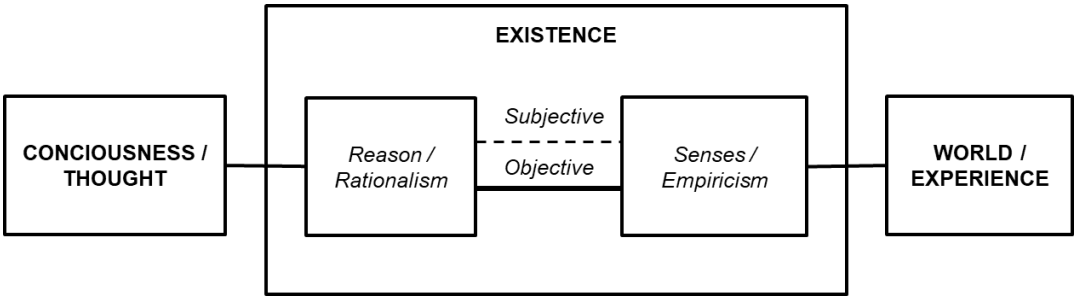

Figure 8. Synthesis of Rationalism and Empiricism

Figure 8 depicts the consciousness as separate from human existence. The knowledge obtained through human existence is subdivided into the two categories of reason (rationalism) and the senses (empericism). There are two lines connecting reason and the senses. The upper dashed line labelled "Subjective" represents Descarte's skepticism of the validity of information obtained through the senses. The lower line marked "Objective" depicts Locke's insistence that the truth can only be obtained through experience.

The theories presented by Kant provide a conceptual framework for understanding the development of trust. Kant recognized and synthesized both empiricism and rationalism as two types of knowledge. Figure 9 illustrates the process described by Kant for coming to know something over time as a feedback loop that includes both empiricism and rationalism.

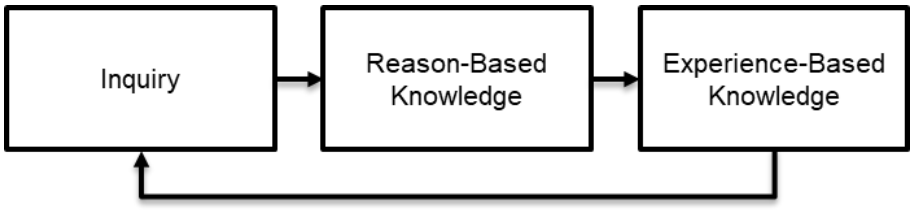

Figure 9. Process of Inquiry Leading to Knowledge

This figure demonstrates two types of knowledge relevant to trust. The left-hand block of the figure indicates that the pursuit of knowledge begins with an inquiry in the form of either a question for inductive reasoning or a theory for deductive revision (Bryman, 2006). In the absence of experience, inquiry is conducted through the rational process of decision-making. Once reason-based problem solving is exhausted, new knowledge must be obtained through experience-based information. This experience-based information provides new knowledge and contributes to wisdom-based decisions in the form of a feedback loop that continues until the inquiry is satisfied. The two types of knowledge correlate to the long-term memory (reason-based) and working memory (experience-based) presented in the human processor model discussed in the previous chapter.

B. HUMAN-HUMAN TRUST

This section reviews human-to-human trust and analyzes how trust relates to obtaining knowledge. There is limited agreement on a definition of trust that is accepted across research disciplines (Abbass et al., 2018; Cho et al., 2015). Castelfranchi and Falcone (2010) review 72 definitions of what it means to know something well enough to trust it, and their work reveals a great deal of confusion and ambiguity surrounding the use of this term. However, two themes are identified in the literature when discussing trust: (a) the basic premise of trust involves two actors, and (b) trust is a relationship where one individual relies on someone, or something, under a specific circumstance. Research into the meaning of a "given criterion" reveals an interchangeable use of the terms *trust* and *confidence or familiarity*. The only noticeable difference in the use of these terms is that trust is based on decisions involving risk, whereas confidence and familiarity involve decisions devoid of consequence. Luhmann (2000) provides an explanation of these differences by presenting that familiarity leading to confidence "is an unavoidable fact of life, whereas trust is a solution for specific problems involving risk." Luhmann (2000) continues by pointing out that trust must be achieved within the same familiar world that leads to confidence, and that changes can occur in the things of the world one finds familiar that can impact how someone develops trust. Uncertainty and changes in familiarity lead

to changes in confidence, which, in turn, influence decisions based on trust (Sniezek & Van Swol, 2001).

The definition of trust varies by academic discipline. Rather than developing new definitions, existing research leverages definitions considered influential based on coherence or consensus. Leading research in human-to-human trust presents vulnerability and risk as the contributing factors unique to the development of such a relationship (Adams & Webb, 2002; de Visser, 2012; Lankton et al., 2015; Schaefer et al., 2016). The survey on trust conducted by Cho (2015) further investigated the concepts of human-to-human trust across multiple academic disciplines. This survey identified that all disciplines follow a basic premise involving vulnerability and risk. For example, academic researchers in philosophy define trust as any risky action that derives from relationships between two persons (Lahno, 1999). The field of sociology defines trust as the subjective probability that two parties will not act in a way that harms the other interests (Gambetta, 2000), and psychology explains trust as a cognitive learning process gained through experience-based interaction (Rotter, 1980).

Rousseau et al. (1998) presents a cross-disciplinary definition of trust as the psychological state of a trustor accepting "vulnerability in a situation involving risk, based on positive expectations of the intentions or behavior of the trustee." Hinde and Groebel (1991) provide a similar and succinct definition of trust as "a state involving confident predictions about another's motives" in situations entailing risk. Most of the early research on trust involves person-person relationships and provides a starting point for understanding the process of how humans develop trust. Figure 10 presents human-to-human trust formation based on the reviewed literature. This illustration is derived from the premise identified earlier that the pursuit of knowledge begins with an *inquiry* in the form of a question or theory. Castelfranchi and Falcone (2010) identify three important concepts as relevant to most of the trust literature. The first is *discovery*, which represents an evaluation that leads to a cognitive response. Next is a *prediction* that relies on the information gathered during discovery. The concept of *prediction* represents an affective response that leads to the third and final concept of *action*. This final concept, *action,* is a behavioral response that manifests the trust response.

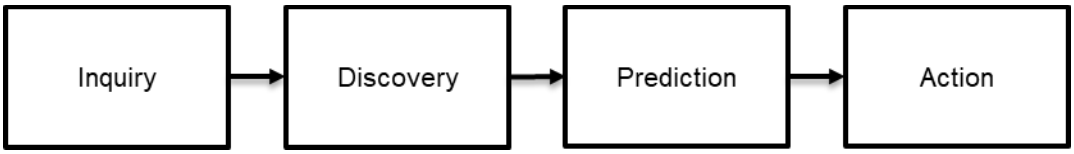

Figure 10. Human-to-Human Trust Formation

Multiple types of trust are described in the literature. Adams and Webb (2002) provide an alternate description of two broad processes of developing trust between two individuals. The first is defined as *person-based trust*, which develops through repeated engagements, and the second is called *category-based trust*, which develops in the absence of direct experience. McAllister (1995) presents a corollary assessment that trust consists of two types: *affect-based trust*, which relies on emotional bonds, and *cognitive-based trust*, which considers performance and capabilities. Cummings and Bromiley (1996) expand the concept and describe three types of trust as *affective trust*, *cognitive trust*, and *behavioral trust*. Kramer and Tyler (1996) assess *reason-based trust* and present it as useful for understanding how one develops a trusting relationship when personal or social interaction is not possible. This type of trust often develops through someone's membership in a familiar group or category. The factors contributing to reason-based trust can be social roles, training, or experience. In reason-based trust, Reeves and Naas (1996) present that the relationship is frequently developed through a reputation that serves as a proxy for direct experience. Rempel et al. (1985) assess that *experience-based trust* relationships develop over a long period of time through repeated personal interaction. In their early research on trust, they describe three factors that influence the development of trust as competence, benevolence, and integrity. Obviously, the literature presents a multifaceted and complex description of what it means to trust.

General agreement is found in the literature that the strength of the multiple types of trust may differ (Castelfranchi & Falcone, 2010; Cho et al., 2015; Rousseau et al., 1998). For example, the concept of reason-based trust involves the development of a relationship through cognition and represents a weaker strength connection explained by *first impressions*. Multiple studies indicate that when an inquiry is performed using reputable sources it can increase reason-based trust, whereas inquiry that relies on unreliable sources

will decrease reason-based trust (Boudreau et al., 2009; Delgado et al., 2005; Merritt & Ilgen, 2008). Experience-based trust involves direct knowledge through repeated interaction. This type of trust represents a stronger connection and is explained by relationships that develop over a longer period through an experience–reason feedback loop. These findings lead to the following hypothesis:

Hypothesis 3: Presenting technology using operational, experienced-based information will increase trust.

A continued literature review on interpersonal trust presented highly cited articles on the OODA (observe, orient, decide, act) loop developed by Colonel John Boyd (1987). The correlation between the OODA loop and the formation of trust is shown in Figure 11. Since its introduction over 30 years ago, the OODA loop has become the leading model for military command and control (Grant & Kooter, 2005). A historical account of the development of the OODA loop is provided by Brehmer (2005) who recounts that Colonel Boyd created OODA through an analysis of the air superiority of American fighter pilots in the Korean and Vietnam wars. Boyd found that American fighter pilots were superior in all four areas of OODA, which, in turn, made them better at *getting inside* the enemy's loop and prevailing in combat. He described *observe* as a note-taking process where the pilot questions the environment, which is very similar to a trust *inquiry* that is any question or theory that involves risk. The OODA process of *orient* involves the pilot pointing the aircraft toward the adversary, which is very similar to trust *discovery*. A trust discovery process involves collecting the relevant knowledge needed to make a prediction. The OODA process of *decide* involves making a choice of what to do, which is like the trust *prediction*. Both OODA *decide* and trust *prediction* lead to an action. The OODA process of *act* involves implementing what is decided, which in the case of trust manifests as *action*. The OODA *act* provides a feedback loop to *observe* in a seemingly never-ending cycle, while the trust *action* provides a feedback loop to Trust *inquiry* in similar fashion. The correlation between the OODA loop and trust formation validates the trust process described in this section.

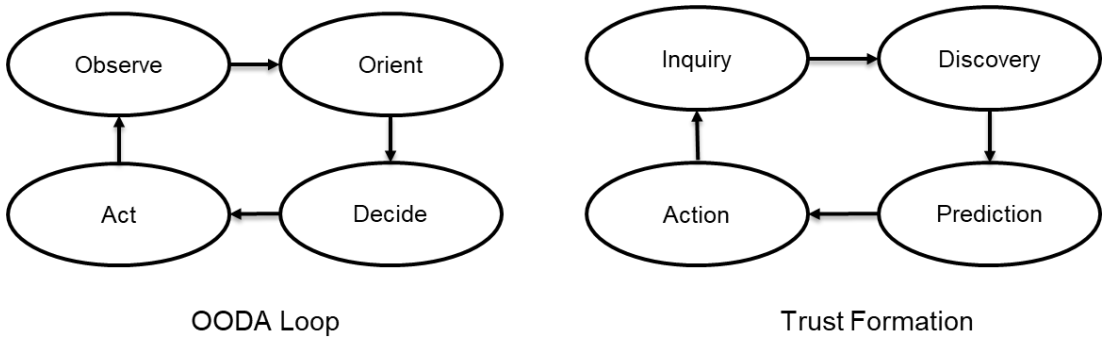

Figure 11. Comparison of OODA Loop and Trust Formation

The first section of this literature review presented two types of knowledge that contribute to human-to-human trust (experience-based and reason-based). This section identified four processes that contribute to trust (inquiry, discovery, prediction, action). Figure 12 integrates the two types of trust with the four processes of trust to create a conceptual life cycle describing the development of trust. This model is representative of the HAL theoretical framework of technology trust.

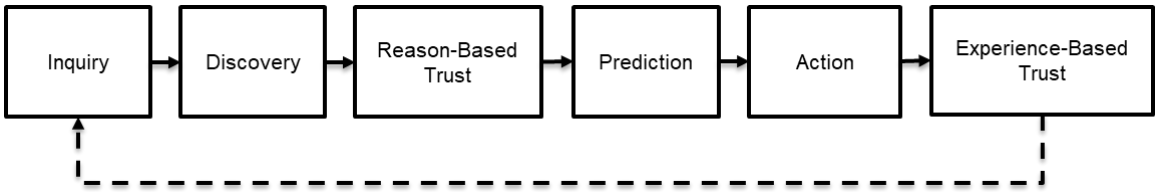

Figure 12. Conceptual Life Cycle of the Development of Trust

The literature on human-human trust presents multiple types of trust. The *trust life cycle* shown as Figure 12 illustrates the two types of trust deemed most relevant as reason-based (initial) trust and experience-based (relational) trust. It incorporates the trust processes of *inquiry and discovery* and *prediction and action*. Discovery represents a rational process of obtaining knowledge for the first time and contributes to the prediction of initial trust or distrust. The prediction is based purely on long-term knowledge, ideas, and intuition, and is established in the absence of any direct experience. If there is enough initial trust to assume the risk associated with the inquiry, it leads to a prediction that is

realized through the acceptance of the relationship and leads to interpersonal action. The action is conducted through repeated human-to-human engagement and uses the working memory to test the hypothesis developed during the prediction phase. This experience-based data generated through interaction is then provided as feedback (the dotted line in Figure 12) to the reason-based inquiry process that further informs the prediction and provides new information regarding the level of risk.

This section identified numerous types of trust in the literature. The concepts of reason-based trust and experience-based trust directly relate to the two types of knowledge identified in the previous section. The duality of reason-based and experience-based trust are used in the following section to develop an understanding of human-to-technology trust.

C. HUMAN-TECHNOLOGY TRUST

This section leverages human-to-human trust to develop an understanding of trust between humans and technology. This understanding is necessary to understand the variables capable of manipulating technology trust in high-risk scenarios. There are many factors identified in the literature that contribute to trust in technology within the DOD such as relevance, functional requirements, and organizational culture (National Research Council, 2004). The National Research Council emphasizes the need for the faster acceptance of technology to decrease costs and increase performance. Ring and Van de Ven (1994) state that "the greater the ability to rely on trust, the lower the transactions costs required of parties to negotiate, reach agreements, and execute a cooperative relationship."

To explore the issues surrounding technology trust, it is imperative to provide a consistent definition of the concepts of technology and trust. A widely accepted definition of technology trust represents a gap in the technology trust prior research. The current study established a definition of technology trust consistent with the study's research objectives by decomposing and combining multiple widely accepted concepts. The conceptual definition of technology trust used for the current study is *a mental state where a prediction about the use of technology entails risk and is based on the expectation of a positive outcome* (Castelfranchi & Falcone, 2010; Rousseau et al., 1988).

Trust and technology are both primitive concepts used to establish the variables for this study. The previous section described the ambiguity surrounding the types of trust. The associated concept of technology is described as the application of the sciences embedded into a machine capable of producing a predictable output for a given input, which requires little to no understanding of the inner workings. The process for developing technology starts with an inquiry that leads to a scientific investigation. Technology is the output of the practice of science and engineering and is used as a tool to increase trust in the response to an inquiry.

Current research on human-to-human trust contributes the framework needed to understand a trust relationship between humans and technology (Adams & Webb, 2002; Castelfranchi, 1995; Reeves & Nass, 1996). The potential for integrating human-to-human trust research with technology is discussed by McKnight et al. (2011). This research found that human-to-human trust is based on a trustee's expectations and reliance on a trustor to perform as expected through benevolence, even though the trustor possesses the volition to choose to do what is right or what is wrong. Since technology does not possess volition (ability to choose), some researchers went as far as to dismiss the idea of trust in technology as irrelevant (Friedman et al., 2000). However, recent advances in artificial intelligence refute the claims that technology lacks volition. This is confirmed in the vast amount of current research into how autonomous systems can make ethical decisions based on a machine's ability to either harm or protect human life (Bostrom & Yudkowsky, 2014; Etzioni, 2017; Scherer, 2015).

Technology trust research is well represented in multiple disciplines of engineering and science. The major fields of technology trust research include, but are not limited to, artificial intelligence, robotics, command and control, human-automation interaction (HAI), human–computer interaction (HCI), data fusion, human–machine fusion, and cybersecurity (Lee & See, 2004; Mittu et al., 2016; Muir, 1994; Parasuraman & Riley, 1997). Technology trust research is multidisciplinary and integrates both humanlike measures and systemlike measures. Multiple models for researching trust are presented in the literature that combine both humanlike and systemlike terminology (Castelfranchi & Falcone, 2010). Three humanlike terms frequently used to discuss technology are

competence, *benevolence*, and *integrity*. The research conducted by McKnight et al. (2011) and Lankton et al. (2015) consider the systemlike alternate terms for technology trust as *reliability*, *functionality*, and *helpfulness*. Several systemlike measures of technology trust, such as supply chain management, past vendor performance, hardware/software-oriented security, and network security, are identified as significant influencers of trust but outside the scope of the current study.

Much of the language used to describe human-to-human trust applies to technology trust. Due to recent advances in technology, some humans may perceive machines as if they are human (Reeves & Naas, 1996). For example, the word *benevolence* is a very humanlike attribute that appears in the literature on the decision-making capabilities of self-driving cars (Muehlhauser & Helm, 2012; Yudkowsky, 2001). A total of 86 different factors and attributes used to describe human-to-human trust are collected from the literature to form a nomological network of trust terms. The combined and unsorted list is presented in Table 1. A *factor* is described as an uncontrollable situational consideration that has the potential to influence trust, such as operating environment or lack of system reliability. Inclement weather is a factor that could contribute to increased uncertainty and decreased trust when using a technology outdoors. An *attribute* is a characteristic inherent to the technology such as its speed, power, and processing capability. Information is not found in the literature that demonstrated the influence of terms in the following areas:

1. Factors and attributes that are capable of measuring reason-based versus experience-based technology trust
2. Factors and attributes capable of serving as a proxy to represent experience-based technology trust

Table 1. Nomological Network of Technology Trust Terms

Ability	Character	Disappointment	Importance	Process	Skills
Adaptive	Communication	Disposition	Incompetent	Protect	Stability
Adoption	Competence	Dynamic	Integrity	Purpose	Supportive
Adversarial	Completeness	Easy	Intelligibility	Rationality	Teammate
Altruism	Confidence	Expectation	Intent	Recency	Trainable
Attractive	Contract	Experience	Knowledge	Reciprocation	Transparency
Autonomous	Control	Faith	Learning	Regret	Uncertain
Availability	Cooperation	Faults	Likable	Relational	Understandability
Awareness	Credibility	Fear	Monitored	Relevance	Unstructured
Belief	Credit	Feeling	Motives	Reliability	Utility
Benevolence	Decisive	Frequency	Perception	Relief	Validity
Capability	Delegation	Frustration	Performance	Responsive	
Capital	Dependability	Helpfulness	Popular	Risk	
Centrality	Difficult	Honesty	Power	Robust	
Certainty	Directability	Hope	Predictability	Similarity	

The collection of terms listed in Table 1 represents a sample of the information available capable of manipulating trust. The influence on trust of the factors and attributes in the nomological network will vary from technology to technology depending on the system. For example, Hancock et al. (2011) found that in robots, the *performance* variable is the largest contributor to the development of trust. This subsection presented multiple types of human-human trust and selected the two most coherent forms as reason-based and experience-based.

Based on the research reviewed and the HAL anthropomorphic hierarchy of system information, the current study rejects the concept that multiple *types of trust* exist and proposes that trust is a single response to multiple *types of information*. This proposition eliminates the potential logical fallacy of using trust to inform trust. It decomposes the multiple definitions of trust by replacing them with a single affective response that is a sum of *trust information* provided by multiple communication sources. The *trust information* is further decomposed as either *reason-based* or *experience-based*. Conceptually, this view of trust contributes to the strength of the relationship between the HAL framework and the IIT (Anderson, 1971) in that trust is a single response that integrates *multiple types of*

information rather than *multiple types of trust*. Figure 13 illustrates this adaptation of the IIT first introduced in Chapter II. It shows that experience-based and reason-based *trust information* integrate to provide a single a *trust response*.

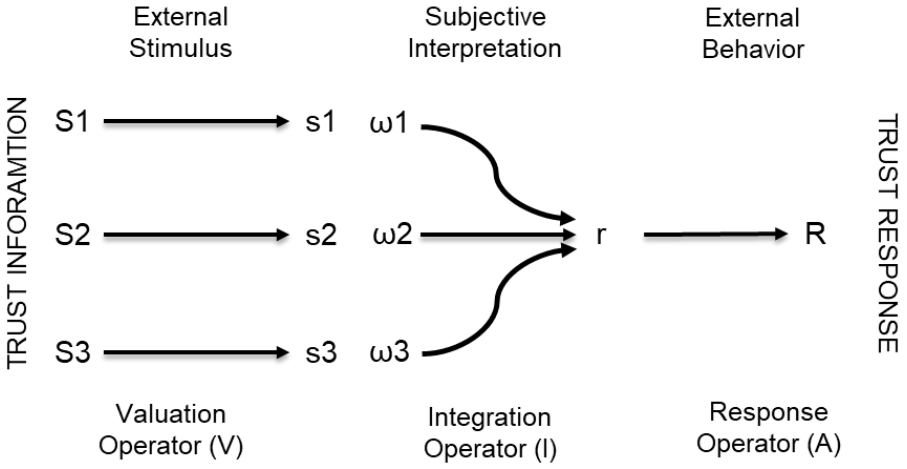

Figure 13. Trust and IIT. Adapted from Anderson (1971).

This introduction to human-technology trust identified related concepts and described how humans develop a trust relationship through both reason-based and experience-based technology *information*. The following two subsections develop the independent variables used to evaluate the influence of reason-based and experience-based information toward the development of trust in technology used in high-risk applications. The first subsection discusses human-computer interaction, which promulgates the independent variable of *system presentation* that includes HAL based on three types of presentation of system information. The last subsection discusses human-automation interaction. It leads to the selection of various kinds of technology for experimentation and represents the second independent variable of *level of automation*. The dependent variable is based on the technology acceptance model (TAM) that is described in the final section of this chapter in a review on measuring technology trust.

1. Human-Computer Interaction (HCI)

This subsection investigates how system presentation influences trust between humans and technology. Early research into human-technology trust investigated the relationship between humans and computers. As Alfred North Whitehead wrote in 1911, "Civilization advances by extending the number of important operations which we can perform without thinking about them" (Whitehead, 2017). This statement is exemplified in the evolution of the human relationship with the computer shown in Figure 14 that chronicles the major advances in this technology over the past 70 years. This figure presents the use of the technology along with its human interface mechanism. Historically, major innovations in technology are driven through a societal desire for improved functionality (Lundvall & Dosi, 1988). According to Geels (2002), it is only through association with a human that technology can fulfill its intended function. This subsection describes the influence of human interaction with technology on the level of trust of that technology.

Human-computer interaction (HCI) looks at the difference between good and bad design and how products differ radially in their usability (Preece et al., 2015). The process of technology discovery for a computer-based system requires a user to understand both the application and the interface necessary to invoke a desired response. The user interface represents the main source of trust with technology, and technology advancements are most often developed to apply increased capabilities with a decreased level of effort (Lee & Moray, 1994; Muir, 1987; Sheridan, 1988). However, a decrease in the effort required to use a technology typically decreases the level of control, which presents a conflict when considering trust and HCI. For example, early computers are programmed at the bit level, but modern computers are programmed using human-readable languages. The human-readable programming language provides increased productivity with little to no concept of how the bit level programming works. One could hypothesize that decreased control could decrease levels of trust in compiled code.

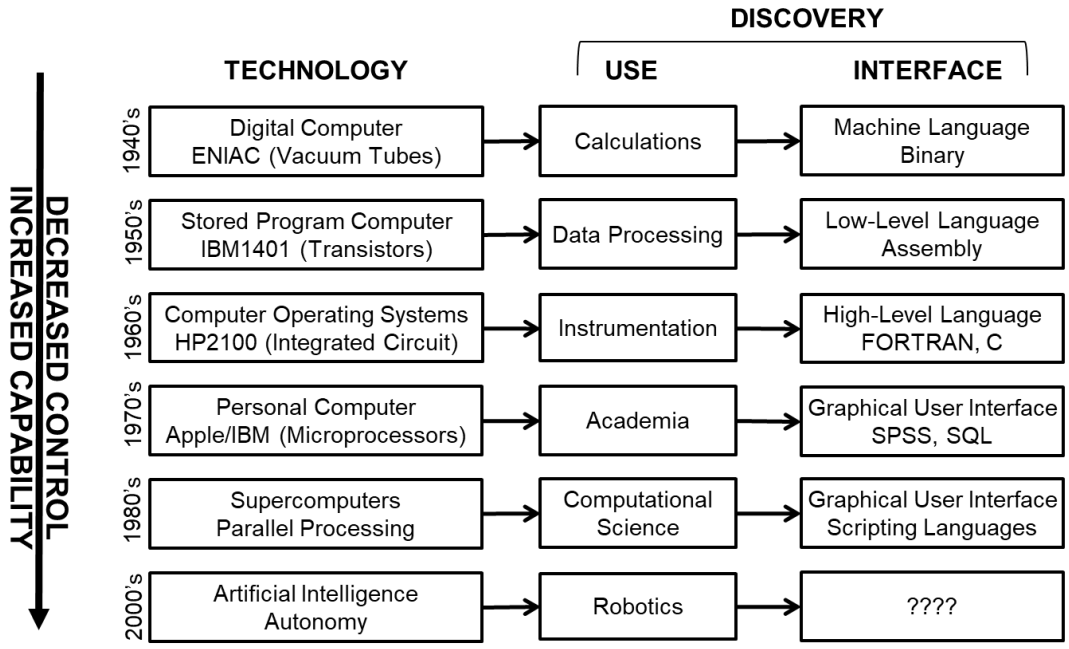

Figure 14. Chronology of Human-Computer Interaction

As shown in Figure 14, the application of the first computers is limited to mathematical calculations due to the burden associated with bit-level programming. The advent of the transistor dramatically increased the capacity of a computer's ability to calculate and made it increasingly difficult to program at the bit level. The functionality needed to improve programming led to the development of human-readable assembly language that could be turned into bit-level programming files through a process of automation. The next significant advance in human-computer interaction is found in the creation of the graphical user interface (GUI). The GUI, along with the personal computer, led to an explosion in human-computer interaction. At this time in history it was possible for computers to transition from the exclusive confines of corporations into classrooms and family homes. The sum of the technological advances over the past 70 years led to the current state of computer-based artificial intelligence (AI) systems. An AI is a computer system capable of performing tasks that historically require human intelligence. The field of AI complicates the concept of human-computer interaction since it does not require human intervention.

Goertzel (2007) posits that the murkiness of trust in AI is due to two factors. First is the challenge of associating AI with human intelligence. Humans are not very competent when compared to computers, and Goertzel points out that measuring computers in comparison to *human-level* intelligence could bound the future of AI. Second is that AI removes the need for human association to fulfill a technology's purpose (Kurzweil, 2005). Since human agency is not needed by AI systems, a method for interfacing with this technology is difficult to establish as indicated by the question marks shown in Figure 14. It is possible to merge the statements made by Alfred North Whitehead and Ray Kurzweil as follows: humans are advancing as a civilization through the use of computer-based systems, of which they have decreasing knowledge of the inner workings, and as a society we are reaching an inflection point where human association will no longer be needed for the fulfillment of a technology's purpose.

A system presentation framework that promotes an individual's belief in their ability to succeed with complex technology may increase their trust in that technology. Bandura (1997) reviews the importance of the "beliefs about one's capabilities to learn or perform behaviors at designated level." Improving system presentation could aid military personnel that possess advanced problem-solving skills but have limited background in the sciences (Levy & Green, 2009). A limited background in the sciences may complicate a user's ability to easily comprehend and, in turn, trust advanced technologies. Military personnel are trained to overcome obstacles using any means available, which leaves a very small window for impressing the usefulness of a new technology. Because of this, once a technology is perceived as an obstacle, it may be quickly discarded or ignored for an alternate easier to understand solution.

Additionally, a method for presenting technology that incorporates trust may increase the window of opportunity for acceptance (Choi & Ji, 2015). Conversely, systems presented without a trusted information source can limit the adoption of autonomous systems within the DOD (David & Nielsen, 2016), and the need for improved system presentation within the DOD is stated by Murphy and Shields (2012). Research by Lankton et al. (2015) compares trust in humans and trust in technology and provides a source for establishing a system presentation treatment that incorporates trust.

In summary, the field of HCI highlights the importance of the subjective interpretation of technology by humans. Technology advances when users trust the technology will perform as expected. Presenting technology in a format that contributes to a uniform response of trust may promote the acceptance of rapidly advancing technology. This subsection identified *system presentation* as an independent variable relevant to the current study on technology trust. This independent variable is further operationalized in the experimental design section.

2. Human-Automation Interaction (HAI)

This subsection investigates how varying levels of automation influence trust between humans and technology. Trust in modern technology is high enough that computers are used to automate nuclear power plants, control the flights of airplanes from start to finish, and drive passengers in cars that need to avoid fast-moving obstacles on busy roadways. The field of human-automation interaction (HAI) studies the relationship between this technology and humans. Automation is defined as the "machine execution of functions" (Parasuraman et al., 2000, p. 286). According to Groover (2018), a more detailed definition of automation is "the application of machines to tasks once performed by human beings or, increasingly, to tasks that would otherwise be impossible. Although the term mechanization is often used to refer to the simple replacement of human labor by machines, automation generally implies the integration of machines into a self-governing system." There are implications with placing trust in automation critical to our ability to function in everyday life, such as automation of the motor vehicle. Fleetwood (2017) presents the public health and ethical implications of automation in terms of the number of potential lives saved per year by *driverless* vehicles. Fleetwood predicts that over 30,000 lives could be saved per year in the United States by removing the human factors responsible for causing vehicle collisions. However, limited trust in automation contributes to the lack of acceptance of driverless cars (Bansal et al., 2016; Kyriakidis et al., 2015).

Many studies show that the trust is a major factor in the acceptance of technology with multiple levels of automation (Hoff & Bashir, 2015; Hoffman et al., 2013; Lee & See, 2004; Muir & Moray, 1996). The study by Verberne et al. (2012) suggests that automation

affects both trustworthiness and acceptability of autonomous systems, and that systems that are less familiar are often deemed less trustworthy. A familiar and basic form of automation is the vehicle cruise control, which became widely available in American cars in the 1960s. Recent advances in technology have produced multiple levels of vehicle automation as well as the number of terms used to describe the features. To remove ambiguity and increase trust, the Society of Automotive Engineers established five levels of vehicle automation (SAE, 2018). The first level starts at 0 and indicates no automation, with the human responsible for all aspects of driving. The second level, 1, refers to driver assistance with a single task such as steering or cruise/brake control with the human performing all other tasks. An example of level 1 automation is adaptive cruise control that can both brake and accelerate. Level 2 indicates partial driving automation where the vehicle performs multiple tasks such as steering and cruise/brake control. Levels 3 through 5 are used to describe autonomous vehicles with the technology that can perform all driving functions to varying degrees. Level 3 is called "conditional automation" and describes any vehicle that can manage all driving with limited human intervention. An example of a level 3 automation is the Tesla Autopilot or Cadillac Super Cruise. In level 4, also called "high automation," a vehicle may or may not have a steering wheel and pedals and can make all decisions necessary to drive (could be considered good or bad) without human intervention. Level 5 is used to describe a vehicle that performs completely autonomously and is capable of meeting or exceeding human performance. There are currently no examples of level 4 or 5 vehicle automation. The SAE categorization of vehicle automation presents a relevant strategy for improving trust in automation (Körber et al.,. 2018). Based on this strategy, it may be possible to develop similar manipulation techniques on a technology-invariant basis that are extensible beyond the motor vehicle, which inform the following hypothesis:

Hypothesis 4: Levels of automation and system presentation will have an interactive effect on trust in technology.

The different SAE levels of automation present two challenges in developing trust in technology. These challenges are associated with operator control and the human transition from owner of the system to becoming a partner or teammate using system-provided decision aids for control (Klein et al., 2004). The difficultly with operator control

manifests in the forced transition to automation and can result in two extreme reactions of overtrust and undertrust in automation. An example of undertrust is user apathy resulting from decision aids that are too difficult for a casual user to understand. In this case a user emphasizes a reason-based trust process utilizing long-term memory that leads to system rejection due to cognitive overload. A second example of undertrust in automation is a driver's refusal to try adaptive cruise control in heavy traffic out of fear of causing an accident. In this case the driver emphasizes the risk associated with automation, which causes them to abandon the inquiry and prevents the development of experience-based trust that could ultimately improve the decision-making ability. An example of overtrust is a driver falling asleep while a vehicle with level 2 automation navigates them through heavy traffic. In this case the driver has minimized the level of risk by failing to establish an accurate level of reason-based or experience-based trust. Overtrust may result from the same user apathy that caused undertrust, which is decision aids that are too difficult to understand and lead to cognitive overload.

Multiple studies contribute to an understanding of overtrust and undertrust in automation and robotics (Hoff & Bashir, 2015; Madhavan & Wiegmann, 2007; Lee & See, 2004; Hancock et al., 2011). The study by Hoff and Bashir (2015) found that trust in automation is based on three core areas: (1) human factors, such as user ability and perceived risk; (2) system attributes, such as reliability and capability; and (3) situational factors, such as operating environment and time constraints. The meta-analysis by Hancock et al. (2011) indicates that system attributes have the greatest contribution to the overall development of trust in technology.

As noted, Hoff and Bashir (2015) capture the three core factors of trust in automation (human factors, system attributes, situational factors). These information sources are compared to the trust life cycle illustrated in Figure 15. This figure indicates that human factors (risk) have a major influence on the inquiry process in that human psychology determines the level of risk a user is willing to assume (Zuckerman & Kuhlman, 2000). If the level of risk is low enough, the user will initiate or abandon the discovery process. The first step of the discovery process is gathering information on the available features and attributes of a candidate technology.

The current study posits that a system presentation framework that uses HAL will influence trust in technology. Once reason-based information is analyzed, a behavior-based response begins to formulate a prediction. The prediction leads to an intent to accept or reject the technology. System attributes dominate the processes of discovery through initial prediction. The prediction process also includes decisions based on situational factors such as environment and system use conditions. The output of the prediction is a decision to accept or reject the use of the technology for the current situation. The use of technology based on operational experiential experimentation with the technology provides the maximum possible information. Experiential experimentation provides a response to unpredictable empirical factors not available through purely reason-based information. At the end of the trust life cycle, the diagram indicates a feedback loop representing both the unpredictable situational factors identified in experimentation (deployment scenario, weather, etc.) and the system attributes identified during discovery (reliability, speed, etc.). Both reason-based and experience-based information contribute to trust and inform an iterative inquiry process.

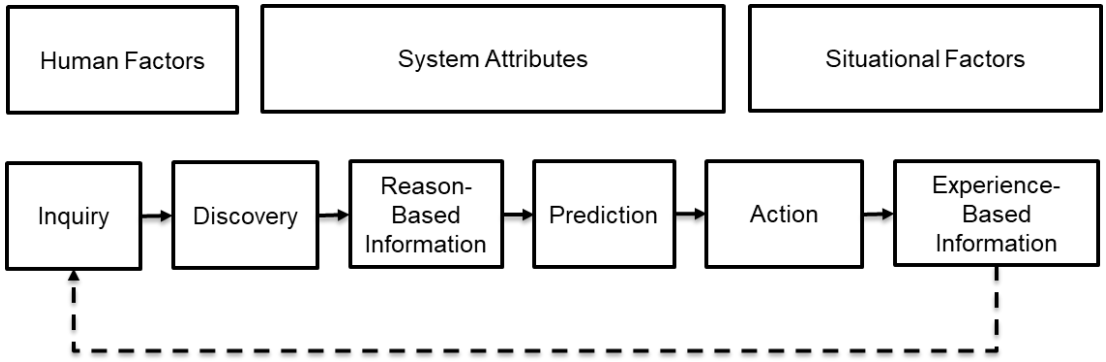

Figure 15. Comparison of Human-to-Technology Trust with Trust Life Cycle

Endsley (2017) identifies a potential problem that can complicate establishing trust in automation. Efforts to increase trust in automation (or robotics) often present as increased levels of control (in the form of additional switches and knobs). This increase in complexity makes a human operator less capable of processing critical tasks due to information overload and decreases the ability to take over manual control when necessary.

Information overload can lead to situations of overtrust (misuse) or undertrust (disuse) when an operator is forced to make an informed decision about the use of a system without a complete understanding caused by human inability to process all available information. The benefits and barriers of trust become more significant with increased levels of risk (Kramer, 1999). The human factors, as noted by Hoff and Bashir (2015), are identified as the area of greatest potential manipulation toward modifying the impact of overtrust and undertrust in technology (Lee & See, 2004). The other two factors noted by Hoff and Bashir (2015) of system attributes and situational factors are not easily controlled. The system attributes are often inherent to the technology and manipulation is typically not possible. The situational factors are subject to conditions outside the control of the operator, such as inclement weather.

Tétard and Collan (2009) advance an intriguing theory related to the challenges of adopting new technology for high-risk scenarios in their work on the lazy-user, hereby referred to in positive connotation as the efficient-user theory. This theory states that in high-risk scenarios users select the technology that demands the least amount of effort to do the job. The influence of the efficient user is demonstrated in the military ethos of *adapt and overcome.* This ethos encourages military personnel to accomplish a mission using any means necessary. In the case of the system presentation variable established earlier, the efficient user theory limits the window of opportunity to explain new technology. In the case of levels of automation, the application of this theory to high-risk military scenarios can increase levels of risk when users reject more capable technology for easier to use systems.

In summary, this subsection identified that users operating in high-risk environments favor technology with lower levels of automation that possess only the features needed to accomplish a mission and may reject new and complex technology in favor of older and more trusted systems. This subsection also identified that trust depends on *level of automation* (Hoff & Bashir, 2015), which is, therefore, used as an independent variable to study any effect of HAL information. This independent variable is further operationalized in the experimental design section and leads to the following hypothesis:

Hypothesis 5: Increased level of automation will decrease trust.

D. TECHNOLOGY ACCEPTANCE MODEL (TAM)

This section reviews current technology trust research and identifies dependent variables required to measure technology trust. A highly cited theory in technology trust research is presented by Fred Davis (1985) who investigated *user motivation* and how it can be used to measure and evaluate the likelihood of accepting a computer-based technology. The work by Davis (1985) presents the technology acceptance model (TAM), which is a validated model capable of predicting system use and is a theory relevant to measuring trust in technology. The TAM uses multiple variables to predict system use, and early studies focused on the acceptance of emerging computer applications such as email and word processors. Currently, the TAM plays a significant role in research investigating factors and attributes of *trust* and how they influence the acceptance of technology (Choi & Ji, 2018; Chutter, 2009; Turner et al., 2010; Kaur & Rampersad, 2018). Figure 16 provides an illustration of the TAM adapted from the work by Davis (1985).

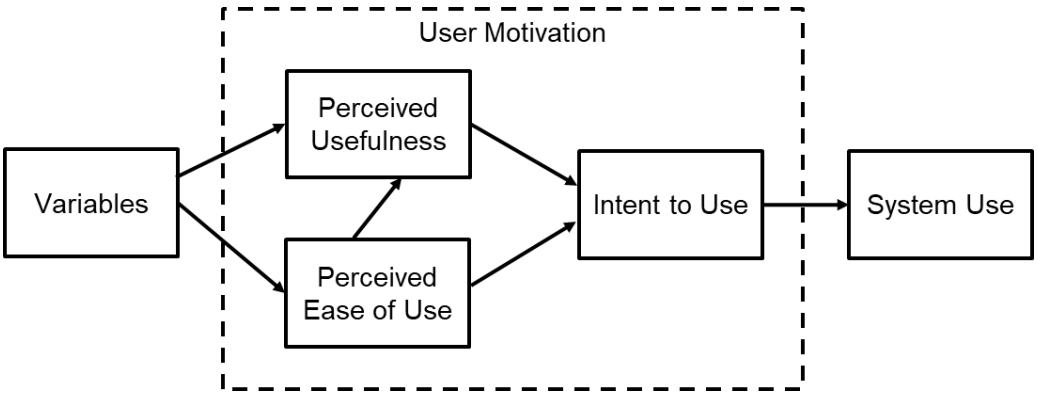

Figure 16. Technology Acceptance Model. Adapted from Davis (1985).

The TAM reveals that the acceptance of a technology depends on the user experience rather than the physical attributes of the technology (Davis, 1985). During experimentation conducted by Davis it was demonstrated that technology acceptance is largely dependent on the attitude that users have toward the product. To this end the TAM assesses the behavioral intention to accept a technology through the use three constructs: (a) perceived usefulness (PU), which describes how much a person feels technology will

improve their job performance, (b) perceived ease of use (PEOU), which is the amount a person thinks that using technology will be free of effort, and (c) intent to use (IU), which is a prediction of actual system use. Each construct is measured through a series of questions that are scored using a 5 or 7-point Likert likelihood scale. Lewis (2019) tested the ordering and format of different TAM scales and found no significant differences.

The TAM scales provide valuable insights relevant to the current study's investigation of technology trust and autonomous systems. Venkatesh and Bala (2008) extend the original TAM to include a moderating variable for *experience,* which they determine as significant for its influence on user acceptance. The Venkatesh and Bala (2008) research confirms the importance of system presentation (training) on the adoption of technology. Technology trust research conducted by McKnight et al. (2002) experimentally determined that trust in a single technology does not predict continued use outside of initial acceptance, and that trust in a technology does not translate to the acceptance of subsequent versions of the same technology. These results indicated the need to further explore factors that affect trust in technology. This ambiguity in the prior research validates the need to test the potential influence of the HAL system presentation framework as reason-based information, as well as confirms the importance of distinguishing between reason-based and experience-based information as it relates to trust.

The most widely researched area of technology trust integrates trust and TAM into a single model. Gefen et al. (2003a) extended the TAM constructs into a causal relationship between trust and actual system use. Similar work by Pavlou (2003) combines trust and risk with the TAM and empirically demonstrates that trust is an antecedent variable to risk, perceived usefulness (PU), perceived ease of use (PEOU), and intent to use (IU). The study by Pavlou (2003) establishes that trust and perceived risk correlate with the TAM variables, and that a decrease in trust increases perceived risk, which, in turn, decreases perceived intent to use (Figure 17). This research confirms that it is possible to manipulate technology trust by altering the user experience through increased or decreased levels of risk, and leads to the following hypothesis:

Hypothesis 6: System presentation will influence perceived risk.

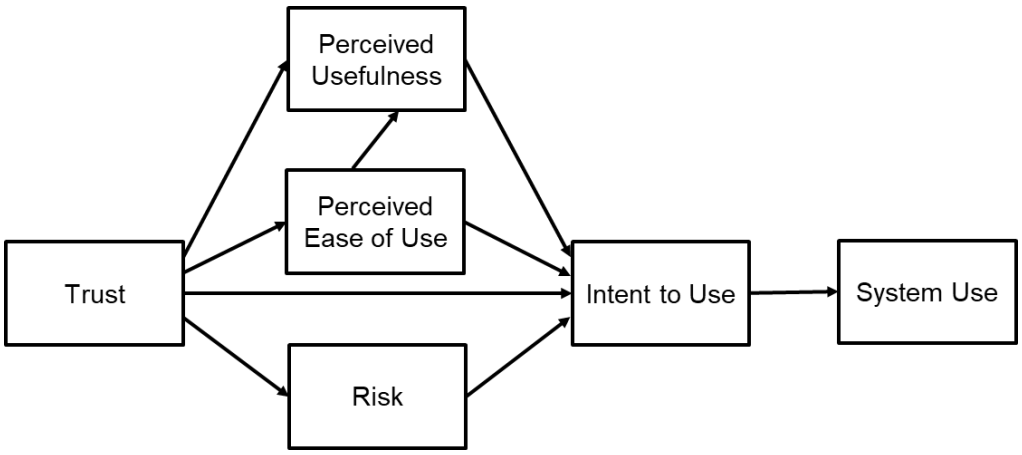

Figure 17. Technology Trust, Risk, and TAM. Adapted from Pavlou (2003).

The relationship between technology trust, TAM, and risk has been widely researched. Wu et al. (2011) presented a meta-analysis of empirical studies that investigated the path strengths between trust and TAM. In this analysis, Wu reviewed 136 empirical studies to chart the pairwise strength between trust and the TAM variables. The weighted mean ES is used to demonstrate the pairwise strength of the data gathered through a meta-analysis (Rosenthal, 1991). Weighted mean ES values of greater than 0.50 indicate a *large effect* as described by Cohen (1988). This is an important implication because it supports the use of TAM and Risk as surrogate dependent variables for technology trust. The Trust-TAM relationship weighted mean ES strengths are presented in Table 2.

Table 2. Trust-TAM Relationship Strength. Adapted from Wu et al. (2011).

Trust-TAM Relationship	Weighted Mean ES
Trust – Intent to use	0.5273*
Trust – Perceived Ease of Use	0.5128*
Trust – Perceived Usefulness	0.5647*

** Statistically significant at p = 0.05*

Although the TAM is widely used in research on technology trust, there are no published scores that provide benchmarks capable of predicting system use. The System Usability Scale (SUS) is an independently established variation of the TAM introduced by Brooke (1986) that functions as a tool to provide a *quick and dirty* rating system for technology. Whereas the TAM intends to predict an attitude toward a technology, the SUS intends to provide a benchmark used to score a technology against similar products. Scores of 70 or higher are considered acceptable for a given technology (Bangor et al., 2008). A review of the SUS reveals that the questions are closely aligned with the TAM Perceived Ease of Use questions. Both the TAM and SUS questions are provided in the experimental design chapter of the current study for comparison. The SUS instrument employs 10 statements that are measured on a 5-point Likert scale of strength of agreement. The SUS differs from TAM in that total scores are summed and vary from 0 (unacceptable) up to 100, which is the maximum level of usability. The 10 statements employed by the SUS alternate between 5 positively worded items, such as "I think that I would like to use system frequently," and 5 negatively worded items, such as "I found the system unnecessarily complex." According to Bangor et al. (2008), the SUS has good reliability with a coefficient alpha of 0.9. The SUS extends the TAM and provides a valid research mechanism for capturing user acceptance following system experience.

The TAM appears to follow a similar response process as presented earlier in Figure 11 illustrating the trust life cycle and OODA. Table 3 compares the OODA loop, the TAM, and the trust life cycle developed for the current study. The row headings in Table 3 (Problem, Cognitive Response, Affective Response, Behavioral Response) represent the original TAM categories developed by Davis (1985). The table provides concurrence between the current study's conceptual framework and widely accepted theories relevant to technology trust.

Table 3. Comparison of Trust Life Cycle, OODA, and TAM

	Trust Life Cycle	**OODA**	**TAM**
Problem	Inquiry	Observe	Design Features
Cognitive Response	Discovery	Orient	Perceived Usefulness & Perceived Ease of Use
Affective Response	Prediction	Decide	Intent to Use
Behavioral Response	Action	Act	Actual System Use

This section provided a review of current technology trust research. It presents the dependent variables of technology trust measurable via the TAM and Risk surrogates. This section also contributes to the experimental design by introducing SUS as a dependent variable that provides a score that is analogous to TAM. The SUS has value as a form of triangulation to confirm the reliability of the TAM response data in analyzing the effects of the independent variables, which are levels of automation and system presentation.

E. SUMMARY

This chapter defined the factors and attributes of technology trust as well as identified gaps in research as they relate to trust in systems. It identified that a methodology for technology discovery that influences trust does not exist. This literature review reveals a clear distinction between reason-based information and experience-based information. It suggests that users are willing to trust technology in high-risk environments and that an experience-based feedback loop can improve the quality of a trust relationship and the pace at which trust is established.

This literature review also identified similarities between human-human trust and human-technology trust as related to a trust life cycle. It discussed the exponential growth of technology dependence and the need for an effective system presentation framework as computer systems become more capable than their human counterparts. The categorization

of levels of autonomation by the SAE is presented as a method capable of improving increased trust in technology.

Two independent variables are developed for the current research. The first is three levels of automation and the second is three types of system presentation. Both variables potentially significantly influence trust and provide manipulation techniques that allow the studying of trust in various autonomous and semi-autonomous systems (Hoff & Bashir, 2015; Schaefer et al., 2016; Waytz et al., 2014). The two dependent variables developed for the current study are operationally defined in order to measure the effect of the two independent variables on trust. Multiple studies have empirically demonstrated that trust is an antecedent to and required for technology acceptance (Gefen et al., 2003a; Pavlou , 2003). The technology acceptance model (TAM) is noted for measuring individual attitudes toward a technology that are more important for acceptance of the technology than the technology's attributes (Davis, 1985). The system usability score (SUS) is closely related to the TAM's PEOU and provides a benchmark score for system use. The SUS differs from the TAM in that it allows for easy comparison among multiple models of the same technology (Bangor et al., 2008).

The TAM, Risk, and SUS metrics have demonstrated their usefulness as valid and predictive measures of technology trust. Figure 18 illustrates the links between the concepts identified in this literature review. This figure includes the two independent variables used in the current study (i.e., system presentation and levels of automation) that are assumed to affect technology trust (as measured by the three TAM metrics). Technology acceptance is introduced as a measure through the SUS benchmark that represents *actual system use*. Also provided in the figure are exemplar research references representing the links between these empirical concepts.

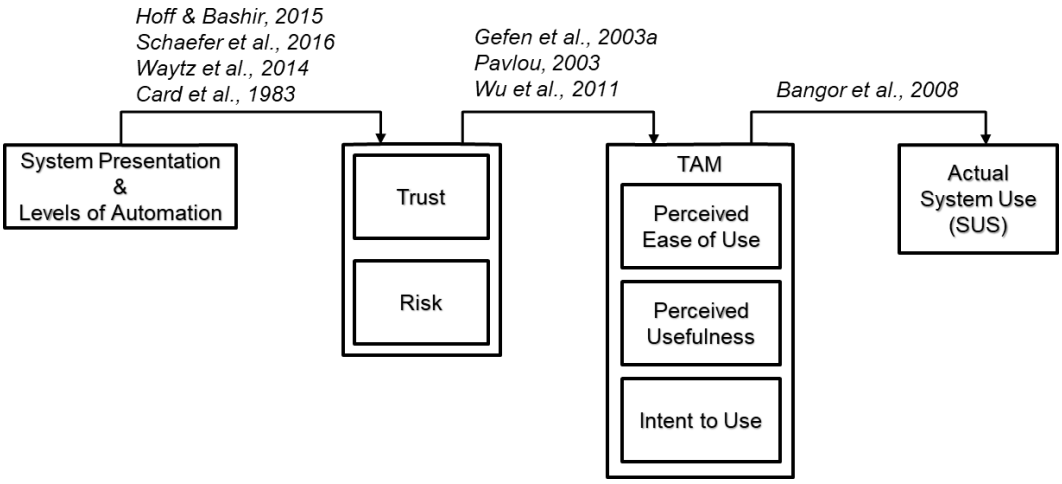

Figure 18. Exemplar Research Linking Independent and Dependent Variables

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IV. EXPERIMENTAL DESIGN

This chapter presents the experimental design used to test the current study hypotheses. The procedures, survey instruments, and experimental apparatus are described. Chapter II discussed the research used to establish HAL as an anthropomorphic hierarchy of system information. Chapter III identified two independent variables that affect technology trust (*system presentation, levels of automation*) and established two surrogate dependent variables *(TAM* and *Risk)* as valid and reliable measures of technology trust. The experimental design incorporates HAL into the variable of system presentation and studies the influence on TAM measures and perceived risk.

The experiment was conducted using a postpositivist worldview. Postpositivism rejects the concepts of positivism that claim absolute knowledge and truth are found through experimentation (Creswell & Creswell, 2017). The postpositivist worldview employed in this experiment recognizes that it is not possible to be certain of knowledge claims when studying the behavior or actions of humans. The current study hypotheses used a probabilistic cause-and-effect philosophy in which causes *probably* generate effects due to manipulations of independent variables. The postpositivist worldview employed by the current study used a quasi-experimental research approach as defined by Creswell & Creswell (2017).

A. OPERATIONAL DEFINITIONS

1. Independent Variables

This experiment manipulated two independent variables, *level of automation* and *system presentation,* to study their effects on technology trust.

a. Level of Automation

The level of automation is an ordinal variable and represents three different levels of automation (LOA) as defined in this subsection. Three different technologies were used to represent the three different LOA and are described in detail in Appendix A. The LOA is a significant contributor to technology trust in multiple studies (Hoff & Bashir, 2015;

Verberne, Ham, & Midden, 2012). This experiment selected technologies with LOA that vary from low to high. All technologies used this experiment are designated for use in a high-risk military application, which is defined as a scenario in which technology failure can lead to the loss of life or serious injury.

The LOA was operationalized as an independent variable using a model developed by Parasuraman et al. (2000). This LOA model presents a 10-point automation scale that varies from manual operation to full automation. For example, at level 1, a system offers no assistance to a human who directs control over all decisions. At the highest level of 10, the system makes all decisions and operates autonomously without any human input. At the mid-levels of 4, 5, and 6, the system may offer limited options for semi-autonomous operation or remote control.

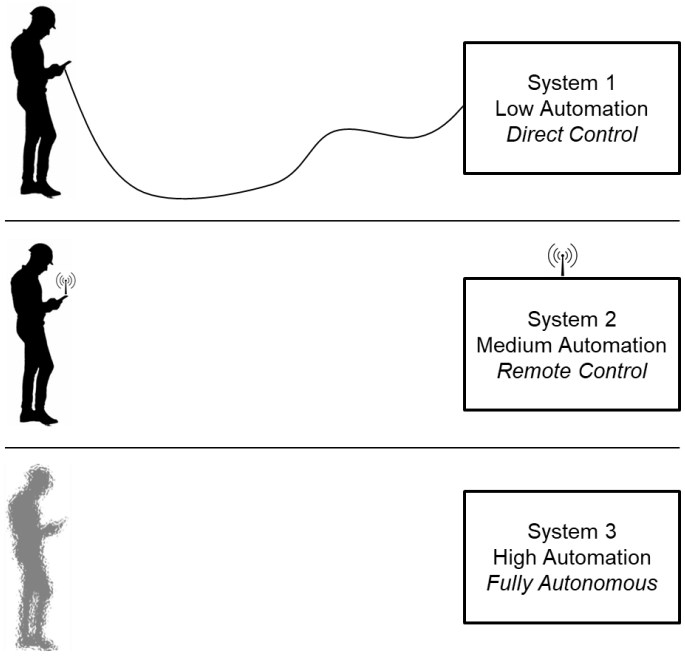

Figure 19. Levels of Automation Used During Experimentation

The low LOA system selected for the current study was directly controlled (level 1). The medium LOA system was remotely controlled with semi-autonomous features (levels 4, 5, and 6). The third system was high LOA and was fully autonomous (level 10). The levels of automation employed in this experiment are illustrated in Figure 19.

b. System Presentation

The system presentation variable is nominal and represents different types of information used during the treatments. System presentation was identified as a significant contributor to technology trust in the research reviewed in Chapter III of the current study. The *system presentation* independent variable is represented by three different types of information: vendor information, HAL information, and operational information.

The *vendor information* treatment exposed participants to reason-based information that was provided by the system vendor. The data were disparate and did not follow a common format. This treatment represents the current state of system presentation provided to military users. The vendor information was treatment one of the system presentation variables and was provided for all three systems (low LOA, medium LOA, high LOA).

The *HAL information* treatment exposed participants to two types of reason-based information (vendor information + HAL information). All vendor system data were collated as standardized HAL information that equally represented the systems under evaluation. In some cases, information in addition to what the vendor provided was included in HAL. The only other deviations between HAL information were due to differing system capabilities. For example, system A was remote-control versus system B that was autonomous. The HAL information was treatment two of the system presentation variables and was provided for all three systems (low LOA, medium LOA, high LOA).

The *operational information* treatment exposed participants to both reason-based and experience-based information (vendor information + HAL information + live experience). The experience information was provided by allowing users to deploy the technology in the intended operating environment, which in this case was the ocean. The operational information was treatment three of the system presentation variables and was provided for all three systems (low LOA, medium LOA, high LOA).

2. Dependent Variables

Three surrogate dependent variables were used to measure technology trust: risk, TAM (PU, PEOU, IU), and the SUS (this was required by the Marine Corps following live experience with technology).

This current study accepted the efficacy of the research reviewed for trust, risk, and TAM. Pavlou (2003) empirically demonstrated that TAM and risk are satisfactory surrogates that can be used to measure trust. Chircu (2000) and Gefen et al. (2003a, 2003b) demonstrated that trust significantly correlated with the TAM variables of and PEOU. Wu et. al., (2011) presented a meta-analysis of 100+ empirical studies that demonstrated the statistically significant path strengths between technology trust and TAM.

This study used TAM and Risk to measure technology trust by administering two surveys following all three system presentation treatments (vendor information, HAL information, operational information). The SUS survey was employed following the operational information (ops info) treatment and was used for regression analysis and to establish external validity for the trust metric. The survey questions are presented in this subsection, and copies of the survey instruments are provided in the Procedures subsection. Figure 20 illustrates the path relationship between the independent and dependent variables.

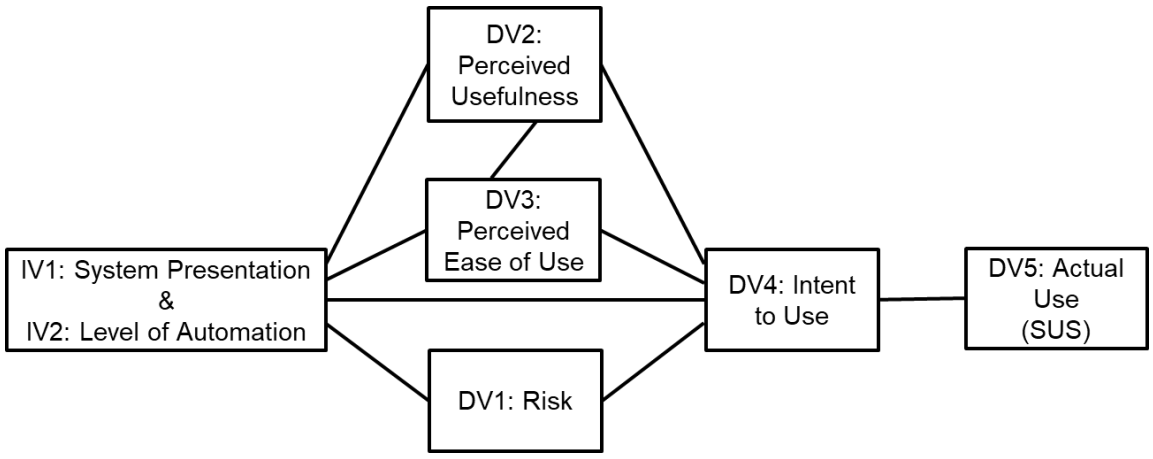

Figure 20. Independent and Dependent Trust Variables Relationships

a. DV1: Risk

Risk was captured once for each of the three treatment groups (vendor info, HAL info, ops info). This dependent variable was used to measure the perceived impact of the failure of system attributes in a high-risk scenario. The following survey items were presented, and participants responded on a Likert scale from 1 (no risk) to 5 (high risk).

Loss of system endurance
Loss of power
Loss of agility
Loss of speed
Only have direct control
Only have radio control
Only have autonomous operation
Loss of ability to store data
Slow response to commands
Loss of ability to obtain imagery
Loss of ability to obtain environmental data
Loss of ability to geolocate
Loss of comms needed to send data
Loss of comms needed to receive data

b. DV2, DV3, DV4: Technology Acceptance Model (TAM)

The TAM was captured three times per treatment group for the three LOA systems (low, medium, high). This dependent variable included questions for DV2, which was perceived usefulness (PU); DV3, which was perceived ease of use (PEOU), and DV4, which was intent to use (IU). The following survey questions were asked, and participants responded on a Likert scale from 1 (strongly disagree) to 5 (strongly agree).

PU1: This system would improve my performance.
PU2: This system would increase my accuracy.
PU3: This system would enhance my effectiveness completing the mission.
PU4: Overall, this system would be useful.
PEOU1: The operational use of this system is clear and understandable.
PEOU2: Using this system should not require a lot of my mental effort.
PEOU3: It should be easy to get this system to do what I want it to do.
IU1: Overall, this system would be easy to use.
IU2: Given the chance, I would use this system.
IU3: It is likely that I would recommend this system.

c. DV5: System Usability Score (SUS)

The SUS was a within-measures variable and was captured only in the ops info treatment group for the three LOA systems (low, medium, high). Relevant only to live experience, it was not captured during vendor info and HAL info. The SUS was used to create benchmark scores for comparison of the acceptability of the fielded technologies for the given scenario. John Brooke (1986) developed the following 10 SUS questions and participants responded on a Likert scale from 1 (not likely) to 5 (very likely). The results of the SUSs were summed to create a score from 0 (worst) to 100 (best). Brooke's (1986) SUS survey questions are:

I think that I would like to use this system frequently.
I found this system unnecessarily complex.
I thought this system was easy to use.
I think that I would need the support of a technical person to be able to use this system.
I found the various functions in this system were well integrated.
I thought there was too much inconsistency in this system.
I would imagine that most people would learn to use this system very quickly.
I found this system very cumbersome to use.
I felt very confident using this system.
I needed to learn a lot of things before I could get going with this system.

3. Blocking Variable

This experiment employed a single blocking variable of *technical background*. Because the study population was relatively homogeneous, the greatest potential variance among participants was found in their familiarity with the experimental technology systems. The technical background question intended to capture the level of familiarity a participant had with the experimental systems and was used in all three treatments (vendor info, HAL info, ops info). The following survey question was asked, and participants responded on a Likert scale from 1 (strongly disagree) to 5 (strongly agree).

I have been exposed to this technology in the past.

B. METHODOLOGY

The experiment was conducted using a 3 x 3 mixed factorial design. Two independent variables (IV) were used: IV1 was *System Presentation (Vendor information, HAL information, Ops information)*, and IV2 was *Level of Automation (Low LOA, Medium LOA, High LOA)*. Four dependent variables (DV) were used. DV1 was the perceived level of risk ("RISK") associated with the loss of a system attribute. DV2, DV3, and DV4 were the TAM variables. DV2 was perceived usefulness (PU), DV3 was perceived ease of use (PEOU), and DV4 was intent to use (IU). The mixed factorial design is illustrated in Table 4. The dependent variables display subscripts that indicated the headings of the survey data used for analytics (e.g., $RISK_{A1}$ indicated that A1 is the column name of the raw data from the survey data provided in Appendix B).

Table 4. 3 x 3 Mixed Factorial Design

		LEVEL OF AUTOMATION (LOA)		
		Low LOA *Direct Control*	Medium LOA *Remote Control*	High LOA *Autonomous*
SYSTEM PRESENTATION	Vendor info *Vendor*	$RISK_{A1}$ PU_{A2} $PEOU_{A2}$ IU_{A2}	$RISK_{A1}$ PU_{A3} $PEOU_{A3}$ IU_{A3}	$RISK_{A1}$ PU_{A4} $PEOU_{A4}$ IU_{A4}
	HAL info *Vendor + HAL*	$RISK_{B1}$ PU_{B2} $PEOU_{B2}$ IU_{B2}	$RISK_{B1}$ PU_{B3} $PEOU_{B3}$ IU_{B3}	$RISK_{B1}$ PU_{B4} $PEOU_{B4}$ IU_{B4}
	Ops info *Vendor + HAL + Live Experience*	$RISK_{C2}$ PU_{C3} $PEOU_{C3}$ IU_{C3} SUS_{C7}	$RISK_{C2}$ PU_{C4} $PEOU_{C4}$ IU_{C4} SUS_{C8}	$RISK_{C2}$ PU_{C5} $PEOU_{C5}$ IU_{C5} SUS_{C9}

1. Participants

System Presentation was a between-subjects factor, and participants were exposed to only one treatment (vendor info OR HAL info OR ops info). *Level of Automation* was a replicated test factor and participants were exposed to three different LOA (low AND medium AND high).

Participants were arranged into three treatment groups. Each of the three treatment groups consisted of different Marines with similar background and training in the high-risk field of explosive ordnance disposal (EOD). The first treatment group had 23 Marines; the second, 20 Marines; and the third, 19 Marines ($n_1 = 23$, $n_2 = 20$, $n_3 = 19$). Three test events were conducted on different days at a Naval/Marine Corps base. The selection of personnel with the same EOD experience was critical to help reduce *history biases*, which can threaten the internal validity of the study. Due to the standard military operating procedures, it was not possible to select participants completely at random, leading to a quasi-experimental design methodology. The participants were, instead, pre-assigned into three groups from within a single military unit. It was possible that the pre-assigning of participants was completely at random, but assignment was outside the control of the experiment. The three treatment groups are illustrated in Figure 21.

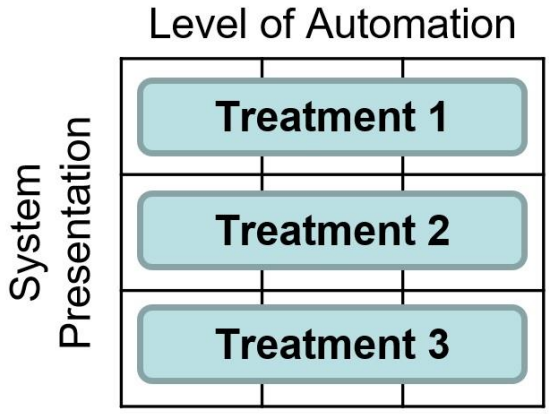

Figure 21. Experimental Treatment Groups

Due to the nature of the Marine Corps active-duty assignments, there was no way to perform pure probabilistic sampling approaches such as random, geographic, or stratified. Instead, the current study had to rely on standard *non-probabilistic convenience sampling*. This is a standard sampling approach applied in traditional classroom research environments that introduced *sampling bias* as a threat to external validity. Since the pool of participants that used technology in high-risk scenarios was exceptionally small, generalizing to a larger population was considered valid. This *quasi-experimental design* was, therefore, still deemed to be a valid approach and offered positive external validity. Due to the quasi-experimental approach, which was something that was beyond the control of the current study, there might exist some *self-selection bias* that threatens the internal validity of the data. To determine if any bias was statistically significant, Inter Class Correlation and Inter-Rater Reliability were conducted.

Due to the small sample size of under 30, normality of the underlying dataset was tested to confirm the application of standard parametric methods. The current study used the nonparametric Kruskal–Wallis test to confirm results from parametric ANOVA test, and the nonparametric Wilcoxon Signed-Rank test was used to confirm the results of standard parametric T-tests.

2. Procedures

Each of the three treatment groups was asked to complete surveys within the same amount of allotted time, in similar Navy-controlled conference rooms, and where all other environmental variables were kept as similar as possible to reduce any significant *environmental biases*. For example, the time the survey was conducted, the allotted time, the sequence of the survey questions, and the room temperature and lighting conditions were controlled to every extent possible. All three groups were asked to respond to two identical surveys, Survey 1 – Risk of System Failure, and Survey 2 – Technology Acceptance Model. The ordering of the survey questions was varied among three different formats. Varying the order of the survey questions can reduce the potential for *fatigue bias.* The same three survey formats were used for all treatment groups. Using the same series of survey instruments helped reduce *instrumentation biases* in the research.

The technologies could not be operated in the conference room setting as they needed to be completely submerged in water to start operating. Therefore, prior to taking the survey in the conference room, treatment group 3 was able to experience the technology in the ocean. Due to the addition of experience to group 3, the system usability score (SUS) was included as an additional survey as required by Marine Corps testing protocols. The SUS questions were not applicable unless participants had experience with the system. This situation could inject additional *maturation bias* if the same Marines were used in all three of the treatment groups. However, maturation bias was reduced because each of the three treatment groups were different Marine personnel with no prior knowledge of any previous treatments or events.

These experiment procedures did not create a perfect 3 × 3 factorial design in that all three treatments did not have the *exact* same controlled environment. Although treatment group 3 (ops info) had the same survey in a similar controlled conference room, it also had one additional survey. The experiment followed factorial design closely and can perhaps be best defined as either *Quasi* or *Mixed 3 x 3 Factorial Design*. There was no other conceivable approach that could have been applied to the third treatment group in order to provide the participants with experience information without the ability to touch and operate the equipment. This approach was found in the literature relating to the Isaac and Michael (1981) convention of Design 4, as well as their factorial design specification (the first factor was *system presentation*, and the second factor was the *LOA*). Detailed procedures for the three *system presentation* treatments is provided in the following.

a. Vendor information - Treatment One

System presentation treatment one was conducted in a controlled and distraction-free classroom environment and involved the participation of a randomly selected group of active-duty military from a single unit tasked with a high-risk mission. This group participated in an early morning session lasting one hour. During the experiment, participants were provided with an overview of a high-risk military scenario that was executed by deploying up to three different technology systems rather than human operators. The independent variable *system presentation* provided users with *vendor information*. The second independent variable, *level of automation*, was provided to each

participant in the form of three technologies with three varying levels of automation (*low LOA, medium LOA, high LOA*). The procedures used during treatment one follow:

1. Group one arrived in classroom and was provided with the paper survey and pencils.
2. Participants were provided with a PowerPoint presentation of a high-risk military scenario.
3. Participants were instructed that the mission was to be accomplished using up to three technologies.
4. The system presentation provided participants with the *vendor information* treatment.
5. The first technology briefed was a low LOA system that was directly controlled by the user through a tether.
6. The second technology briefed was a medium LOA remotely controlled by the user.
7. The third technology briefed was a fully autonomous system.
8. Participants were next asked to complete two paper surveys.
9. The first survey recorded the overall risk associated with the technology's attributes for all three systems.
10. Participants were instructed to wait until the entire group completed the first survey.
11. The second survey was administered and recorded the technology acceptance model questions for all three systems.
12. Participants were instructed to wait until the entire group completed the second survey.
13. Group one participants handed in the completed surveys and exited the classroom.

b. HAL information - Treatment Two

System presentation treatment two was conducted in a controlled and distraction-free classroom environment and involved the participation of a randomly selected groups of active-duty military from a single unit tasked with a high-risk mission. This group participated in a late morning session lasting one hour. During the experiment, participants were provided with an overview of a high-risk military scenario that was executed by deploying up to three different technology systems rather than human operators. The independent variable *system presentation* provided users with *HAL information*. The

second independent variable, *level of automation* was provided to each participant in the form of three technologies with three varying levels of automation (*low LOA*, *medium LOA*, *high LOA*). The procedures used during treatment two follow:

1. Group two participants entered the classroom within 15–30 minutes of treatment group one's departure.
2. Participants were provided with the same paper surveys as group one.
3. Participants were provided the identical high-risk mission scenario as group one.
4. Participants were instructed that the mission was be accomplished using up to three technology.
5. The system presentation provided participants with the *HAL information* treatment.
6. The first technology briefed was a low LOA system that was directly controlled by the user through a tether.
7. The second technology briefed was a medium LOA remotely controlled by the user.
8. The third technology briefed was a fully autonomous system.
9. Participants were next asked to complete two paper surveys.
10. The first survey recorded the overall risk associated with the technology's attributes for all three systems.
11. Participants were instructed to wait until the entire group completed the survey.
12. The second survey was administered and recorded the technology acceptance model questions for all three systems.
13. Participants were instructed to wait until the entire group completed the second survey.
14. Group two participants handed in the completed surveys and exited the classroom.

c. Operational information – Treatment Three

Experimental treatment three was conducted in the field and involved hands-on experience with the three technologies introduced during experiments one and two. This experiment was conducted six months after the classroom surveys taken for experiment one and experiment two. Treatment three participants were selected from the same military unit that participated in experiments one and two. This experiment was conducted over a

12-day period. The first 3 days were reserved for classroom and hands-on presentations, and the subsequent 9 days were used for operationally assessing the capabilities of three systems in the same high-risk scenario presented to the participants of treatments one and two. The day after field testing concluded, all participants gathered in a controlled and distraction-free classroom environment to complete the same surveys employed in treatment one and two. The procedures used during treatment three follow:

1. Participants were divided into three teams (A, B, C) consisting of five operators and one additional observer (O) from an external military unit.
2. Participants arrived at the field-testing facility and received training on all three systems using both *vendor information* and *HAL information* over a three-day period until proficient.
3. Participants were presented the identical high-risk mission scenario as in experiments one and two.
4. Participants were instructed to use all three technologies to accomplish the mission.
5. One team at a time was provided access to all three systems over a 24-hour period to accomplish the mission.
6. Each of the three teams was provided three 24-hour field testing periods for a total of nine days of experimentation.
7. Following completion of field testing, all participants gathered in a classroom.
8. Participants were first provided with the same two paper surveys as in experiment one and two.
9. Participants were instructed to complete the two surveys based on the potential of the technologies under ideal conditions, and to disregard any unexpected system failures.
10. Participants were then instructed to wait until the entire group completed the surveys.
11. Participants were next provided with an additional paper survey to record the system usability scale (SUS).
12. Participants were instructed to complete this survey based on the current state of the technology including system failures.
13. Participants were instructed to wait until everyone was done.
14. Participants handed in the surveys and exited the classroom.

All three treatments employ the same two surveys asking questions about system risk (survey 1) and technology acceptance (survey 2). Ops info employs an additional survey asking the participants to provide feedback on the actual use of the technology through the system usability scale (survey 3). Survey 3 was used to capture bias due to varying levels of technology readiness between the three systems. For example, one system may have more unexpected software or hardware failures than the other systems. The codes and associated surveys questions are provided in Table 5, Table 6, and Table 7.

Table 5. Survey 1 – Risk of System Failure

Code	**SURVEY 1 – Risk of System Failure**
HA1	Loss of system endurance
HA2	Loss of power
HA3	Loss of agility
HA4	Loss of speed
AL1	Only have direct control
AL2	Only have radio control
AL3	Only have autonomous operation
AL4	Loss of ability to store data
AL5	Slow response to commands
LN1	Loss of ability to obtain imagery
LN2	Loss of ability to obtain environmental data
LN3	Loss of ability to geolocate
LN4	Loss of comms needed to send data
LN5	Loss of comms needed to receive data

Table 6. Survey 2 – Technology Acceptance Model

Code	SURVEY 2 – Technology Acceptance Model (TAM)
PU1	This system would improve my performance.
PU2	This system would increase my accuracy.
PU3	This system would enhance my effectiveness completing the mission.
PU4	Overall, this system would be useful.
PEOU1	The operational use of this system is clear and understandable.
PEOU2	Using this system should not require a lot of my mental effort.
PEOU3	It should be easy to get this system to do what I want it to do.
PEOU4	Overall, this system would be easy to use.
IU1	Given the chance, I would use this system.
IU2	It is likely that I would recommend this system
IU3	I have been exposed to this technology in the past

Table 7. Survey 3 – System Usability Score

Code	SURVEY 3 – System Usability Scale (SUS)
Q1	I think that I would like to use this system frequently.
Q2	I found this system unnecessarily complex.
Q3	I thought this system was easy to use.
Q4	I think that I would need the support of a technical person to be able to use this system.
Q5	I found the various functions in this system were well integrated.
Q6	I thought there was too much inconsistency in this system.
Q7	I would imagine that most people would learn to use this system very quickly.
Q8	I found this system very cumbersome to use.
Q9	I felt very confident using this system.
Q10	I needed to learn a lot of things before I could get going with this system.

C. RELIABILITY AND VALIDITY

This experiment considered two indicators to ensure that measurements were both accurate and precise. The first indicator was reliability, which refers to the extent that the experiment was reproducible and that the measurements were free from error. The second indicator was validity, which attests that the experiment captured what it intended to measure.

1. Reliability

This experiment utilized the Technology Acceptance Model (TAM) as a reliable measurement instrument. King and He (2006) review 57 empirical studies that use the TAM and conclude that all constructs were highly reliable with an average Cronbach α (reliability) of 0.85 or greater.

2. Validity

Internal validity states that an experiment's statistical inferences about the causal effects were representative of both the population sampled and the scenarios under study. This experiment included two main threats to internal validity. The first is the size of the sample population, which was less than 30 and does not meet the standards of the central limit theorem necessary for assumption of normal data. Because of the small sample size, additional statistical techniques were employed to ensure that survey data were normally distributed. A second threat to internal validity exists in varying features between the three systems selected for experimentation beyond the differing LOA. There was no feasible way to correct for this threat since the current study was not in control of technology development. To lessen the influence of this bias, a blocking variable for overall *technology familiarity* was employed as described in the dependent variable section of this chapter.

External validity refers to the degree to which the experiment can be generalized from the population and scenario studied to other populations and scenarios. For example, external validity asks if the implications of the experiment were extensible outside of the unit of analysis, which for this experiment was a single military occupation. This experiment included participants that work with technology that can lead to death should

it fail. The population of individuals that work with such technology was very small (e.g. Navy EOD has a total of ~2,000 technicians). There was no expectation that the results of the current study apply outside of the military population of EOD. Any such generalizations have limited external validity due to interaction of selection and treatment bias. Generalizations outside of EOD require additional experiments with a more diverse sample population.

D. JUSTIFICATION FOR EXPERIMENTATION

The circumstances of this research required the participation of active-duty military involved with the high-risk deployment of autonomous systems. Pursuant to SECNAVINST 3900.39 (Secretary of the Navy, 2018), NPS requires institutional review board (IRB) approval for human-subjects research, as employed in this research. DOD Instruction 3216.02 (Department of Defense, 2011) prohibits monetary compensation to federal employees as a method of participant coercion. This research did not provide monetary compensation in the research design or as a recruitment contrivance. Approval was obtained for this research following institutional review board.

E. DATA ANALYTICS

This section provides an overview of the methods used to conduct the data analytics. The current study used primary data provided by an ongoing DOD experiment presented in Appendix A. A detailed explanation of the analytic approach is provided in Appendix B. The current study put significant effort into ensuring the data were normal, reliable, and valid. Based on the data distribution, additional justification was provided for the use of parametric versus nonparametric testing. Multiple inferential and descriptive statistical methods were described to support comparative hypothesis testing of multiple variables. Following group data analytics, the main effects pairwise hypotheses testing was conducted. The data analytics concluded with variable interrelationship regression testing to identify if the experiment data revealed a predictive capability between independent and dependent variables. The detailed results are provided in Appendix C. The next chapter provides the results of the hypothesis testing and presents key analytic findings. The conclusions and recommendations are discussed in Chapter VI.

F. SUMMARY

This chapter presented the experimental research design, methods, and procedures. This research used a 3 x 3 factorial design that manipulates the independent variables of *system presentation* and *level of automation*. The design incorporates three dependent variables: Risk, TAM, and SUS.

This chapter described a concept for system presentation that introduces and operationally defines HAL as an anthropomorphic hierarchy of information. The HAL information is technology invariant and organizes a system in the categories of hardware, algorithms, and links. This chapter also operationally defined the level of automation used in experimentation and discussed its effect on the development of trust.

The dissertation experimentally tested three treatments of the *system presentation* variable, and the procedures for each were presented. Three different LOA systems were presented to participants by manipulating the system presentation between vendor info, HAL info, and operational info. The operational info treatment was conducted in the field. In this treatment participants were introduced to the same technologies presented in treatments one and two. However, in this treatment the system information was obtained through experience. The participant experience was captured at the end of each of the three treatments by administering a survey for use in subsequent data analysis.

V. RESULTS

Various analytics were applied to the survey data to determine their statistical properties, such as tests of normality and tests of significance. The detailed approach, results of the tests of normality, tests of significance, and the survey raw data are provided in Appendix B and Appendix C. The tests of normality indicate that the data were quasi-normally distributed, which was why additional nonparametric testing was performed. The results of the parametric and nonparametric tests were identical in almost all cases.

A total of 62 Marines participated in the study. The vendor information group had 23 Marines; the HAL information group, 20 Marines; and the ops information group, 19 Marines ($n_1 = 23$, $n_2 = 20$, $n_3 = 19$). The average time in service of the participants was 10 years, and the average time in their current role was 4 years.

A. HYPOTHESES REVIEW

Hypothesis 1 predicted that autonomous systems used in high-risk application described using human-like information will be perceived as more useful than the same system described using standard vendor information. This hypothesis was partially supported in that HAL information appears to influence the high LOA (autonomous) system. Although the data shown in Table 19 did not produce a statistically significant difference between vendor info and HAL info ($p = 0.3857$, $\alpha = 0.10$), the TAM averages displayed in Table 13, Table 14, and Table 15 reveal an increase in the overall scores for both PU and IU.

Hypothesis 2 predicted that any technology, not just autonomous systems (high LOA), that is presented in humanlike terms would increase overall trust. This hypothesis was partially supported in that 2 of 4 perceived usefulness TAM scores for a single LOA system showed an increase from vendor to HAL information treatments. In this case the medium LOA system reveals two statistically significant results when performing T-Tests on the data in Table 24 for both perceived usefulness question 3 ($p = 0.0148$, $\alpha = 0.10$) and perceived usefulness question 4 ($p = 0.0102$, $\alpha = 0.10$).

Hypothesis 3 predicted that presenting any technology using experience-based operational information will increase trust in technology used in high-risk military scenarios. This hypothesis was fully supported in that aggregate TAM scores for Ops info were higher than both vendor info and HAL info for all three LOA systems. The data in Table 19 produced statistically significant T-Test results for both Vendor < Ops ($p = 0.0453$, $\alpha = 0.10$), and HAL < Ops ($p = 0.0700$, $\alpha = 0.10$).

Hypothesis 4 predicted an interactive effect between LOA and system presentation. This hypothesis states that LOA will have increased aggregate levels of trust if the system information was presented using a format analogous to the human body. This hypothesis was partially supported by the data displayed in Table 18. Both high LOA and medium LOA displayed increased TAM scores for PU, PEOU, and IU when the vendor information treatment is compared to the HAL information treatment. The low LOA system, on the other hand, decreased in PU, PEOU, and IU scores when the vendor information treatment is compared to the HAL information treatment. However, a two-way ANOVA failed to produce a statistically significant interactive effect ($p=0.2335$, $\alpha = 0.10$).

Hypothesis 5 predicted that trust in technology used in high-risk applications will decrease with increased LOA. This hypothesis was rejected in that regardless of system presentation, the LOA had no effect on the aggregate TAM scores. The data in Table 18 produced T-Test results for low LOA < med LOA ($p = 0.7337$, $\alpha = 0.10$), low LOA < max LOA ($p = 0.8668$, $\alpha = 0.10$), and med LOA < max LOA ($p = 0.7677$, $\alpha = 0.10$).

Hypothesis 6 predicted that system presentation will influence the perceived risk of failure for the three HAL categories of hardware, algorithms, and links. This hypothesis was partially supported in that the hardware categories displayed significant lower levels of risk when systems were presented using operational information. This was likely due limited insight into the algorithm and links, which indicates a potential gap of understanding of the risks associated with the failure of the algorithms and links categories. The results in Table 20 reveal that the perceived risk of hardware failure decreased when comparing Ops Info to HAL Info ($p = 0.0463$, $\alpha = 0.10$), and Ops Info to Vendor Info ($p = 0.0299$, $\alpha = 0.10$).

B. DATA ANALYTICS

The data were analyzed using Real Options Valuation BizStats. To effectively use statistical software techniques, the treatment groups are referred to in the following sections as A, B, and C. Group A is listed as VENDOR INFO; Group B as HAL INFO; and Group C as OPS INFO.

1. Interclass Correlation Reliability Test

The Interrater Reliability Test with Interclass Correlation (ICC) tests were run to determine if the data received were statistically reliable (Table 8). The ICC tests the reliability of the users' ratings by comparing the variability of all the ratings of the same participant to the total variation across all ratings and all users simultaneously. A high ICC indicates a high level of reliability (Mun, 2018).

The ICC test was run, and it was concluded that the collected data were reliable and valid for the research. The ICC ranged from 0.1581 to 0.3544 for the vendor and HAL information, compared to a range of from 0.2200 to 0.6925 for the ops information results.

Table 8. ICC and Reliability Analysis

Intercorrelation ICC Reliability Measures (ICC)

Vendor Info	ICC	P-value
A1:: VAR1:VAR14	0.3544	0.0000
A2:: VAR15:VAR25	0.2886	0.0000
A3:: VAR26:VAR36	0.2302	0.0000
A4:: VAR37:VAR47	0.2692	0.0000
A5:: VAR48:VAR51		
HAL info	**ICC**	**P-value**
B1:: VAR101:VAR114	0.3207	0.0000
B2:: VAR115:VAR125	0.2568	0.0000
B3:: VAR126:VAR136	0.2528	0.0000
B4:: VAR137:VAR147	0.2975	0.0000
B5:: VAR148:VAR151	0.1581	0.0016
Ops info	**ICC**	**P-value**
VAR201:VAR214	0.5067	0.0000
VAR215:VAR228	0.4584	0.0000
VAR229:VAR239	0.6709	0.0000

VAR240:VAR250	0.2593	0.0000
VAR251:VAR261	0.2200	0.0000
VAR262:VAR265	0.3146	0.0000
VAR266:VAR275	0.6925	0.0000
VAR276:VAR285	0.2264	0.0000
VAR286:VAR295	0.2328	0.0000
VAR296:VAR298	0.6081	0.0000

2. Internal Validity Test

Using the ANOVA with blocking variables model, the results are shown in Table 9. In this experiment, the active-duty military either had experience with similar technology or they did not. The ANOVA test was run with blocking or controlling the user background. The null hypothesis was rejected in that the three LOA systems were statistically different with no intervening variables. The treatment factor indicates that there were statistically significantly different results among the three LOA systems, but whether an end user had a technical background or not did not affect the results.

Table 9. ANOVA with Randomized Blocks

Model Inputs:
VAR296; VAR297; VAR298
SUSA, SUSB, SUSC

ANOVA Randomized Blocks Multiple Treatments

	DF	SS	MS	F Stat	p-Value
Block Factor (Row)	18	4384.65	243.59	1.5282	0.1367
Treatment Factor (Column)	2	11369.96	5684.98	5.6650	**0.0000**
Error	36	5738.38	159.40		
Total	56	21492.98			

F Critical (Treatment) @ 0.01	5.247893
F Critical (Blocking) @ 0.01	2.479730

3. Hotelling Test Result

The Hotelling parametric test provides a grouped estimate of differences between the system presentations. Results from this test provided rough estimates of significance for the effect of system presentation in hypotheses one and two. This tested group survey responses as a whole and checked for statistical differences between the grouped responses of the three LOA systems. For example, was the TAM score for the LOA system different when vendor information was provided, HAL information was provided, or when ops information was provided?

The Hotelling test indicated that not all data were sufficiently statistically different. There were no perceivable differences between the vendor information and HAL information groups (comparing all elements of Group A to all elements of Group B as shown in Table 10).

When comparing the vendor information or HAL information group against the ops information group, there was a statistically significant difference among the responses. The trend seemed to be that there was more difference between Group A (vendor information) and Group C (ops information) than between Group B (HAL information) and Group C. In addition, the significance was higher for low LOA systems than for medium LOA systems, which, in turn, was more significant than for high LOA systems.

Table 10 and Table 11 show a sampling of the results from the Hotelling T2 test. The null hypothesis was that there were no statistical differences using a parametric Hotelling T2 test, where all the survey responses in each of the subcategories, when taken together, simultaneously do not indicate that there were any differences between the two groups tested.

Table 10. Hotelling Test 1 Results Summary

Hotelling Test Groups	**P-value**	**Variables Tested**
Group A1 vs. Group B1	0.5863	VAR1:VAR14 vs. VAR101:VAR114
Group A2 vs. Group B2	0.7998	VAR15:VAR25 vs. VAR115:VAR125
Group A3 vs. Group B3	0.3515	VAR26:VAR36 vs. VAR126:VAR136
Group A4 vs. Group B4	0.2084	VAR37:VAR47 vs. VAR137:VAR147
Group A5 vs. Group B5	0.7095	VAR48:VAR51 vs. VAR148:VAR151
Group A6 vs. Group B6	0.4475	VAR52:VAR54 vs. VAR152:VAR154
Group A2 vs. Group C3A	**0.0000**	VAR15:VAR25 vs. VAR415:VAR425
Group A3 vs. Group C4A	**0.0144**	VAR26:VAR36 vs. VAR426:VAR436
Group A4 vs. Group C5A	**0.0793**	VAR37:VAR47 vs. VAR437:VAR447
Group B2 vs. Group C3A	**0.0000**	VAR115:VAR125 vs. VAR415:VAR425
Group B3 vs. Group C4A	0.1215	VAR126:VAR136 vs. VAR426:VAR436
Group B4 vs. Group C5A	0.3232	VAR137:VAR147 vs. VAR437:VAR447

Table 11. Hotelling Test 2 Results for Group A6 vs. Group B6

VAR52; VAR53; VAR54 vs. VAR152; VAR153; VAR154
D1, D2, D3 vs. D1, D2, D3
Hotelling T-Square: Two Independent Variable
Equal Variance with Multiple Related Measures

Hotelling T2	2.85372
F Statistic	0.90484
P-value	0.44753

Null hypothesis tested is that there is zero difference between all the related variables compared across the two groups.

Covariance GROUP 1

	VAR52	VAR53	VAR154
VAR52	0.00000	0.00000	0.00000
VAR53	0.00000	15.56621	13.61660
VAR54	0.00000	13.61660	17.73419

Covariance GROUP 2

	VAR152	VAR153	VAR154
VAR152	0.23947	-0.26711	-1.00395
VAR153	-0.26711	9.35461	10.39408
VAR154	-1.00395	10.39408	15.11776

Covariance POOLED

	VAR52	VAR53	VAR54
VAR152	0.11098	-0.12378	-0.46524
VAR153	-0.12378	12.68766	12.12324
VAR154	-0.46524	12.12324	16.52170

4. Bonferroni Test Results

The previous parametric Hotelling test grouped all three LOA system in one system presentation group and compared them to the same three LOA in another system presentation group. Results from the Bonferroni test provided a more refined estimate of significance for hypotheses four and five that discuss the effect of level of automation. The parametric Bonferroni test compared one pair of TAM scores at a time, like the T-test. The improvement over the Hotelling test is that the Bonferroni test accounts for the added degrees of freedom with multiple simultaneous pairwise tests. Table 12 shows a sampling of the results from the Bonferroni test.

When all the survey responses for each subgroup were taken individually, there were no statistical differences in the responses in terms of the three systems. In all the tests, no statistical significance was detected, and all treatments were statistically identical. This implied that additional and more detailed parametric testing was required.

Table 12. Bonferroni Test (Sample Results)

Simultaneous Confidence Intervals
Mean Difference of Null is 0
Model Inputs:

	VAR48; VAR148; C1,	VAR49; VAR149; C2,	VAR50; VAR150; C3,	VAR51 VAR151 C4
Mean Difference	0.0522	-0.3283	-0.0152	-0.0457
Variance Group 1	1.6917	1.5336	0.8024	0.5850
Variance Group 2	1.4105	0.5553	0.3658	0.5553
Pooled Variance	1.2496	1.0393	0.7746	0.7558
F-Critical	2.6190	2.6190	2.6190	2.6190
T-Critical	3.3620	3.3620	3.3620	3.3620
Standard Error	0.3820	0.3178	0.2368	0.2311
Lower Confidence	-1.2323	-1.3966	-0.8115	-0.8225
Upper Confidence	1.3366	0.7401	0.7810	0.7312
Within Confidence?	Yes.	Yes.	Yes.	Yes.
Bonferroni Critical	2.6127	2.6127	2.6127	2.6127
Lower Confidence	-1.4760	-1.5993	-0.9626	-0.9700
Upper Confidence	1.5803	0.9428	0.9321	0.8786
Within Confidence?	Yes.	Yes.	Yes.	Yes.

Null hypothesis: the individual expected differences are equal to zero.

5. Two-Way ANOVA

A total of three two-way ANOVA tests were performed to determine if the independent variables (LOA, system presentation) produced statistically significant differences in the TAM scores (PU, PEOU, IU). Each of the three TAM scores were tested in order and the results were used to inform hypotheses two through five. The data for all two-way ANOVA tests, along with the survey questions, are provided in Table 13, Table 14, and Table 15. The LOA was the columns factor and the system presentation was the rows factor.

The first tested was the perceived usefulness (PU) score within the three LOA. In a two-tailed test, the LOA (columns) displayed statistically significant differences within the PU variable and the null hypothesis was rejected with $p = 0.00$, $\alpha = 0.10$. The system presentation treatments (rows) were also tested between PU, and the null was likewise rejected with $p = 0.00$, $\alpha = 0.10$.

The perceived ease of use (PEOU) dependent variable was tested next within the three LOA (columns) and was not seen as statistically different; the null hypothesis in this case was accepted with $p = 0.8281$, $\alpha = 0.10$. The system presentation treatment (rows) did display a strong difference between this PEOU variable, and the null was accepted with $p = 0.00$, $\alpha = 0.10$. This means that even though the system presentation treatment caused a difference in PEOU, the LOA did not affect the PROU regardless of the amount or type of information used for system presentation.

Lastly, the intent to use (IU) dependent variable was tested. In this case the LOA (columns) did not display a difference within the IU variable and the null was accepted with $p = 0.5490$, $\alpha = 0.10$. The system presentation treatment (rows) revealed statically significant differences between the IU variables, and the null was rejected with $p = 0.0222$, $\alpha = 0.10$.

In summary, the two-way ANOVA tests revealed statically significant differences between the system presentation treatments (rows) for all three TAM variables (PU, PEOU, IU). The LOA (columns) displayed significant differences for only one of the three variables (PU, and not PEOU or IU).

Table 13. Perceived Usefulness (Average Scores)

Factor A: System Presentation	Factor B: Level of Automation		
Averages	Low	Med	High
Vendor PU1	3.8261	3.5652	3.6087
Vendor PU2	3.9565	3.6957	4.0870
Vendor PU3	3.6087	3.2174	3.1739
Vendor PU4	3.6522	3.1739	3.3913
HAL PU1	3.6500	3.8500	3.8000
HAL PU2	4.0500	3.8500	3.8000
HAL PU3	3.4000	3.7000	3.8500
HAL PU4	3.4500	3.7500	3.5500
Ops PU1	4.8947	4.1053	3.3684
Ops PU2	4.9474	3.6842	3.3684
Ops PU3	4.9474	3.9474	3.2632
Ops PU4	4.9474	4.0526	3.4737

Perceived Usefulness Questions

PU1: This system would improve my performance identifying targets.
PU2: The system would increase my accuracy identifying targets.
PU3: The system would enhance my effectiveness completing the mission.
PU4: Overall, this system would be useful.

Table 14. Intent to Use (Average Scores)

Factor A: System Presentation	Factor B: Levels of Automation		
Averages	Low	Medium	High
Vendor IU1	3.7391	3.5217	3.4783
Vendor IU2	3.2609	3.0000	3.1739
Vendor IU3	1.9130	2.0000	1.8696
HAL IU1	3.3500	3.8000	3.6000
HAL IU2	2.8000	3.4500	3.2500
HAL IU3	1.8500	2.1000	1.9000
Ops IU1	4.7368	4.0526	3.1579
Ops IU2	4.8421	3.9474	2.8421
Ops IU3	1.7368	1.8947	1.7368

Intent to Use Questions

Iteration 1: Given the chance, I would use this system.
Iteration 2: It is likely that I would recommend this system.
Iteration 3: I have been exposed to this technology in the past.

Table 15. Perceived Ease of Use (Average Scores)

Factor A: System Presentation	Factor B: Level of Automation		
Averages	Low	Med	High
Vendor PEOU1	3.9130	3.8261	4.0000
Vendor PEOU2	3.0000	3.0435	3.9565
Vendor PEOU3	3.7826	3.5652	3.2174
Vendor PEOU4	3.3913	3.6957	3.5652
HAL PEOU1	3.6000	3.8500	3.8000
HAL PEOU2	3.0500	3.3500	3.8500
HAL PEOU3	3.7000	3.8000	3.5000
HAL PEOU4	3.4000	3.5500	3.5000
Ops PEOU1	4.5263	4.1053	3.8421
Ops PEOU2	4.0526	4.0000	3.7895
Ops PEOU3	4.6842	4.0526	4.0526
Ops PEOU4	4.5789	4.1053	3.8947

Perceived Ease of Use Questions
PEOU1: The operational use of this system of clear and understandable.
PEOU2: Using this system should not require a lot of my mental effort.
PEOU3: It should be easy to get this system to do what I want it to do.
PEOU4: Overall, this system would be easy to use.

6. ANOVA I – Level of Automation Test Results

A total of 43 separate single variable multiple treatment ANOVA models were replicated, and the results used to address the influence of LOA in hypotheses three, four, and five. Table 16 shows the statistically significant results from the ANOVA models. Results from this test were used to inform LOA significance in hypotheses 4 and 5. Out of the 43 models, 21 showed statistical significance. ANOVA tested each of the survey question in each of the three systems independently. For example, when testing VAR20, VAR31, VAR42, the results showed that at least one or more of these three variables were statistically different from one another.

The ANOVA test looked at the individual questions within each of these groups to identify which questions returned different responses for each LOA systems between the three different system presentations (vendor info, HAL info, ops info).

The three systems were statistically different in their characteristics. The within-subjects ANOVA results support the results from the Hotelling T2 tests, where Group A

was statistically significantly different than Group B and Group C, and Group B was statistically significantly different than Group C.

Table 16. ANOVA Results I

ANOVA	P-value
VAR20; VAR31; VAR42	**0.0008**
VAR21; VAR32; VAR43	**0.0903**
VAR120; VAR131; VAR142	**0.0264**
VAR124; VAR135; VAR146	**0.0362**
VAR229; VAR240; VAR251	**0.0000**
VAR230; VAR241; VAR252	**0.0000**
VAR231; VAR242; VAR253	**0.0000**
VAR232; VAR243; VAR254	**0.0002**
VAR233; VAR244; VAR255	**0.0601**
VAR237; VAR248; VAR259	**0.0004**
VAR238; VAR249; VAR260	**0.0000**
VAR239; VAR250; VAR261	**0.0000**
VAR266; VAR276; VAR286	**0.0000**
VAR267; VAR277; VAR287	**0.0285**
VAR268; VAR278; VAR288	**0.0003**
VAR269; VAR279; VAR289	**0.0020**
VAR270; VAR280; VAR290	**0.0000**
VAR271; VAR281; VAR291	**0.0000**
VAR272; VAR282; VAR292	**0.0351**
VAR273; VAR283; VAR293	**0.0002**
VAR274; VAR284; VAR294	**0.0000**

7. ANOVA II – System Presentation Test Results

A total of 33 separate single variable multiple treatment ANOVA models were run to test the individual questions within the three LOA systems between the three system presentations (i.e., for each of the survey questions, if each of the three LOA systems have similarities or differences between the vendor information, HAL information, and ops information groups). The results of this test were used to inform on the influence of the level of automation in hypotheses four and five. Table 17 shows the statistically significant results from the ANOVA models. Out of the 33 models, 16 showed statistical significance at the $\alpha = 0.10$ level.

The low LOA system tended to benefit the most from the operational information. The medium LOA system tended to somewhat benefit from operational information. The

high LOA systems tended to benefit the least from the operational information, and, in fact, the additional work performed contributes added insights to only 18% of the cases.

Table 17. ANOVA Results II

Model	P-Value
ANOVA on VAR15; VAR115; VAR415	**0.0000**
ANOVA on VAR16; VAR116; VAR416	**0.0000**
ANOVA on VAR17; VAR117; VAR417	**0.0000**
ANOVA on VAR18; VAR118; VAR418	**0.0000**
ANOVA on VAR19; VAR119; VAR419	**0.0008**
ANOVA on VAR20; VAR120; VAR420	**0.0003**
ANOVA on VAR21; VAR121; VAR421	**0.0001**
ANOVA on VAR22; VAR122; VAR422	**0.0000**
ANOVA on VAR23; VAR123; VAR423	**0.0001**
ANOVA on VAR24; VAR124; VAR424	**0.0000**
ANOVA on VAR25; VAR125; VAR425	0.9065
ANOVA on VAR26; VAR126; VAR426	0.1378
ANOVA on VAR27; VAR127; VAR427	0.8325
ANOVA on VAR28; VAR128; VAR428	**0.0232**
ANOVA on VAR29; VAR129; VAR429	**0.0157**
ANOVA on VAR30; VAR130; VAR430	0.4783
ANOVA on VAR31; VAR131; VAR431	**0.0114**
ANOVA on VAR32; VAR132; VAR432	0.2256
ANOVA on VAR33; VAR133; VAR433	0.1102
ANOVA on VAR34; VAR134; VAR434	0.3337
ANOVA on VAR35; VAR135; VAR435	**0.0089**
ANOVA on VAR36; VAR136; VAR436	0.8973
ANOVA on VAR37; VAR137; VAR437	0.3700
ANOVA on VAR38; VAR138; VAR438	**0.0472**
ANOVA on VAR39; VAR139; VAR439	0.0843
ANOVA on VAR40; VAR140; VAR440	0.8850
ANOVA on VAR41; VAR141; VAR441	0.6999
ANOVA on VAR42; VAR142; VAR442	0.8385
ANOVA on VAR43; VAR143; VAR443	**0.0324**
ANOVA on VAR44; VAR144; VAR444	0.4305
ANOVA on VAR45; VAR145; VAR445	0.4985
ANOVA on VAR46; VAR146; VAR446	0.4633
ANOVA on VAR47; VAR147; VAR447	0.9063

8. T-Tests – Aggregate Scores

Two variable T-tests were performed on aggregated TAM scores (PU, PEOU, IU) and Risk scores to determine the effect of changing the type of information used during system presentation (vendor, HAL, Ops). The aggregate data used for the TAM T-tests are shown in Table 18 and Table 19. The p-values for the risk T-tests are shown in Table 20.

The first set T-test compared scores within the three LOA (low, medium, high) and informed hypotheses four and five. The aggregate data used for this test are shown in Table 18. Test one was run to see if low LOA had a lower aggregate TAM score than medium LOA (low LOA < medium LOA). Test two was run to see if low LOA had a lower aggregate TAM score (low LOA < med LOA < high LOA). In all cases (low < med, low < high, med < high), the null hypothesis was accepted with the following p-values: low LOA < med LOA ($p = 0.7337$, $\alpha = 0.10$), low LOA < max LOA ($p = 0.86682$, $\alpha = 0.10$), med LOA < max LOA ($p = 0.7677$, $\alpha = 0.10$). Given these results, it was concluded that the level of automation had no significant effect on the TAM scores.

Table 18. Level of Automation T-Test

		Factor B: Level of Automation		
	Average	Low	Med	High
Factor A: System Presentation	Vendor PU	3.7609	3.4130	3.5652
	Vendor PEOU	3.5217	3.5326	3.6848
	Vendor IU	2.9710	2.8406	2.8406
	HAL PU	3.6375	3.7875	3.7500
	HAL PEOU	3.4375	3.6375	3.6625
	HAL IU	2.6667	3.1167	2.9167
	Ops PU	4.9342	3.9474	3.3684
	Ops PEOU	4.4605	4.0658	3.8947
	Ops IU	3.7719	3.2982	2.5789

The second set of T-tests compared scores between the three system presentations (vendor, HAL, ops) and informed hypotheses one, two, and three. The aggregate data used for this test are shown in Table 19. Test one was run to see if vendor information produced a lower TAM score than the HAL information treatment (vendor < HAL). In this case we

accept the null hypothesis with $p = 0.3857$, $\alpha = 0.10$, and conclude that the addition of more reason-based information adds no value. The second T-test was conducted to determine if system presentation using vendor information had a lower aggregate TAM score than ops information (vendor < ops). This test revealed a statistically significant result and the null hypothesis was rejected ($p = 0.0453$, $\alpha = 0.10$); it is concluded that ops information, indeed, provided a higher aggregate TAM score. The third test asked if HAL information had a lower aggregate TAM score than ops information (HAL info < ops info). In this case the result was statistically significant, so the null was rejected ($p = 0.0700$, $\alpha = 0.10$), and we concluded that ops information adds significant value over the vendor information and HAL information treatments.

Table 19. System Presentation T-Test

		Factor B: System Presentation		
	Average	Vendor	HAL	Ops
Factor A: Level of Automation	Low PU	3.7609	3.6375	4.9342
	Med PU	3.4130	3.7875	3.9474
	High PU	3.5652	3.7500	3.3684
	Low PEOU	3.5217	3.4375	4.4605
	Med PEOU	3.5326	3.6375	4.0658
	High PEOU	3.6848	3.6625	3.8947
	Low IU	2.9710	2.6667	3.7719
	Med IU	2.8406	3.1167	3.2982
	High IU	2.8406	2.9167	2.5789

The third set of T-tests compared the risk of failure of the various HAL categories (hardware, algorithm, links). The results of this test were used to inform on perceived risk per hypothesis six. The p-values of the directional T-tests are shown in Table 20. The Mann–Whitney (MW) is a nonparametric version of the T-test and was used to confirm the validity of the data given the small sample size. The results clearly indicated that the parametric T-test and nonparametric MW have matching results, thus confirming normality of data. In this case, the perceived risk of hardware failure was reduced when subjects were presented with operational information. For ops info < HAL info, the null

was rejected ($p = 0.0463$, $\alpha = 0.10$). For ops info < vendor info, the null was rejected ($p = 0.0299$, $\alpha = 0.10$).

Table 20. Risk of Failure T-Test

One Tailed Alternate Hypotheses Tested	p-values T-Test	MW
Hardware Risk with Ops Info < Hardware Risk with HAL Info	**0.0463**	**0.0486**
Hardware Risk with Ops Info < Hardware Risk with Vendor Info	**0.0299**	**0.0307**
Hardware Risk with HAL Info < Hardware Risk with Vendor Info	0.4219	0.4323
Algorithm Risk with Ops Info < Algorithm Risk with HAL Info	0.3847	0.2368
Algorithm Risk with Ops Info < Algorithm Risk with Vendor Info	0.2536	0.1848
Algorithm Risk with HAL Info < Algorithm Risk with Vendor Info	0.3521	0.4228
Links Risk with Ops Info < Links Risk with HAL Info	0.1334	0.1559
Links Risk with Ops Info < Links Risk with Vendor Info	0.5415	0.4051
Links Risk with More Info < Links Risk with Vendor Info	0.9018	0.1049

9. T-Test I – Level of Automation Results

The T-tests were only performed on the ANOVA variables identified as statistically significant. This test provided detailed results and contributed to the effect of LOA addressed in hypotheses four and five. This test was run within each experimental treatment for the three LOA (low vs. medium vs. high) to see if they were perceived to be the same. For example, when presented with less system information, are the three LOA systems perceived to be the same or different?

The results indicated that only some of the TAM scores were different for the LOA systems within the same system presentation treatment. For example, the low LOA vs. high LOA show the most amount of difference, regardless of the experimental treatment. A majority of the low LOA vs. medium LOA and medium LOA vs. high LOA systems also showed differences, although less than the low LOA vs. high LOA systems.

Table 21 shows matching results from the relevant parametric T-tests and nonparametric MW tests.

Table 21. Parametric T-Test and Nonparametric Mann–Whitney Test I

Low LOA vs. Medium LOA	T-Test pvalue	MW pvalue	Low LOA vs. High LOA	T-Test p-value	MW pvalue	Medium LOA vs. High LOA	T-Test pvalue	MW pvalue
VAR20; VAR31	0.4306	0.4388	VAR20; VAR42	**0.0008**	**0.0013**	VAR31; VAR42	**0.0011**	**0.0016**
VAR21; VAR32	0.1783	0.2914	VAR21; VAR43	**0.0146**	**0.0199**	VAR32; VAR43	0.1100	0.0782
VAR120; VAR131	0.1728	0.1584	VAR120; VAR142	**0.0025**	**0.0043**	VAR131; VAR142	**0.0442**	**0.0684**
VAR124; VAR135	**0.0069**	**0.0180**	VAR124; VAR146	**0.0496**	**0.0902**	VAR135; VAR146	0.1984	0.2030
VAR229; VAR240	**0.0008**	**0.0011**	VAR229; VAR251	**0.0000**	**0.0000**	VAR240; VAR251	**0.0469**	**0.0362**
VAR230; VAR241	**0.0000**	**0.0000**	VAR230; VAR252	**0.0000**	**0.0000**	VAR241; VAR252	0.3202	0.3413
VAR231; VAR242	**0.0000**	**0.0000**	VAR231; VAR253	**0.0000**	**0.0000**	VAR242; VAR253	0.0577	0.0626
VAR232; VAR243	**0.0000**	**0.0002**	VAR232; VAR254	**0.0000**	**0.0001**	VAR243; VAR254	0.1160	0.1336
VAR233; VAR244	0.1970	0.3795	VAR233; VAR255	**0.0064**	**0.0148**	VAR244; VAR255	0.0847	0.0722
VAR237; VAR248	**0.0211**	**0.0068**	VAR237; VAR259	**0.0000**	**0.0001**	VAR248; VAR259	**0.0207**	**0.0178**
VAR238; VAR249	**0.0010**	**0.0006**	VAR238; VAR260	**0.0000**	**0.0000**	VAR249; VAR260	**0.0126**	**0.0212**
VAR239; VAR250	0.3377	0.2651	VAR239; VAR261	0.4549	0.3521	VAR250; VAR261	0.3706	0.3851
VAR266; VAR276	**0.0012**	**0.0027**	VAR266; VAR286	**0.0000**	**0.0000**	VAR276; VAR286	**0.0007**	**0.0016**
VAR267; VAR277	**0.0461**	**0.0994**	VAR267; VAR287	**0.0015**	**0.0044**	VAR277; VAR287	0.1865	0.2195
VAR268; VAR278	0.1402	0.2110	VAR268; VAR288	**0.0001**	**0.0010**	VAR278; VAR288	**0.0037**	**0.0090**
VAR269; VAR279	0.3237	0.2919	VAR269; VAR289	**0.0006**	**0.0015**	VAR279; VAR289	**0.0036**	**0.0043**
VAR270; VAR280	**0.0007**	**0.0026**	VAR270; VAR290	**0.0000**	**0.0000**	VAR280; VAR290	0.1646	0.2060
VAR271; VAR281	**0.0000**	**0.0002**	VAR271; VAR291	**0.0000**	**0.0000**	VAR281; VAR291	**0.0008**	**0.0019**
VAR272; VAR282	0.3549	0.4883	VAR272; VAR292	**0.0070**	**0.0128**	VAR282; VAR292	**0.0305**	**0.0191**
VAR273; VAR283	0.4451	0.4362	VAR273; VAR293	**0.0001**	**0.0004**	VAR283; VAR293	**0.0001**	**0.0005**
VAR274; VAR284	**0.0048**	**0.0080**	VAR274; VAR294	**0.0000**	**0.0000**	VAR284; VAR294	**0.0034**	**0.0040**

The nonparametric test Kruskal–Wallis (KW) test was used to confirm the validity of the parametric T-test results. The data normality section of this study identified that the data were only somewhat normal, meaning that parametric testing may not be valid. As discussed earlier in this study, the KW test is the nonparametric version of the ANOVA. It was used to confirm the results of the ANOVA similar to using MW for the T-Test. Table 22 shows the results from the nonparametric Kruskal–Wallis that concur with the ANOVA results. The KW results showed that out of the 43 models, the same 21 combinations as ANOVA have statistical significance. This confirmed that the more powerful parametric testing was a valid choice for this study.

Table 22. Within ANOVA and Kruskal–Wallis Comparative Results I

VARIABLES TESTED	ANOVA:	K-W:
VAR20; VAR31; VAR42	**0.0008**	**0.0008**
VAR21; VAR32; VAR43	**0.0903**	**0.0116**
VAR120; VAR131; VAR142	**0.0264**	**0.0057**
VAR124; VAR135; VAR146	**0.0362**	**0.0317**
VAR229; VAR240; VAR251	**0.0000**	**0.0000**
VAR230; VAR241; VAR252	**0.0000**	**0.0000**
VAR231; VAR242; VAR253	**0.0000**	**0.0000**
VAR232; VAR243; VAR254	**0.0002**	**0.0000**
VAR233; VAR244; VAR255	**0.0601**	**0.0851**
VAR237; VAR248; VAR259	**0.0004**	**0.0000**
VAR238; VAR249; VAR260	**0.0000**	**0.0000**
VAR239; VAR250; VAR261	**0.0000**	**0.0248**
VAR266; VAR276; VAR286	**0.0000**	**0.0000**
VAR267; VAR277; VAR287	**0.0285**	**0.0239**
VAR268; VAR278; VAR288	**0.0003**	**0.0022**
VAR269; VAR279; VAR289	**0.0020**	**0.0162**
VAR270; VAR280; VAR290	**0.0000**	**0.0000**
VAR271; VAR281; VAR291	**0.0000**	**0.0000**
VAR272; VAR282; VAR292	**0.0351**	**0.0208**
VAR273; VAR283; VAR293	**0.0002**	**0.0007**
VAR274; VAR284; VAR294	**0.0000**	**0.0000**

Table 23 shows the additional results from the nonparametric KW test. Similar to the parametric ANOVA, the KW showed that out of the 33 models, the same 16 combinations showed statistical significance.

Table 23. Between ANOVA and Kruskal–Wallis Comparative Results II

	ANOVA	KW
ANOVA & KW on VAR15; VAR115; VAR415	**0.0000**	**0.0000**
ANOVA & KW on VAR16; VAR116; VAR416	**0.0000**	**0.0000**
ANOVA & KW on VAR17; VAR117; VAR417	**0.0000**	**0.0000**
ANOVA & KW on VAR18; VAR118; VAR418	**0.0000**	**0.0000**
ANOVA & KW on VAR19; VAR119; VAR419	**0.0008**	**0.0015**
ANOVA & KW on VAR20; VAR120; VAR420	**0.0003**	**0.0000**
ANOVA & KW on VAR21; VAR121; VAR421	**0.0001**	**0.0003**
ANOVA & KW on VAR22; VAR122; VAR422	**0.0000**	**0.0000**
ANOVA & KW on VAR23; VAR123; VAR423	**0.0001**	**0.0000**
ANOVA & KW on VAR24; VAR124; VAR424	**0.0000**	**0.0000**
ANOVA & KW on VAR28; VAR128; VAR428	**0.0232**	**0.0128**
ANOVA & KW on VAR29; VAR129; VAR429	**0.0157**	**0.0127**
ANOVA & KW on VAR31; VAR131; VAR431	**0.0114**	**0.0085**
ANOVA & KW on VAR35; VAR135; VAR435	**0.0089**	**0.0008**
ANOVA & KW on VAR38; VAR138; VAR438	**0.0472**	**0.0631**
ANOVA & KW on VAR43; VAR143; VAR443	**0.0324**	**0.0614**

10. T-Test II – System Presentation Results

The T-tests were only performed on the ANOVA variables identified as statistically significant. The tests were used to further inform the influence of system presentation identified in hypotheses one and two. This test was run between the three system presentation treatments (vendor info, HAL info, ops info) to see how the LOA system was perceived. In other words, between the three treatments, was the low LOA system perceived to be the same or different?

The results were that ops information showed a significant difference in the TAM scores. The difference between vendor information and HAL information was only limited. In other words, having additional system information on paper without the inclusion of experience yields little difference and only minor benefits. Table 24 shows a summary of the results from the relevant parametric T-tests and nonparametric MW tests.

Table 24. Parametric T-Test and Nonparametric Mann–Whitney Test II

Vendor info vs. HAL info	T-Test p-value	MW p-value	Vendor info vs. Ops info	T-Test p-value	MW p-value	HAL info vs. Ops info	T-Test p-value	MW p-value
VAR15; VAR115	0.2858	0.2593	VAR15; VAR415	**0.0000**	**0.0000**	VAR115; VAR415	**0.0000**	**0.0001**
VAR16; VAR116	0.3564	0.4038	VAR16; VAR416	**0.0000**	**0.0000**	VAR116; VAR416	**0.0000**	**0.0000**
VAR17; VAR117	0.2419	0.2438	VAR17; VAR417	**0.0000**	**0.0000**	VAR117; VAR417	**0.0000**	**0.0000**
VAR18; VAR118	0.2298	0.4038	VAR18; VAR418	**0.0000**	**0.0000**	VAR118; VAR418	**0.0000**	**0.0000**
VAR19; VAR119	0.0968	0.1094	VAR19; VAR419	**0.0037**	**0.0043**	VAR119; VAR419	**0.0005**	**0.0010**
VAR20; VAR120	0.4280	0.1704	VAR20; VAR420	**0.0000**	**0.0004**	VAR120; VAR420	**0.0000**	**0.0010**
VAR21; VAR121	0.3632	0.3711	VAR21; VAR421	**0.0000**	**0.0002**	VAR121; VAR421	**0.0000**	**0.0005**
VAR22; VAR122	0.4853	0.4227	VAR22; VAR422	**0.0000**	**0.0000**	VAR122; VAR422	**0.0000**	**0.0000**
VAR23; VAR123	0.1156	**0.0489**	VAR23; VAR423	**0.0012**	**0.0003**	VAR123; VAR423	**0.0000**	**0.0000**
VAR24; VAR124	**0.0518**	**0.0610**	VAR24; VAR424	**0.0000**	**0.0000**	VAR124; VAR424	**0.0000**	**0.0000**
VAR28; VAR128	**0.0148**	**0.0388**	VAR28; VAR428	**0.0078**	**0.0055**	VAR128; VAR428	**0.0271**	0.1005
VAR29; VAR129	**0.0102**	**0.0192**	VAR29; VAR429	**0.0059**	**0.0022**	VAR129; VAR429	0.1867	0.0515
VAR31; VAR131	0.1438	0.1420	VAR31; VAR431	**0.0016**	**0.0017**	VAR131; VAR431	**0.0362**	**0.0254**
VAR35; VAR135	**0.0383**	**0.0771**	VAR35; VAR435	**0.0032**	**0.0016**	VAR135; VAR435	0.0617	**0.0142**
VAR38; VAR138	0.0986	0.0883	VAR38; VAR438	**0.0130**	**0.0395**	VAR138; VAR438	0.0948	0.1769
VAR43; VAR143	0.1612	0.1650	VAR43; VAR443	**0.0085**	**0.0123**	VAR143; VAR443	**0.0484**	**0.0486**

11. T-Test III – Risk of Failure Results

This analytic investigated how different types of information influenced the perceived risk of the system hardware, algorithm, and links. This test further informed the ANOVA results used to address hypothesis six. In the current context, hardware risks include loss of system endurance, power, agility, and speed. Algorithm risks include slow response to command, inability to store data, and failure of control. Link risks include loss of comms needed to read data, inability to obtain imagery and environmental data, or inability to geolocate and navigate.

When performing two independent variables T-tests with equal variance and MW tests, there was only statistical significance for hardware risks, and only when the operational information was provided.

These results implied that perceived hardware risk was reduced only when the operational information condition existed. However, operational information had no significant impacts in reducing perceived risks of algorithms and links. Hands-on experience with the technology only allows the participants to touch, feel, and use the hardware, and the operational use was not long enough (such as weeks or months) so that participants could stress-test the equipment under different conditions to really get a feel for the algorithm and link failure risks. And in all situations, having different types of non-operational information, even anthropomorphic HAL information, did not help reduce the subjects' perceived risks. The detailed statistics for perceived risk are provided in Appendix C.

12. Regression Test Results

Regression tests were run to determine if the outcome of the ops information treatment could be predicted by providing HAL information in the form of an anthropomorphic hierarchy of system information. This test is not the result of a hypothesis generated during the literature review. However, if the answer to this question were found to be positive, the DOD could save considerable amounts of time and expense. Results from extensive field testing could be predicted from a basic preliminary review of the technology.

The final detailed results of ops information cannot be sufficiently predicted regardless of how much paper-based system information was provided to the user. Table 25 shows a sampling of the results from a multivariate regression model. There was little to no statistical significance when using pre-experience data to predict the outcomes of the post-experience scores. Multiple linear and nonlinear interacting multivariate regressions were also run, and none seemed to exhibit coefficients of determination greater than 50% and adjusted coefficients of determination greater than 25%.

Table 26 shows a principal component analysis and factor analysis result where the multiple variables were reduced further to see if there would be any improvements in the multivariate regression, but the results similarly indicated that there was very low predictive power in the pre-experience results.

A traditional ordinary least squares multivariate regression also does not make too much sense in that there was no one-to-one correspondence among the data rows. That is, different active-duty military from the same unit were involved in the three experimental stages. This means that the responses of one soldier will not correspond to the same perception of another soldier testing another system during a different stage. This partially explains the low predictability of post-experience results using pre-experience data.

Additional sophisticated methods such as bootstrapping the regression were performed, where an empirical bootstrap of the data was nonparametrically simulated and bootstrapped, and then regression models were run. The process was repeated thousands of times. Figure 22, Figure 23, and Figure 24 illustrate the results. Only 9% to 12% of the

time will a single variable be considered statistically significant, and the goodness-of-fit predictability levels vary widely, from 18% to 95% depending on the specific issue under study. There seems to be no consistent and valid predictive power in the non-operational information, vendor and HAL. This was confirmed by the two-variable T-tests and MW tests shown previously. These tests revealed that significant and valuable insights developed when users were provided hands-on operational information. Further, this means without these experiments, paper-based system information alone was insufficient to identify the true value and risks of a system.

Table 25. Linear and Nonlinear Multivariate Regression

Model Inputs:
VAR296 vs. VAR15; VAR16; VAR17; VAR18; VAR19; VAR20; VAR21; VAR22; VAR23; VAR24; VAR25
SUSA vs. PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Regression Results

OVERALL FIT			
Multiple R	0.85341	Maximum Log Likelihood	-52.79311
R-Square	0.72830	Akaike Info Criterion (AIC)	6.82033
Adjusted R-Square	**0.30135**	Bayes Schwarz Criterion (BSC)	7.41682
Standard Error	7.28268	Hannan-Quinn Criterion (HQC)	6.92128
Observations	19		

	Coeff	Std.Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	135.82272	26.21155	5.18179	0.00128	73.84226	197.80319
VAR X1	-1.78874	5.52795	-0.32358	0.75571	-14.86027	11.28279
VAR X2	0.02206	4.87473	0.00452	0.99652	-11.50484	11.54895
VAR X3	-13.67128	6.12796	-2.23097	0.06088	-28.16161	0.81904
VAR X4	-9.34621	6.28587	-1.48686	0.18065	-24.20993	5.51752
VAR X5	-1.40361	5.80732	-0.24170	0.81594	-15.13574	12.32853
VAR X6	-5.81092	3.63238	-1.59976	0.15369	-14.40012	2.77829
VAR X7	-2.34249	4.29174	-0.54581	0.60215	-12.49084	7.80587
VAR X8	1.71980	3.64092	0.47235	0.65105	-6.88960	10.32921
VAR X9	17.00398	5.38884	3.15541	0.01603	4.26140	29.74656
VAR X10	2.09003	3.88437	0.53806	0.60721	-7.09505	11.27512
VAR X11	-5.90165	2.22358	-2.65412	0.03275	-11.15957	-0.64372

ANOVA	DF	SS	MS	F	p-Value
Regression	11	995.19	90.47	1.70580	0.24525
Residual	7	371.26	53.04		
Total	18	1366.45			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2): 6.538166
Critical F-statistic (95% confidence with DFR1 and DFR2): 3.603037
Critical F-statistic (90% confidence with DFR1 and DFR2): 2.683924

Table 26. Limited Use for Principal Component Analysis

```
Model Inputs:
VAR23:VAR33
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

* indicates negative values

Cum Proportions:

55.05% 75.51% 85.26% 90.59% 94.76% 96.74% 97.92% 98.97% 99.57% 99.87% 100.00%

Eigenvectors:

0.3537 *0.2475 *0.1379 *0.0953 0.1383 *0.3637 *0.0508 *0.4055 0.5314 *0.0935 *0.4195
0.3592 *0.2186 0.0260 0.1763 0.1098 *0.1431 *0.7667 0.1402 *0.1323 0.2344 0.2811

Eigenvalues (Arranged and Ranked):

6.0552 2.2509 1.0725 0.5861 0.4586 0.2184 0.1292 0.1157 0.0666 0.0320 0.0148
```

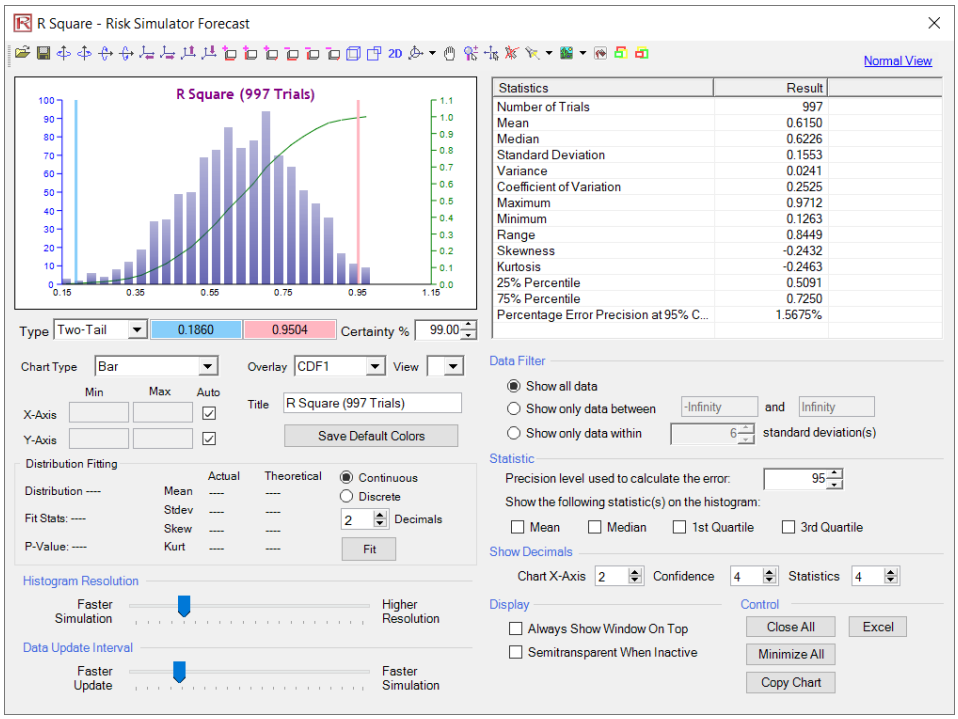

Figure 22. Bootstrap Regression I

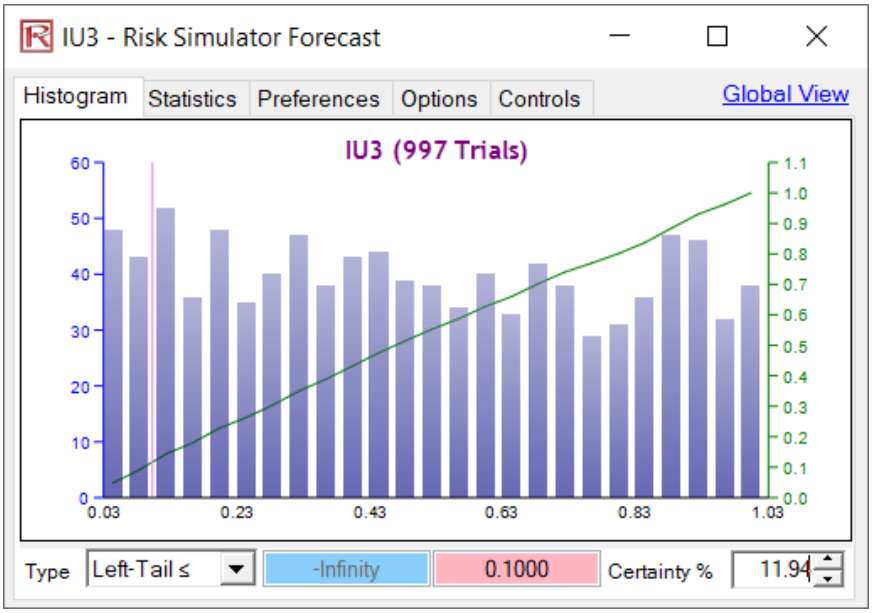

Figure 23. Bootstrap Regression II

Forecast Statistics Table (Bootstrap Regression)

Variable	IU1	IU2	IU3	PEOU1	PEOU2	PEOU3	PEOU4	PU1	PU2	PU3	PU4	R Square
Number of Datapoints	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Mean	0.5035	0.4958	0.4816	0.5066	0.4952	0.5217	0.5016	0.5064	0.5018	0.4944	0.5035	**0.6150**
Median	0.5132	0.4926	0.4652	0.5103	0.5026	0.5277	0.4935	0.5071	0.4971	0.4974	0.5057	**0.6226**
Standard Deviation	0.2886	0.2922	0.2931	0.2853	0.2899	0.2893	0.2867	0.2801	0.2862	0.2846	0.2917	0.1553
Variance	0.0833	0.0854	0.0859	0.0814	0.0840	0.0837	0.0822	0.0785	0.0819	0.0810	0.0851	2.41%
Coefficient of Variation	57.32%	58.94%	60.86%	56.32%	58.54%	55.46%	57.17%	55.32%	57.04%	57.57%	57.93%	0.2525
Maximum	1.0000	0.9974	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9712
Minimum	0.0021	0.0004	0.0004	0.0009	0.0005	0.0051	0.0003	0.0020	0.0009	0.0009	0.0005	0.1263
Range	0.9979	0.9970	0.9996	0.9991	0.9995	0.9949	0.9997	0.9980	0.9991	0.9991	0.9995	0.8449
Skewness	-0.0422	0.0362	0.0921	-0.0761	-0.0067	-0.0855	0.0071	0.0015	0.0005	0.0199	-0.0284	-0.2432
Kurtosis	-1.2087	-1.2455	-1.2177	-1.1780	-1.2168	-1.2010	-1.1436	-1.1199	-1.1846	-1.1535	-1.2117	-0.2463
25% Percentile	0.2408	0.2426	0.2211	0.2619	0.2352	0.2718	0.2533	0.2696	0.2630	0.2519	0.2550	0.5091
75% Percentile	0.7496	0.7566	0.7372	0.7596	0.7483	0.7652	0.7395	0.7330	0.7448	0.7325	0.7575	72.50%
Error Precision at 95%	3.56%	3.66%	3.78%	3.50%	3.63%	3.44%	3.55%	3.43%	3.54%	3.57%	3.60%	0.0157
5% Percentile	0.0463	0.0547	0.0409	0.0463	0.0443	0.0653	0.0459	0.0568	0.0501	0.0465	0.0430	0.3515
10% Percentile	0.1017	0.0985	0.0854	0.0986	0.0931	0.1071	0.1045	0.1205	0.1030	0.0985	0.0906	0.4041
20% Percentile	0.1984	0.1979	0.1840	0.2091	0.1917	0.2191	0.2021	0.2212	0.2137	0.2060	0.1933	0.4786
30% Percentile	0.3000	0.2837	0.2786	0.3223	0.2888	0.3305	0.3096	0.3198	0.3107	0.2929	0.2997	0.5361
40% Percentile	0.4165	0.3776	0.3701	0.4166	0.3913	0.4321	0.4187	0.4094	0.3993	0.3930	0.4010	0.5781
50% Percentile	0.5129	0.4914	0.4645	0.5098	0.5024	0.5260	0.4929	0.5062	0.4969	0.4962	0.5043	0.6224
60% Percentile	0.6109	0.5961	0.5733	0.6227	0.5969	0.6353	0.5875	0.6018	0.6012	0.5886	0.6142	0.6661
70% Percentile	0.7032	0.6981	0.6784	0.7089	0.6980	0.7279	0.6947	0.6931	0.7002	0.6800	0.7015	0.7013
80% Percentile	0.7940	0.8051	0.7959	0.7999	0.7913	0.8209	0.7956	0.7899	0.7930	0.7898	0.8053	0.7545
90% Percentile	0.8957	0.9014	0.8895	0.8876	0.8964	0.9119	0.9032	0.8988	0.9020	0.8868	0.9035	0.8156
95% Percentile	0.9418	0.9455	0.9498	0.9368	0.9448	0.9543	0.9536	0.9498	0.9419	0.9447	0.9570	0.8594
99% Percentile	0.9915	0.9894	0.9920	0.9912	0.9875	0.9914	0.9905	0.9923	0.9955	0.9914	0.9904	0.9344
Certainty Value 0.01	0.80%	1.40%	0.80%	1.10%	1.10%	0.40%	1.40%	1.20%	0.80%	1.30%	1.00%	
Certainty Value 0.05	5.52%	4.71%	6.32%	5.02%	5.52%	3.81%	5.22%	4.21%	4.81%	5.02%	5.52%	
Certainty Value 0.1	**9.83%**	**10.13%**	**11.94%**	**10.03%**	**10.73%**	**9.33%**	**9.53%**	**7.92%**	**9.83%**	**10.23%**	**10.93%**	

Figure 24. Bootstrap Regression III

VI. CONCLUSION

The topic of trust in technology is increasingly important to the DOD as outlined in the Defense Science Board Study on Autonomy (David and Nielsen, 2016), which states, "There is a need to build trust in autonomous systems while also improving the trustworthiness of autonomous capabilities. These are enablers that align RDT&E processes to more rapidly deliver autonomous capabilities to DOD missions."

A. KEY FINDINGS

This study extends the work of technology trust by testing in a situation of extreme risk. In remote-controlled systems (medium LOA) the use of HAL information demonstrated some efficacy as a technique for increasing perceived usefulness. Since these results are minimal, future research is required to confirm this finding. In the other two systems, direct-controlled (low LOA) and autonomous (high LOA), the use of HAL information versus vendor information did not produce significant differences in any TAM survey question. The increased perceived usefulness of remote-controlled systems is potentially due to the increased social presence of this commonly used technology. Gefen and Straub (2003) present that technology with increased social presence may result in higher perceived humanness, and in some cases may be seen as surrogates for humans. A key finding of this study is that varying the level of automation did not have an impact on the TAM scores for either vendor information or HAL information.

The current study reveals that hands-on operational information can increase the aggregate TAM scores in both the direct-controlled and remote-controlled systems. The combination of reason-based information and experience-based information appears to significantly influence trust in systems used in situations of extreme risk. However, operational information did not have any effect on the aggregate TAM scores of autonomous systems. The perceived risk of a hardware failure is shown to decrease when users are provided with hands-on operational information, but the perceived risks associated with algorithms and links are not impacted.

This study begins to answer the question of whether it is possible to predict and potentially capture experience-based information for technology used for high-risk military applications. If a causal relationship exists between the features of a technology and acceptance, it could greatly reduce the time and expense of adopting new systems. The experiment reveals that users are willing to trust autonomous systems in high-risk military applications. The research also developed the HAL anthropomorphic hierarchy of system information that shows promise as a surrogate for capturing and presenting experience-based information. The initial findings indicate that manipulating trust in technology using an anthropomorphic hierarchy, without the addition of experience-based information, yields little difference and only minor benefits. The study concludes that integrating trust and autonomous systems intended for use in high-risk military applications requires the addition of experience-based information.

B. LIMITATIONS

The participant sample size was not within the control of the dissertation and represented a smaller than optimal number of participants. It assumed that the participants that provided data were rational actors, and that they were looking only at the betterment of society and not acting on self-fulfilling intentions.

There was a domain limitation in using the technology acceptance model (TAM) as a measure of trust. The strength of the relationship between trust and TAM is experimentally demonstrated as strong (Pavlou, 2003). However, the current study did not run path analysis to confirm the strengths between the TAM variables captured during experimentation. The current study does not question the efficacy of existing research on trust and TAM and an assumption was made that the results presented in the literature are valid and reliable.

Another limitation is the impact of system reliability during the hands-on operational information treatment. The current study does not account for system reliability as a variable since this information is not present in either the vendor information or HAL information treatment. The autonomous system broke down more frequently and was difficult to operate. The remote-controlled system was the easiest to operate but also had

mechanical failures. The direct-controlled system was the most reliable but took the longest to operate.

C. RESEARCH CONTRIBUTION

The goal of the current study is to understand the effect of system presentation and level of automation on trust in technology. The new knowledge developed in this study can potentially save the DOD time and money by developing methods to capture and present experience-based information to new system users. The current study established an anthropomorphic information technique that may increase the acceptance rate of beneficial technologies, thereby reducing the time it takes to adopt developmental platforms as a new operational capability. To that end, the results of the current study modify and extend existing theory in technology trust. The trust constructs of system presentation and level of automation were experimentally manipulated and measured. Connections between the constructs used in this research are provided in the literature review of the current study.

The application of this trust research also contributes to an improved understanding of human-machine trust formation, and the development of a technology-literate military workforce capable of accurately assessing new technologies. The concept of technology trust has applicability beyond the DOD. Private industry can greatly benefit from the concepts and methodologies developed in the current study by applying the research methods to the development of existing or new consumer technologies such as machine learning, artificial intelligence systems, smart algorithms, and embedded technologies. These intelligent systems are transformative areas that will eventually integrate into all industries (e.g., self-driving cars, delivery drones, big data analytics, and the Internet of Things, where algorithms, machines, and computer systems are continually learning and evolving). The approach and results used in this experiment are extensible and can be adopted into both military and private industry.

The current study contributes new knowledge on technology trust and acceptance in high-risk military scenarios. Data are collected from an ongoing DOD evaluation of multiple systems used in high-risk military applications throughout fiscal year 2019. The analysis compares the influence of trust variables on multiple LOA systems and measures trust by

manipulating the presentation of system information between multiple study groups. The recommendations provide a conceptual framework for how a military community develops trust in technologies, and how varying external factors influence the development of that relationship. The practical contribution of this work led to a new USMC program of record that employs alternate versions of the experimental technology presented in Appendix A.

D. FUTURE RESEARCH

Although the HAL anthropomorphic hierarchy of system information did not produce significant change in trust for all levels of automation, it still holds promise for future research. The experiment demonstrates that without the addition of experience-based information, the amount of trust a user has in a technology does not deviate based on the level of autonomy. The experiment further demonstrates that direct experience is required before users can develop accurate measures of trust in autonomy. The implications of these findings are high, and the current study proposes that using HAL to capture and present experience-based information can improve the accuracy of initial trust for multiple levels of automation.

To increase the value of HAL, it is further conceptualized as a *score* of trustworthiness. Future research is required to develop HAL into a system capable of capturing user experience and serving as a benchmark for evaluating systems. In this scenario, the scores of the three HAL categories could range from 0 to 100 and lead to a maximum score (indicating most trustworthy) of 300. Future research could leverage information integration theory (IIT; Anderson, 1971) to identify the values and weights of the HAL score necessary to accurately represent a trust response.

The IIT works by focusing on the unobservable (subjective) interpretations used to develop a behavioral response to external stimulus (Anderson, 1971). It is developed using the following three main operators displayed in Figure 2:

1. The valuation operator (V) converts observable external stimulus (S) into a subjective representation (s), where $s = V(S_1, S_2, S_3)$.
2. The integration operator (I) applies weights (ω) to the subjective valuations (s), and combines the multiple stimulus into an overall implicit response (r), where $r = I(s_1, s_2, s_3)$.

3. The response operator (*A*) transforms the implicit response (*r*) into an observable external response (*R*), where *R = A(r)*.

Anderson (1996) describes the integration operator (*I*) as a form of *cognitive algebra* represented by simple arithmetic operations such as addition and multiplication. A distinction is made between value (*s*) and weight (ω). Anderson (1971) states that value (*s*) comes from an internal judgement system that is not influenced by the validity of the source of the communication. A communication is information from a source capable of influencing opinion. The weight (ω) parameter represents a more important variable to trust because it is subject to persuasion by the source of communication. Anderson (1971) developed a weighted average response to external stimulus written as a function of subjective interpretations ω and *s*. The IIT averaging response is shown below, which includes C_0 and C_1 to represents the slope-intercept of a linear response, and an error factor (ε) that is expected to be zero (Anderson, 1982).

$$R = C_0 + C_1\left(\frac{\omega_1 s_1 + \omega_2 s_2 + \omega_3 s_3}{\omega_1 \omega_2 \omega_3}\right) + \varepsilon$$

This theory indicates that individuals that are subject to persuasion (less confident) develop lower-level responses. The same can be said for individuals that are not subject to persuasion but interpret the source of information as violating their value system. This is indicated by the influence of the product of ω shown in the denominator of response (*R)*. Regardless of the source of communication, information that either persuades or goes against an individual's value system will decrease the level of a response. It is common knowledge that in order to influence a broad response, it is best to use information from multiple reputable sources that appeal to an individual's value system. This is revealed by the tendency to trust healthcare advice from a Doctor of Medicine (MD) working at a prestigious hospital over the opinion of an anonymous source posting advice on an internet forum. The title of MD is shared value representing an authority of reliable information. The process of referencing multiple validated sources provides the basis for building credibility and developing trust through HAL.

The current study proposes that standardizing multiple sources of information using HAL could make it easier for individuals to conduct the cognitive algebra necessary to develop *accurate* trust in technology. The current study further posits that HAL can reduce variations in the subjective interpretations of the weight parameter (ω_x) by standardizing the presentation format. The effect of reducing variations in the weights (ω_x) is an algebraically more uniform response (R) to the multiple external stimulus. The result of a uniform response across multiple individuals is increased agreement towards the adoption (or rejection) of emerging technologies such as autonomous systems.

Since experience-based trust data was not available to the current study, the HAL hierarchy was tested without any associated values or weights. Even without this information, HAL demonstrates an increase in perceived usefulness for a technology with a high social presence (remote-controlled). It is possible that, with this added information, HAL could accurately manipulate a user's trust in technology. A second experiment needs to occur where the HAL hierarchy is tested as an experience-based proxy.

The development of a HAL proxy can provide valuable intelligence by both capturing and presenting experience-based trust in technology. The findings of the current study provide the basis for designing a second experiment that tests an experience-based trust proxy without the need for expensive field testing. If the analytics of such an experiment yield statistically significant differences between users presented with an experience-based proxy and those without, it is recommended that the DOD undertake efforts to promote the use of surrogates capable of providing experience-based information when presenting new technologies. In conclusion, the current study posits that the use of HAL as proxy of experience-based trust may increase the acceptance of future autonomous systems.

APPENDIX A. EXPERIMENT

This appendix describes the experiment that provided the primary data used in this dissertation. The experiment was designed at NPS and executed by the author while attached to the Naval Information Warfare Center (NIWC) Pacific. The objective of the NIWC Pacific work was to evaluate commercial technologies capable of identifying objects in the littorals (surf zone). This work was conducted in support of the USMC Rapid Capability Office (RCO) Littoral Explosive Ordnance Neutralization (LEON) program by technical staff from NIWC Pacific and operational staff from the USMC. This appendix accompanies the USMC Public Affairs video for LEON released at the following web address: https://www.dvidshub.net/video/702096/stabilizing-surf-zone

A. TECHNOLOGY SELECTION

The experimentation begins with the selection of commercial technologies capable of operating in the littorals. The selection process was initiated through a literature review of past, present, and future capabilities relevant to littoral operations. Market research was then conducted to identify commercial solutions that can provide the Marines with capabilities to identify objects in the littorals. Potential solutions include Autonomous Underwater Vehicles (AUV), Remotely Operated Vehicles (ROV), Unmanned Underwater Vehicles (UUV), and Unmanned Surface Vehicles (USV), as well as imaging and electromagnetic (EM) sensors capable of assisting in object detection and analysis. Based on these findings, a Broad Agency Announcement (BAA) was drafted and issued to commercial industry to solicit potential solutions. A technology evaluation and down selection of BAA responses was conducted to identify the most relevant solutions.

Systems are evaluated and selected based on the following criteria:

1. Technology Readiness Level (TRL)
2. Hardware: Operational Relevance and Capabilities
3. Algorithms: Level of Automation and System Control
4. Links: Communication and Data Collection (sonar, video, etc.)

The following three systems are selected and procured for experimentation:

1. Unmanned Surface Vehicle (UUV): Sonar EMILY
2. Remotely Operated Vehicle (ROV): SRS Fusion
3. Autonomous Underwater Vehicle (AUV): Sea Otter / Sea Ox

B. EXPERIMENTATION

A single experiment was conducted using three separate treatments. The experiment begins with a series of classroom presentations to active-duty Marines aboard Camp Pendleton on 08 March 2019. The systems are presented to two groups of preassigned Marines in multiple paper-based classroom training sessions. In the first treatment, the system presentation provides users with system vendor-provided information. In the second treatment, the system presentation provides significantly more organized and detailed information. A survey was administered following both classroom system presentations to capture user feedback on the systems. The results are used to inform the development of a third treatment where the system presentation provides hands-on experience.

The third treatment takes place in the field aboard San Clemente Island between 15 July 2019 and 08 August 2019. During this treatment, the systems are presented to operators through both classroom and hands-on experience. Field testing and evaluation are conducted toward the development of both a technical and operational assessment. An experimental survey was administered following field experience to capture operator feedback on the systems under evaluation.

All field testing occurs in the vicinity of San Clemente Island. One training lane and three test lanes are established and emplaced with targets. Test lanes are approximately 165M x 165M in size and range in depth from 0 to 18 meters. Bottom type was mixed and described in the Test Lanes section of this appendix.

Three days of hands-on training and practice are conducted on 22–24 July 2019. During practice days. each team searches for targets in a practice test lane using both the Emily USV and Fusion ROV. SEA Otter and Sea Ox AUV are not available during the

practice period. Post-processing of sonar data and imagery was conducted to confirm or deny the presence of targets.

Nine days of field testing was conducted between 26 July and 03 August 2019. EMILY USV and Fusion ROV are operational throughout the test period. Sea Otter and Sea Ox are non-operational between 29 July and 31 July due to equipment failures. The Sea Ox conducted trials on 27 July and completed multiple passes in and out of the surf. During surf trials. the Sea Ox did not return from its autonomous mission but was eventually recovered. All test trials conclude on 03 August 2019.

C. TECHNOLOGY ASSESSMENT

A technology assessment was conducted by staff from NIWC Pacific to record the hardware, algorithm, and link capabilities of all three systems under study.

1. Sonar EMILY USV

The Sonar EMILY (Emergency Integrated Lifesaving Lanyard) is a small remote-controlled USV originally created for beach rescue. The EMILY is a lightweight boat equipped with additional floatation and powered through commercial LiPo batteries. The control unit consists of a commercial RC controller. The sonar feature is powered through a commercial Humminbird fish finder with a remote 12-inch display.

a. Hardware

Sonar EMILY consists of two large Pelican cases of 36” x 24” x 24” weighing 50 lbs, and the vehicle bag is 48” x 14” x 14” weighing 40 lbs. The Sonar EMILY was the lightest and smallest of the three systems evaluated.

Sonar EMILY was easy to deploy with an average deployment time of under 5 minutes. Surveys are conducted between 1 meter and 15 meters in depth, and surface operating speeds of 3–4 kts yield the best sonar imagery. Average mission time was 35 minutes to complete a survey of 165 square meters. The Emily USV can collect bathymetric data, determine bottom type, and provide potential target data. The data can be exported to a software package, *SAR Hawk,* in the form of a contact list that associates

times with images and side scan mosaic. This feature improves the ability to identify objects in the littorals. System-level maintenance was easily conducted by operators with little or no training required. Operational use of this system is shown in Figure 25 and Figure 26.

Figure 25. Sonar EMILY Operations

Figure 26. Sonar EMILY off San Clemente Island

b. Algorithms

The Sonar EMILY was a remotely controlled USV. Mission planning was conducted on a commercial Humminbird fish finder console. Operational teams planned missions directly on the Humminbird or utilized *WinTAK* (Windows Tactical Awareness Kit) or *ATAK* (Android Team Awareness Kit). The WinTAK software (Figure 27) was used create routes that ensure sufficient coverage of the test lane. Missions using in third-party software require conversion to Humminbird PC format. All teams eventually migrated mission planning to WinTAK.

The main operating mode for the EMILY was remote control. The software provides a semi-autonomous mode to transit between waypoints identified in mission planning software. A cursory review of the semi-autonomous mode was conducted, and it was deemed not effective due to wind drift. Further evaluation of the semi-autonomous mode was not conducted.

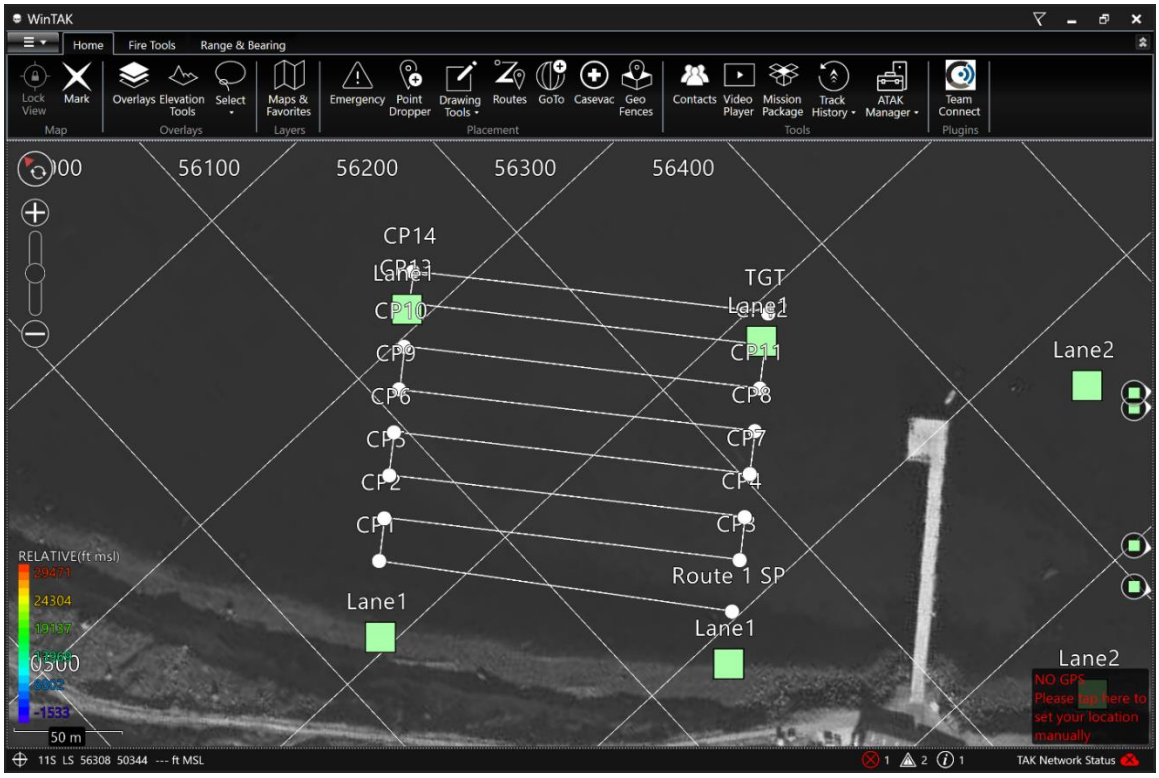

Figure 27. Sonar EMILY Mission Plan

c. Links

Sonar EMILY is equipped with Side Scan Sonar, GPS, and manual control via RF (2.4GHz) link. The RF telemetry range is between 1–1.5 kilometers. Sonar EMILY produces real-time video of side scan sonar. The video data transmission range was limited to ~500M utilizing the standard antenna configuration. Sonar data are also recorded by Sonar EMILY for post-processing using a third-party software called *SAR Hawk*. This *SAR Hawk* software provides imagery at higher resolutions than the Humminbird console and is shown in Figure 28. The WinTAK software was used to create overlays of the Sonar EMILY bathymetry data as shown in Figure 29.

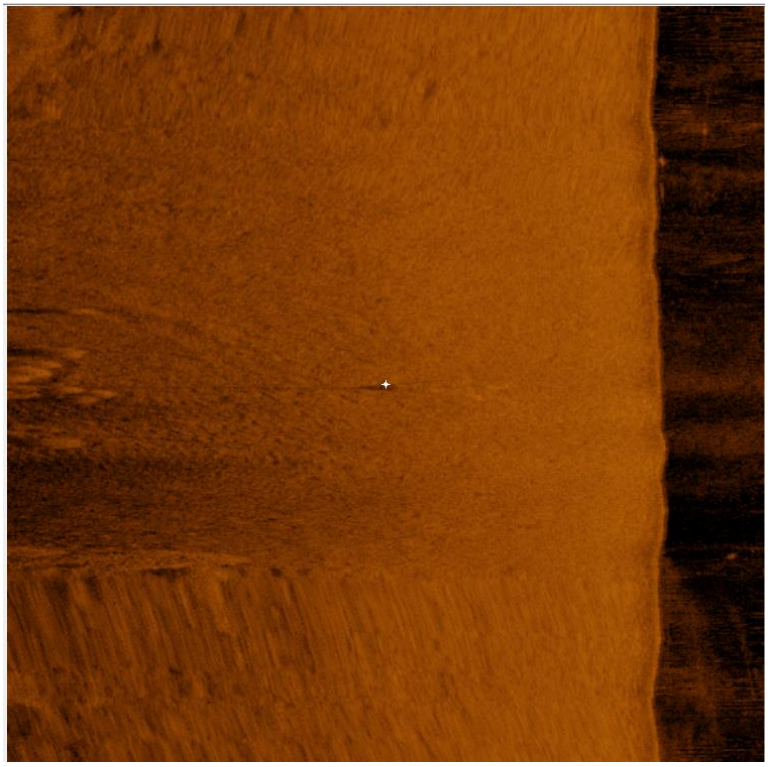

Figure 28. Bathymetry from Emily Sonar

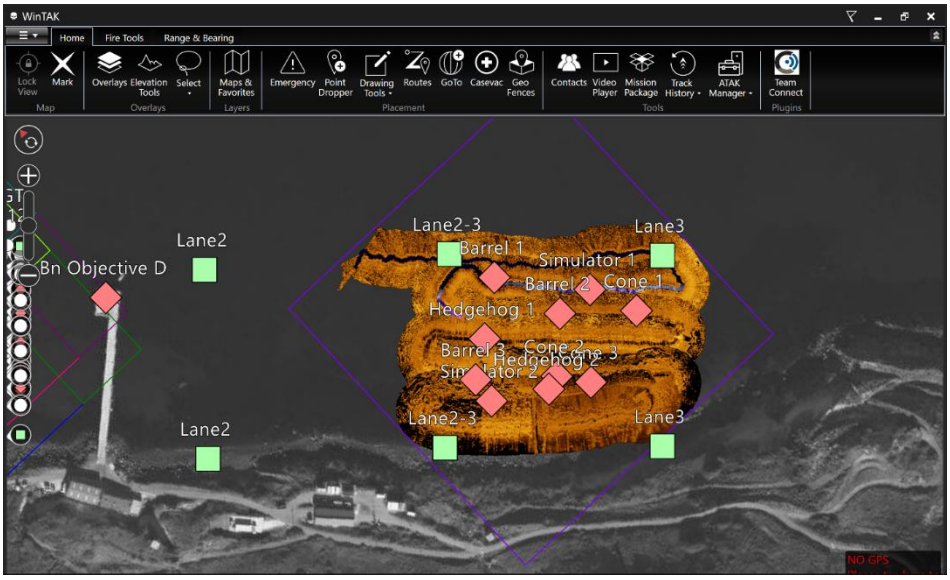

Figure 29. WinTAK Side Scan Mosaic

d. Limitations

The EMILY hardware was limited by the weather. The system did not maintain course in winds over 5 Kts. Waves over 2ft also decreased sonar effectiveness due to the impeller creating bubbles around the transducer. Time intensive system hardware maintenance was required before and after each mission. The Sonar EMILY utilizes an impeller that required inspection to remove entangled materials. During post-mission breakdown, the vehicle batteries must be removed for recharging. The battery contacts seem to require daily cleaning to prevent corrosion that resulted in reduced operating time.

The semi-autonomous search algorithms generated by the onboard navigation system appeared to cause problems. While conducting missions in semi-autonomous mode, the USV was not able to follow a straight line. Due to the light weight of the vehicle, it was not stable while navigating, which results in reduced sonar quality. This resulted in the side scan sonar interpretation being the only method available for identifying potential targets. Initially teams struggled to identify targets and anomalies. As the exercise continued, each team's ability to identify and validate targets improved.

The Sonar EMILY control link was very limited in that it is a commercial hobbyist RC transceiver. The 2.4 GHz ISM (industrial, scientific, and medical) band provides

limited data transmission capabilities, and mission ranges of over 500 meters demonstrate severe degradation.

2. SRS Fusion ROV

The SRS Fusion is an ROV that is directly controlled by a tether. It is a small battery powered ROV with onboard forward-looking multibeam sonar and camera. The Sonar EMILY and the SRS Fusion both have semi-autonomous and manual navigation capabilities. The system is controlled via commercial tablet operating the SRS Fusion software suite.

a. Hardware

The SRS system footprint is four pelican cases. Two large cases containing the vehicle reel and control unit weigh 70 lbs and measure 36" x 24" x 24." The other two cases contain the underwater positioning system, batteries, and charger and weigh 40 lbs and measure 48" x 24" x 8."

The SRS Fusion has the highest technology readiness of all three systems. It was easy to deploy and excelled at identifying targets of interest. The SRS Fusion was much slower than the Sonar EMILY. Its forward-looking sonar was reported as easier to interpret than the Sonar EMILY side scan sonar. The SRS was also equipped with a high-resolution onboard camera that was useful in confirming sonar contacts. Two methods are used to deploy the SRS: (a) some teams elected to utilize the SRS as a conformation tool reacting to a *quick look* list of contacts generated by the Sonar EMILY and (b) some teams created a survey grid (lawnmower pattern) to cover the entire area with the sonar and camera. Contacts are identified and exported as videos or images that are tagged with GPS coordinates. The SRS Fusion batteries provide for operations of over 5 hours and proved to be more than sufficient to execute the given mission. The mission control tablet battery required changing and charging on a regular basis. Operation of the Fusion was intuitive and end users report proficiency in a very limited time as show in Figure 30 and Figure 31.

Figure 30. SRS Fusion Deploying from Boat

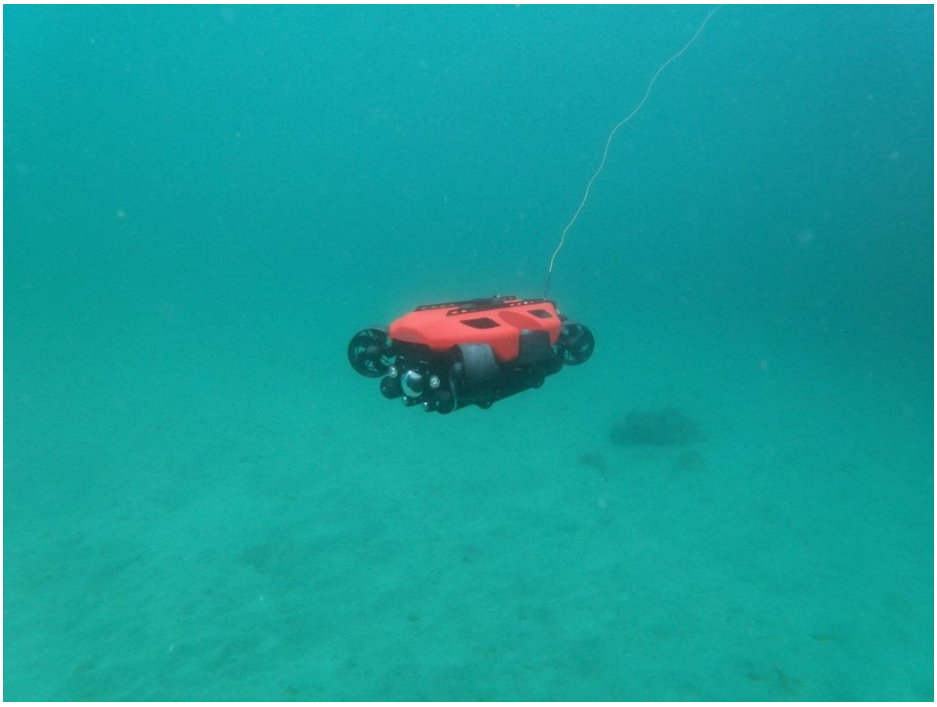

Figure 31. SRS Fusion Operations

b. Algorithms

The SRS Fusion was directly controlled through a tether. Mission planning was conducted in the SRS Fusion software. Fusion software has the capability to generate survey patterns, waypoints, and routes (Figure 33). Missions planned on the system tablet are loaded directly onto the vehicle and executed while tethered. Routes generated by third-party applications such as WinTAK could not be imported during the experiment.

The main operating mode for the SRS was directly through the tether. The SRS Fusion also provides for a semi-autonomous mode permitting transit between waypoints. A cursory review of the semi-autonomous mode was conducted and deemed somewhat effective but not evaluated further.

Figure 32. SRS Fusion Planned Route with Tracks

c. Links

SRS Fusion produces live-stream video and sonar data. It also generates a proprietary mission file that can be later reviewed in an SRS Viewer program. Both video and sonar can be exported to standard video formats. Log Files are output in spreadsheet format and contain full navigation and bathymetric data. The SRS Fusion data files are large and can generate bathymetric raster images. Raster image creation requires powerful computers due to data size, as shown in Figure 33.

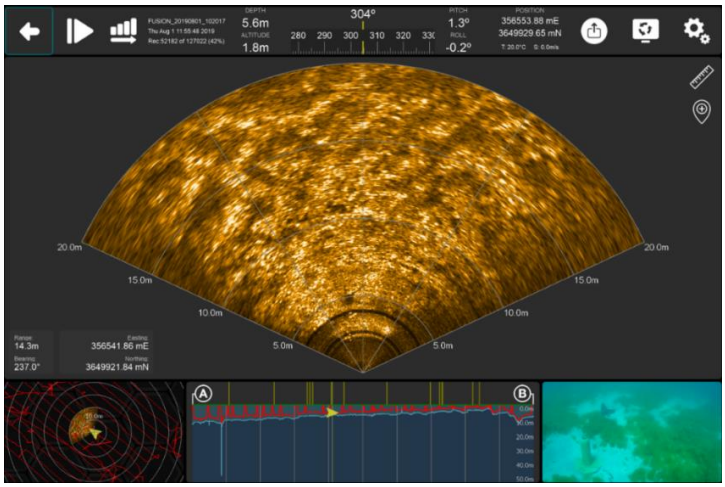

Figure 33. SRS Fusion Dashboard with Target Sonar Return

d. Limitations

The primary limitation of the SRS Fusion was survey speed, which ranges between 1kt and 2.5kts. Frequent stops and path deviations are required to confirm or deny targets. Throughout the trial, the SRS took an average of 226 minutes to survey a 165M x 165M lane. A second limitation was the inability to plan routes in WinTAK or ATAK, which are the desired choices of software. A third limitation was difficulty exporting waypoints and paths to TAK systems. Autonomous operations proved problematic due to software issues that required mid-mission restarts.

3. Sea Otter / Sea Ox AUV

The Sea Otter and Sea Ox are tracked and fully autonomous underwater ground vehicles designed to operate in the surf and shallow water environments (Figure 35). Otter and Ox are designed as fully autonomous systems, but also support a surface tethered buoy that provides an RF link (Silvus Radio) (Figure 36 and Figure 37). The Sea Otter is a smaller version of the Sea Ox. Both systems are equipped with sensors that can be swapped depending on the mission and desired platform. Both systems are developmental and represent the lowest TRL evaluated.

a. Hardware

The Sea Otter configuration weighs 125 lbs. Sea Ox weighs 230 lbs. Currently the Sea Ox and Sea Otter systems require two large crates for shipping of 57”L x 53”W x 33”H, 725 lbs, and 57”L x 53”W x 52”H ,1040 lbs. The Sea Ox is designed to fit in a single Joint Modular Intermodal Container.

The Sea Otter and Sea Ox are capable of maneuvering in sandy and semi-complex bottom types (Figure 38). Both are rugged underwater systems enabling long-term data collection. Both systems have endurance levels of over 5 hours and the ability to carry heavy loads. Both platforms can effectively navigate the heavy surf zone but require additional modifications and increased reliability.

Figure 34. Sea Otter and Sea Ox with Control Systems

Figure 35. Sea Otter with Radio Tether, Sonar, and Camera

Figure 36. Sea Ox with Radio Tether, Sonar, and Camera

Figure 37. Sea Ox Traversing Littorals

b. Algorithms

The Sea Otter and Sea Ox are fully autonomous systems. Both use third-party *GreenSea Workspace* software for autonomous mission planning and control (Figure 39). Sonar, camera, and geospatial overlays are integrated into the GreenSea Workspace.

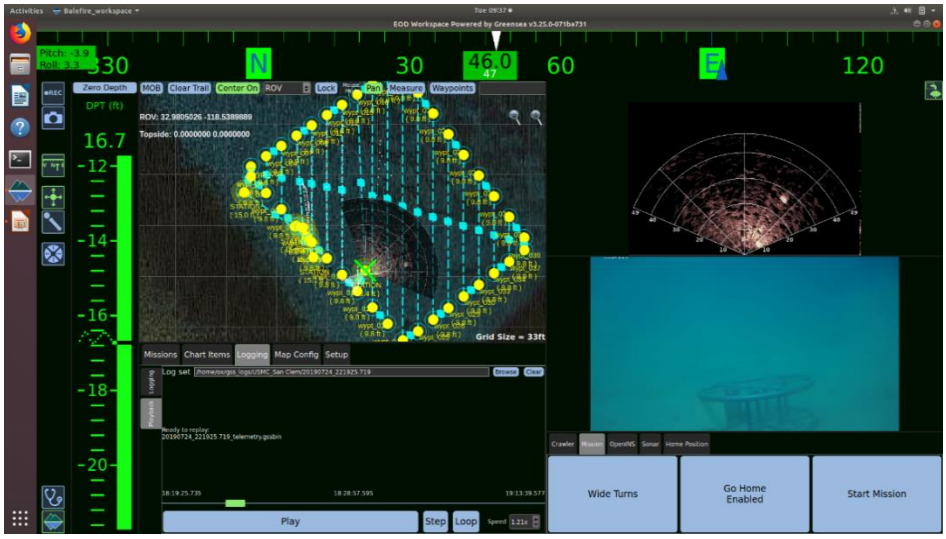

Figure 38. GreenSea Workspace

c. Links

The Sea Otter and Sea Ox use an open-source operating system that permits the addition and modification of multiple sensor payloads. Both Sea Ox and Sea Otter produce live-streamed video and sonar imagery through the GreenSea workspace on a standard laptop computer (Figure 39 to Figure 41). Video and sonar are stored for later review and report generation. Both vehicles are equipped with depth and inclinometer sensors used to conduct autonomous navigation. Data can be post-processed to generate bathymetric overlays and raster images (Figure 43). A developmental magnetometer was attached, and the data it generates requires post-processing. The magnetometer data can be live-streamed through the RF tether but requires third-party software to display active readings.

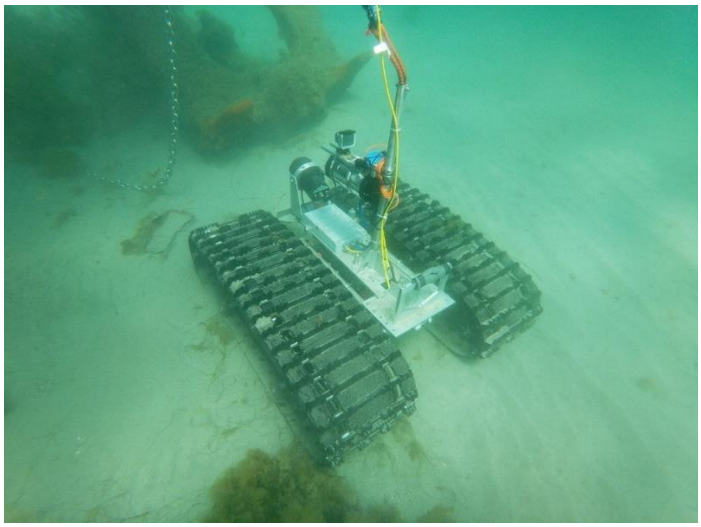

Figure 39. Sea Ox Conducting Sonar Testing

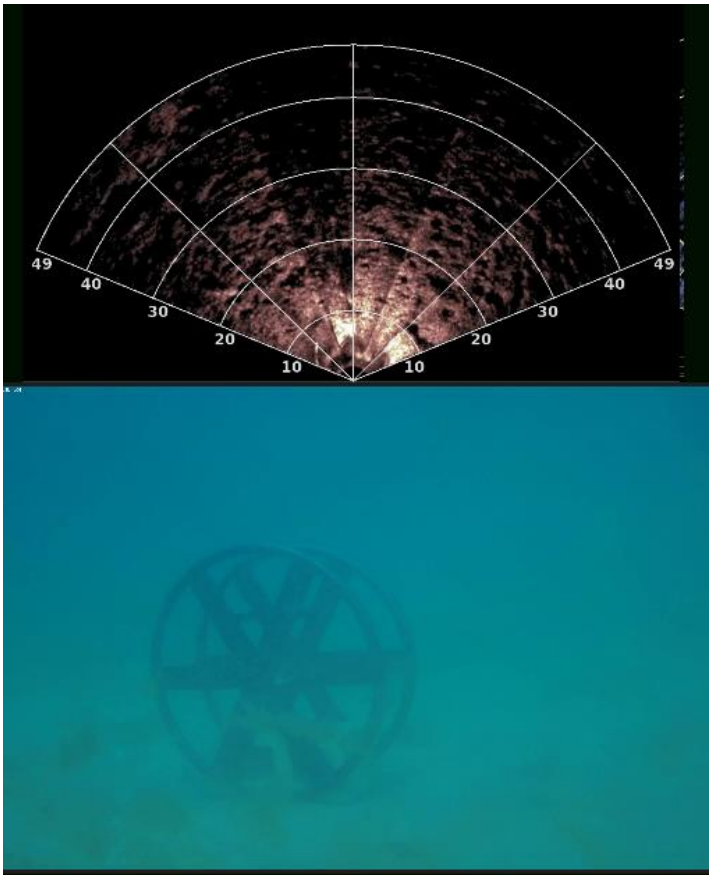

Figure 40. Sea Otter Target Sonar and Imagery

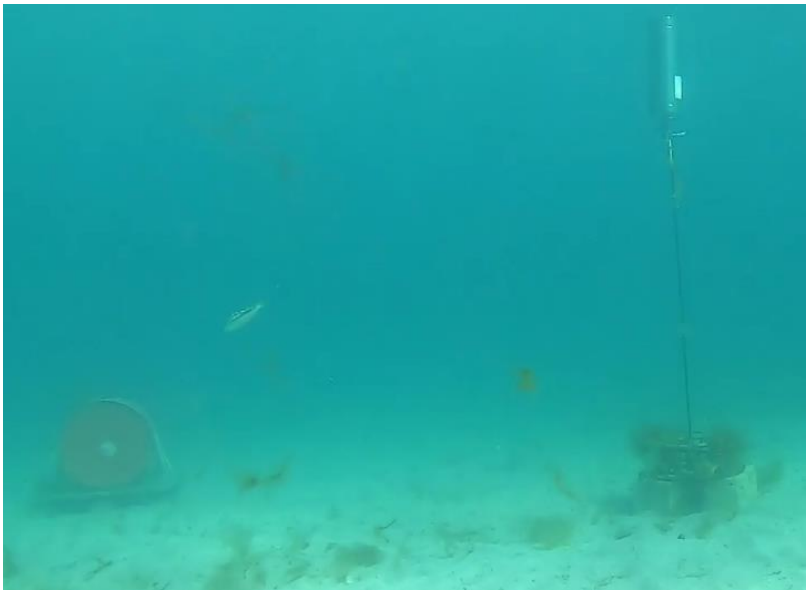

Figure 41. Sea Otter Captured Image

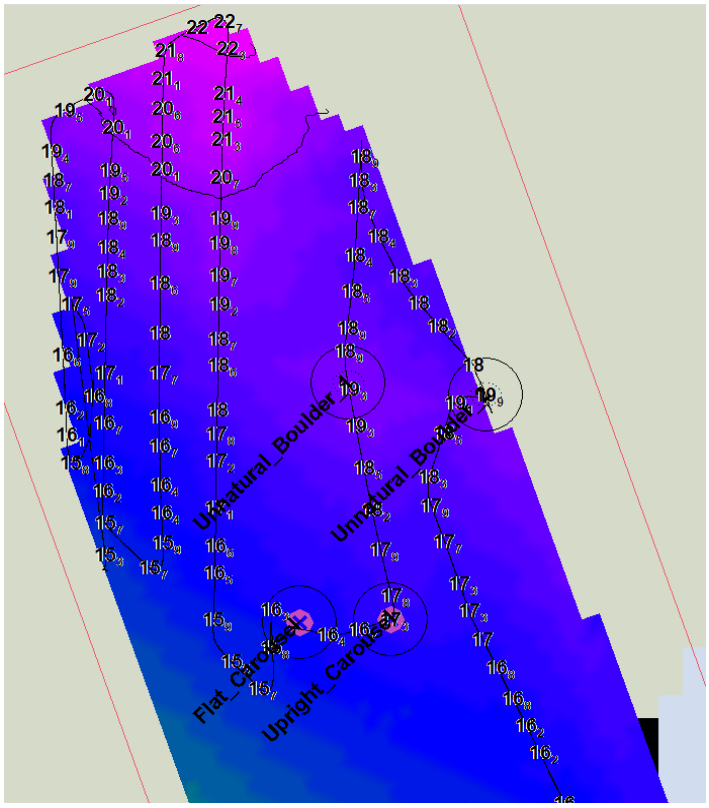

Figure 42. Sea Otter Bathymetric Overlay

d. Limitations

Both Sea Otter and Sea Ox had technical issues throughout the testing. The systems are developmental and the only available ground-based system. Both required a radio tether to ensure communications. The RF link frequently drop when the buoy was jostled or was hidden behind a wave.

A 1m-tall mast provides mounting points for the camera, GPS, and sonar. The mast system becomes entangled with seaweed during surf zone ingress and egress and causes the system to tip over. The pan-tilt 360-degree camera was easily damaged by vibration. The BlueView M900 multibeam sonar requires tuning to optimize imagery.

Autonomous operations are very limited. The system was not equipped with obstacle avoidance or tilt limiters. This causes the Sea Otter and Sea Ox to become stuck or tip over on rock formations. Once stuck, the systems require recovery by Navy divers.

D. OPERATIONAL ASSESSMENT

This subsection presents data collected from the operational assessment conducted by the USMC. Three operational test teams are established (Alpha, Bravo, Charlie) consisting of Marines with limited to no exposure to the systems under test. Each team was made up of five operators and up to three additional support staff. All operational teams conduct the same missions with the same availability to the systems. The three teams deploy all three systems on four days for a total of 12 days of testing. The first day for each team was practice and the subsequent three days involve running the systems in three different test lanes. The operational assessment is summarized in Table 27.

Table 27. Operational Assessment Summary

Section	Description
Test Lanes	Presents the setup of the testing lanes.
Targets	Presents the six target types used to test system capabilities.
Execution Time	Time spent completing search of a test lane.
Results	Number of targets identified in each test lane.

1. Test Lanes

Three test lanes are established in the vicinity of San Clemente Island. Targets are initially placed in a single lane for three days of practice and subsequently rearranged for the nine days of operational testing. Testing was conducted as described in Table 28 and the test lanes are shown in Figure 43.

Table 28. Operational Assessment Schedule

Day	Team	Lane
Day 1	Alpha	Practice 1
Day 2	Bravo	Practice 1
Day 3	Charlie	Practice 1
Day 4	Alpha	Lane 1
Day 5	Bravo	Lane 2
Day 6	Charlie	Lane 3
Day 7	Alpha	Lane 3
Day 8	Bravo	Lane 1
Day 9	Charlie	Lane 2
Day 10	Alpha	Lane 2
Day 11	Bravo	Lane 3
Day 12	Charlie	Lane 1

Figure 43. Test Lane Diagram

2. Targets

Each lane contains up to ten different targets that are placed in areas containing one of three different bottom types as indicated by the levels of complexity shown in Table 29.

Table 29. Bottom Complexity Type

Type	Complexity
1	None - Sandy surface with no obstacles.
2	Semi - Contains mid-sized obstacles, some organics.
3	Complex - Contains large rocks, soft bottoms, seaweed.

A total of six different target types are employed as described in Table 30. The targets emplaced in multiple bottom types are shown in Figure 44 through Figure 50.

Table 30. Target Types

	Name	Description
1	Barrel	Steel 55-gallon drum
2	Cone	Ceramic antenna covering
3	Structure	Welded aluminum tent posts
4	Moored	Aluminum fire extinguisher
5	Reel	Steel fire hose reel
6	Tube	Steel hollow tube

Figure 44. Target Barrel, Type 3 Complex Bottom

Figure 45. Target Cone, Type 2 Semi-Complex Bottom

Figure 46. Target Structure 1, Type 1 Non-Complex Bottom

Figure 47. Target Structure 2, Type 1 Non-Complex Bottom

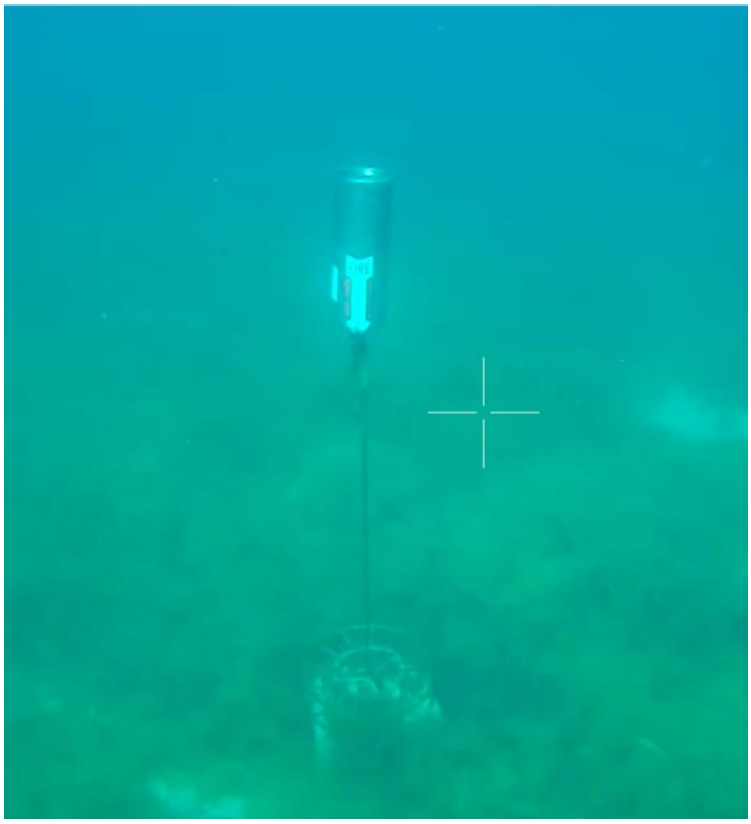

Figure 48. Target Moored, Type 2 Semi-Complex Bottom

Figure 49. Target Reel, Type 2 Semi-Complex Bottom

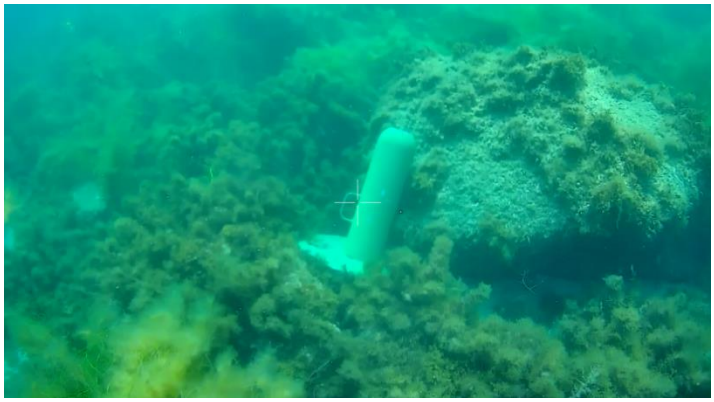

Figure 50. Target Tube, Type 3 Complex Bottom

3. Execution Time

Total execution time was recorded for each test event. The execution time is the sum of pre-operational check time plus time to deploy plus operating time. The pre-operational check (*preop checks*) was recorded for the time it takes to ensure the system was up and running properly and ready for operations. The amount of time it takes to move the system from the container into the water was recorded as *deploying*. The total amount of time the system spends in the water conducting a mission was recorded as *operating*.

Execution times for Sea Ox and Sea Otter are not recorded due to the developmental nature of the systems. System operating times are shown in Figure 51 and Figure 52.

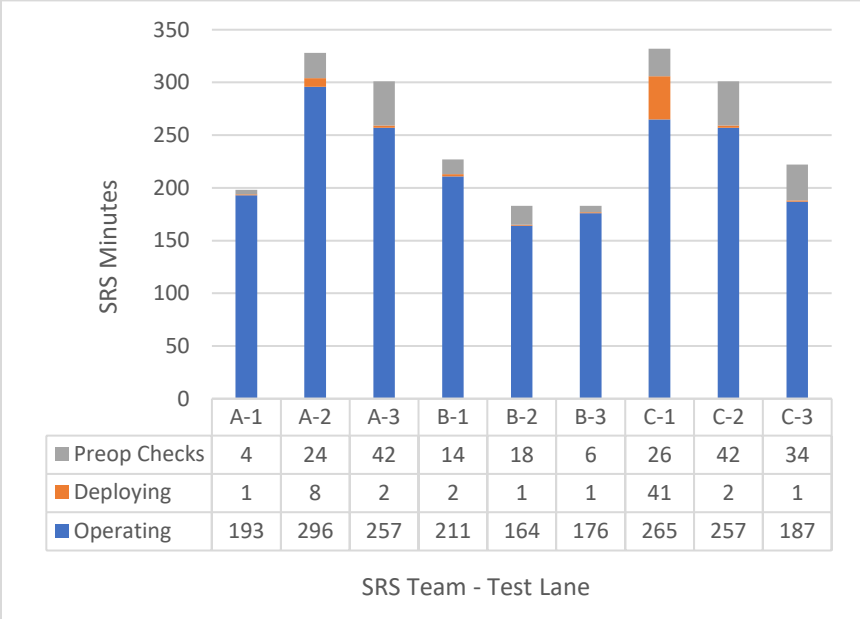

Figure 51. SRS Fusion ROV Lane Clearance Time

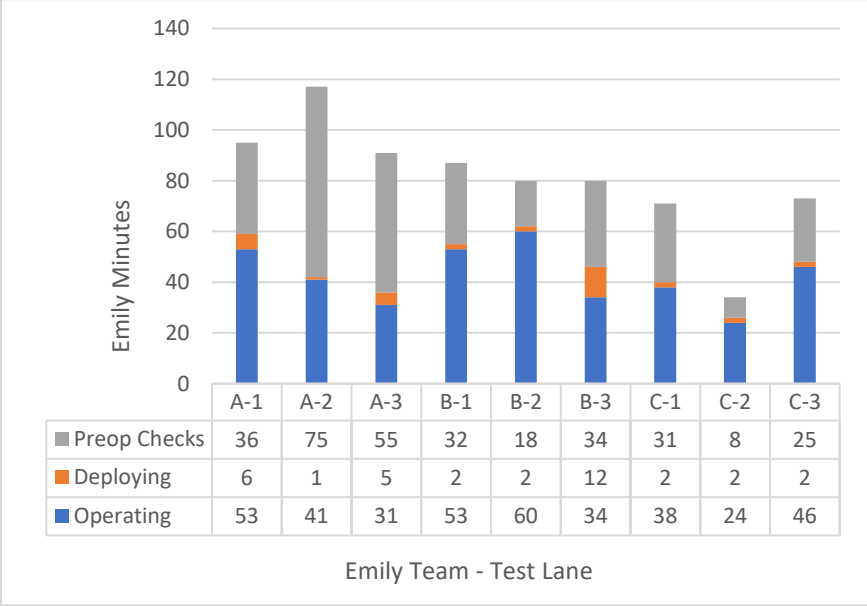

Figure 52. Sonar EMILY USV Lane Clearance Time

4. Test Results

Each test lane contains a maximum of ten targets that can be identified during a test event. The search rate and endurance of each of the three systems is presented in Table 31.

Table 31. System Endurance and Search Rates

System	Control	Endurance	Search Rate
Sonar EMILY USV	Remote	1.5 hours	13 m^2/sec
SRS Fusion ROV	Direct/Tether	Greater than 5 hours	2 m^2/Sec
Sea Otter AUV	Autonomous	Greater than 5 hours	n/a
Sea Ox AUV	Autonomous	Greater than 5 hours	n/a

The number of targets identified by each team per test lane was recorded and shown in Figure 53. Additional information providing detailed test results is available on request.

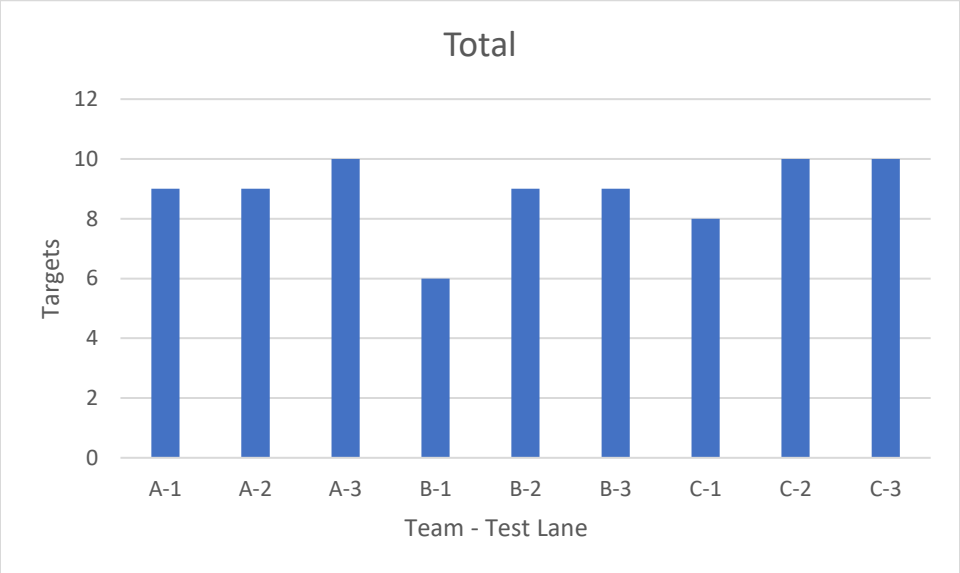

Figure 53. Target Test Results

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APPENDIX B. DATA ANALYTICS APPROACH

Various analytics are applied to the survey data to determine their statistical properties and significance. This Appendix lists the methodologies applied to include tests for data normality. The next Appendix showcases the key results and interpretation. The following approach was applied, which starts with high-level group tests and works down to more refined ANOVA tests before concluding with two variable T-tests:

1. Survey data are tested for normality, reliability, and validity.
2. Hotelling tests are run to compare aggregate data as a *group.*
3. Bonferroni tests are run to refine Hotelling tests using adjusted p-values.
4. ANOVA tests are applied to compare three variables at a time.
5. Kruskal–Wallis tests are run as a nonparametric corollary to ANOVA.
6. Directional T-tests are applied only to variables identified by ANOVA.
7. Mann–Whitney and Wilcoxon tests are run as nonparametric versions of the T-test.
8. Regression analysis is performed to test for external validity.

A. SURVEY DATA

Figure 54 through Figure 58 illustrate the survey data collected. The data are distributed and analyzed using Real Options Valuation (ROV) BizStats. To effectively use the statistical software techniques, the treatment groups are temporarily coded as A, B, and C. Group A is listed in analytics as VENDOR INFO. Group B is listed in analytics as HAL INFO. Finally, Group C is referred to as OPS INFO. The relationship of the design variables to analytic variables is outlined in Table 32.

Table 32. Dependent Variable vs. Analytic Heading

Heading	Survey	System Presentation	LOA	DATA
A1	Risk	Vendor info	n/a	VAR 1 to VAR 14
A2	TAM	Vendor info	Low	VAR 15 to VAR 25
A3	TAM	Vendor info	Med	VAR 26 to VAR 36
A4	TAM	Vendor info	High	VAR 37 to VAR 47
B1	Risk	HAL info	n/a	VAR 101 to VAR 114
B2	TAM	HAL info	Low	VAR 115 to VAR 125
B3	TAM	HAL info	Med	VAR 126 to VAR 136
B4	TAM	HAL info	High	VAR 137 to VAR 147
C2a	Risk	Ops info	n/a	VAR 401 to VAR 414
C3a	TAM	Ops info	Low	VAR 425 to VAR 425
C4a	TAM	Ops info	Med	VAR 426 to VAR 436
C5a	TAM	Ops info	High	VAR 437 to VAR 447
C7	SUS	Ops info	Low	VAR 266 to VAR 275
C8	SUS	Ops info	Med	VAR 276 to VAR 285
C9	SUS	Ops info	High	VAR 286 to VAR 295
C10	SUS	Ops info	n/a	VAR 296 to VAR 298

Note: For TAM, PU = x15–x18, PEOU = x19–x22, IU = x23–x25.

GROUP ONE - (CODE 1): VENDOR INFO

	SURVEY ONE (Risk of failure) "A1"														SURVEY TWO (Technology Acceptance)																																	
															SYSTEM A (Low LOA) "A2"											System B (Medium LOA) "A3"											System C (High LOA) "A4"											FORM
	VAR1	VAR2	VAR3	VAR4	VAR5	VAR6	VAR7	VAR8	VAR9	VAR10	VAR11	VAR12	VAR13	VAR14	VAR15	VAR16	VAR17	VAR18	VAR19	VAR20	VAR21	VAR22	VAR23	VAR24	VAR25	VAR26	VAR27	VAR28	VAR29	VAR30	VAR31	VAR32	VAR33	VAR34	VAR35	VAR36	VAR37	VAR38	VAR39	VAR40	VAR41	VAR42	VAR43	VAR44	VAR45	VAR46	VAR47	
USER	HA1	HA2	HA3	HA4	AL1	AL2	AL3	AL4	AL5	LN1	LN2	LN3	LN4	LN5	PU1	PU2	PU3	PU4	PEOU1	PEOU2	PEOU3	PEOU4	IU1	IU2	IU3	PU1	PU2	PU3	PU4	PEOU1	PEOU2	PEOU3	PEOU4	IU1	IU2	IU3	PU1	PU2	PU3	PU4	PEOU1	PEOU2	PEOU3	PEOU4	IU1	IU2	IU3	1/2/3
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Figure 54. Group A: Survey Data with Vendor Info

GROUP TWO - (CODE 2): HAL INFO

	SURVEY ONE (Risk of failure) "B1"														SURVEY TWO (Technology Acceptance Model)																																	
															SYSTEM A (Low LOA) "B2"											System B (Medium LOA) "B3"											System C (High LOA) "B4"											FORM
	VAR101	VAR102	VAR103	VAR104	VAR105	VAR106	VAR107	VAR108	VAR109	VAR110	VAR111	VAR112	VAR113	VAR114	VAR115	VAR116	VAR117	VAR118	VAR119	VAR120	VAR121	VAR122	VAR123	VAR124	VAR125	VAR126	VAR127	VAR128	VAR129	VAR130	VAR131	VAR132	VAR133	VAR134	VAR135	VAR136	VAR137	VAR138	VAR139	VAR140	VAR141	VAR142	VAR143	VAR144	VAR145	VAR146	VAR147	
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Figure 55. Group B: Survey Data with HAL Info

GROUP THREE - (CODE 3): OPERATIONAL INFO

SURVEY ONE (Risk of Failure) "C2"

USER	VAR215	VAR216	VAR217	VAR218	VAR219	VAR220	VAR221	VAR222	VAR223	VAR224	VAR225	VAR226	VAR227	VAR228
	HA1	HA2	HA3	HA4	AL1	AL2	AL3	AL4	AL5	LN1	LN2	LN3	LN4	LN5
A1	75	35	40	50	65	60	55	100	70	90	20	95	85	80
A2	40	30	30	10	50	50	60	70	40	60	30	50	40	40
A3	60	40	50	10	50	50	50	70	60	100	90	90	80	80
A4	63	70	65	60	20	80	68	55	90	100	50	99	95	98
A5	90	80	70	20	30	50	90	90	80	90	20	100	100	100
B1	80	80	40	60	70	0	60	60	60	100	20	100	70	70
B2	80	15	45	50	25	10	35	85	50	100	90	95	55	60
B3	30	20	20	20	50	50	50	50	30	100	5	90	70	70
B4	70	40	50	40	20	20	60	100	80	100	10	90	100	100
B5	65	50	65	60	65	65	90	65	70	100	50	95	90	90
C1	50	40	80	50	10	10	70	90	60	100	10	90	65	65
C2	60	60	60	40	10	30	70	70	50	80	60	70	80	80
C3	25	75	25	50	10	25	75	50	50	100	25	100	100	100
C4	50	50	30	0	50	50	62	75	55	100	50	90	70	70
C5	40	20	75	50	33	33	33	40	50	100	10	95	100	100
O1	75	100	75	90	75	75	75	90	90	100	20	100	40	50
O2	90	70	50	50	30	70	30	90	50	50	50	90	50	50
O3	50	50	40	20	30	30	30	80	40	70	70	80	90	90
O4	40	75	20	40	20	40	70	85	30	95	20	95	100	100

SURVEY TWO (Technology Acceptance Model)

SYSTEM A (Low LOA) "C3"

USER	VAR229	VAR230	VAR231	VAR232	VAR233	VAR234	VAR235	VAR236	VAR237	VAR238	VAR239
	PU1	PU2	PU3	PU4	PEOU1	PEOU2	PEOU3	PEOU4	IU1	IU2	IU3
A1	100	100	100	100	85	80	90	100	100	100	0
A2	70	90	80	80	60	70	70	70	40	60	10
A3	100	100	100	100	70	80	90	80	100	100	0
A4	100	100	100	100	90	90	80	90	90	98	0
A5	100	100	100	100	70	80	50	50	100	100	0
B1	100	100	100	100	90	80	90	85	100	100	0
B2	100	100	100	100	90	100	95	95	95	95	0
B3	100	100	100	100	80	30	100	80	100	90	0
B4	100	100	100	100	70	70	90	100	100	100	0
B5	100	100	100	100	90	80	85	90	100	100	0
C1	100	100	100	100	90	100	100	100	100	100	100
C2	90	95	90	90	100	90	85	85	100	95	0
C3	100	100	100	100	100	75	75	75	100	100	100
C4	100	100	100	100	80	75	90	80	100	100	0
C5	100	100	100	100	100	50	90	95	100	100	100
O1	100	100	100	100	100	80	100	100	100	100	0
O2	80	80	100	100	80	70	100	100	50	100	0
O3	90	100	100	100	70	50	70	65	90	80	50
O4	100	100	100	100	90	95	90	95	100	100	0

System B (Medium LOA) "C4"

USER	VAR240	VAR241	VAR242	VAR243	VAR244	VAR245	VAR246	VAR247	VAR248	VAR249	VAR250
	PU1	PU2	PU3	PU4	PEOU1	PEOU2	PEOU3	PEOU4	IU1	IU2	IU3
A1	50	30	50	60	100	100	90	100	80	80	0
A2	30	10	30	20	40	10	10	20	10	10	5
A3	30	30	20	10	80	90	80	90	10	10	50
A4	50	40	50	50	60	90	40	50	30	50	0
A5	60	40	60	60	60	60	60	60	50	60	0
B1	100	80	90	90	80	80	70	80	80	80	0
B2	85	85	85	85	85	95	90	90	90	90	0
B3	100	100	100	100	40	40	100	30	100	70	0
B4	80	70	80	90	100	90	90	100	100	100	70
B5	100	80	70	75	80	70	85	70	90	80	20
C1	80	90	100	100	100	100	90	100	100	100	100
C2	80	70	75	80	95	70	75	75	90	85	0
C3	75	75	75	75	50	75	75	75	100	75	0
C4	80	60	70	70	80	75	60	70	70	70	0
C5	90	75	80	90	100	50	100	100	80	80	50
O1	100	100	100	100	100	80	100	100	100	100	0
O2	100	100	100	100	100	100	80	100	100	100	80
O3	90	70	80	100	75	60	70	70	80	75	80
O4	90	90	90	95	90	95	80	90	90	95	0

System C (High LOA) "C5"

USER	VAR251	VAR252	VAR253	VAR254	VAR255	VAR256	VAR257	VAR258	VAR259	VAR260	VAR261
	PU1	PU2	PU3	PU4	PEOU1	PEOU2	PEOU3	PEOU4	IU1	IU2	IU3
A1	80	100	90	100	90	100	100	100	50	80	75
A2	40	50	40	50	30	30	40	40	20	40	10
A3	90	90	80	80	60	70	90	80	70	80	0
A4	70	80	75	100	90	90	90	90	90	98	0
A5	80	90	90	90	80	100	90	90	100	100	80
B1	30	30	20	20	80	80	90	80	0	0	50
B2	75	75	75	75	80	90	85	85	85	85	0
B3	100	100	100	100	50	70	100	50	100	20	0
B4	60	30	50	50	80	80	80	80	50	30	0
B5	60	60	60	60	70	70	90	85	50	40	0
C1	20	20	10	10	70	30	50	50	10	10	0
C2	75	80	75	70	90	75	60	70	75	60	0
C3	100	75	75	100	50	50	50	50	100	50	0
C4	60	60	30	30	50	70	40	50	50	40	0
C5	90	80	70	75	100	50	100	100	75	75	50
O1	40	40	40	50	100	80	100	100	25	25	0
O2	80	80	100	100	50	50	70	80	50	100	100
O3	25	40	20	10	50	70	30	20	0	10	20
O4	40	40	50	60	70	60	70	65	40	40	0

Figure 56. Group C: Ops Info Survey Data (Part 1)

System Usability Score																																
SYSTEM A (Low LOA) "C7"											SYSTEM B (Medium LOA) "C8"										SYSTEM C (HighLOA) "C9"										*SCORE* "C10"*		
VAR266	VAR267	VAR268	VAR269	VAR270	VAR271	VAR272	VAR273	VAR274	VAR275	VAR276	VAR277	VAR278	VAR279	VAR280	VAR281	VAR282	VAR283	VAR284	VAR285	VAR286	VAR287	VAR288	VAR289	VAR290	VAR291	VAR292	VAR293	VAR294	VAR295	VAR296	VAR297	VAR298
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	*SUSA*	*SUSB*	*SUSC*
5	1	5	1	5	1	5	2	4	1	3	2	4	1	2	4	4	2	5	1	4	2	3	1	3	3	5	3	4	1	95	70	73
4	1	4	2	3	2	5	3	3	2	1	2	3	5	1	5	1	4	1	4	3	2	2	4	3	4	3	3	2	3	73	18	43
5	2	4	4	4	3	3	2	5	2	1	1	5	1	2	4	5	2	1	1	5	3	3	4	4	5	3	5	4	3	70	63	48
5	2	4	1	4	2	3	3	5	3	2	1	3	2	2	5	5	3	2	2	4	2	5	2	3	4	3	5	3	3	75	53	55
5	2	4	4	5	2	4	2	5	3	4	4	4	4	2	5	4	4	3	4	1	3	3	3	3	3	4	3	1	3	75	40	43
5	2	4	2	5	1	4	3	5	2	5	3	4	1	5	2	4	2	4	3	1	2	5	5	2	5	5	3	2	2	83	78	45
5	3	4	2	4	2	4	3	4	4	4	3	4	2	4	2	4	3	4	4	3	3	4	2	4	2	4	4	4	4	68	65	60
5	2	5	2	4	2	5	3	5	3	4	4	3	4	2	4	3	2	4	3	2	3	2	5	1	5	3	5	1	3	80	48	20
5	2	4	3	4	2	4	2	5	3	4	1	5	2	3	3	5	1	5	2	2	2	4	3	2	4	4	5	4	2	75	83	50
5	2	4	2	5	2	4	4	5	4	4	4	4	2	2	4	4	4	4	4	2	2	3	4	2	5	3	4	3	3	73	50	38
5	2	4	2	4	2	5	1	5	4	5	2	4	2	4	2	5	1	5	4	1	3	4	4	4	5	4	5	1	5	80	80	30
5	1	4	1	5	2	5	5	5	1	5	2	5	2	5	3	4	5	4	2	2	3	4	2	2	5	4	3	2	2	85	73	48
4	2	4	2	4	2	4	2	5	4	4	4	3	2	2	3	4	3	3	4	4	4	2	4	4	4	4	4	2	4	73	50	40
5	2	4	1	5	1	5	2	5	4	3	4	4	1	5	4	5	2	4	4	2	1	3	3	4	5	5	4	4	4	85	65	53
5	1	5	1	4	2	4	1	5	3	5	1	5	1	3	3	4	1	4	3	2	2	4	2	2	4	3	4	3	3	88	80	48
5	3	4	3	4	2	3	3	3	5	5	3	4	3	4	2	3	3	3	5	2	4	4	3	4	5	3	4	2	5	58	58	35
4	3	5	3	4	3	4	4	4	1	5	1	5	3	4	2	5	2	5	1	3	5	3	3	2	5	3	5	3	3	68	88	33
4	2	4	2	4	2	4	4	5	3	4	2	4	2	4	2	5	4	5	3	1	3	2	3	2	5	1	2	1	3	70	73	28
5	2	5	1	4	2	5	1	4	4	4	3	4	2	3	3	4	1	4	4	2	4	2	5	1	5	2	5	3	5	83	65	15

*SCORE = ((Q1-1)+(5-Q2)+(Q3-1)+(5-Q4)+(Q5-1)+(5-Q6)+(Q7-1)+(5-Q8)+(Q9-1)+(5-Q10))*2.5

Figure 57. Group C: Ops Info Survey Data (Part 2)

RISK SCORE "C2a"															SYSTEM A (Low LOA) "C3a"											System B (Medium LOA) "C4a"											System C (High LOA) "C5a"													
VAR401	VAR402	VAR403	VAR404	VAR405	VAR406	VAR407	VAR408	VAR409	VAR410	VAR411	VAR412	VAR413	VAR414	VAR415	VAR416	VAR417	VAR418	VAR419	VAR420	VAR421	VAR422	VAR423	VAR424	VAR425	VAR426	VAR427	VAR428	VAR429	VAR430	VAR431	VAR432	VAR433	VAR434	VAR435	VAR436	VAR437	VAR438	VAR439	VAR440	VAR441	VAR442	VAR443	VAR444	VAR445	VAR446	VAR447
HA1	HA2	HA3	HA4	AL1	AL2	AL3	AL4	AL5	LN1	LN2	LN3	LN4	LN5	PU1	PU2	PU3	PU4	PEOU1	PEOU2	PEOU3	PEOU4	IU1	IU2	IU3	PU1	PU2	PU3	PU4	PEOU1	PEOU2	PEOU3	PEOU4	IU1	IU2	IU3	PU1	PU2	PU3	PU4	PEOU1	PEOU2	PEOU3	PEOU4	IU1	IU2	IU3
4	2	2	3	4	3	3	5	4	5	1	5	5	4	5	5	5	5	5	4	5	5	5	5	1	3	2	3	3	5	5	5	5	4	4	1	4	5	5	5	5	5	5	5	3	4	4
2	2	2	1	3	3	3	4	2	3	2	3	2	2	4	5	4	4	3	4	4	4	2	3	1	2	1	2	1	2	1	1	1	1	1	1	2	3	2	3	2	2	2	2	1	2	1
3	2	3	1	3	3	3	4	3	5	5	5	4	4	5	5	5	5	4	4	5	4	5	5	1	2	2	1	1	4	5	4	5	1	1	3	5	5	4	4	3	4	5	4	4	4	1
4	4	4	3	1	4	4	3	5	5	3	5	5	5	5	5	5	5	5	5	4	5	5	5	1	3	2	3	3	3	5	2	3	2	3	1	4	4	4	5	5	5	5	5	5	5	1
5	4	4	1	2	3	5	5	4	5	1	5	5	5	5	5	5	5	4	4	3	3	5	5	1	3	2	3	3	3	3	3	3	3	3	1	4	5	5	5	4	5	5	5	5	5	4
4	4	2	3	4	1	3	3	3	5	1	5	4	4	5	5	5	5	5	4	5	5	5	5	1	5	4	5	5	4	4	4	4	4	4	1	2	2	1	1	4	4	5	4	1	1	3
4	1	3	3	2	1	2	5	3	5	5	5	3	3	5	5	5	5	5	5	5	5	5	5	1	5	5	5	5	5	5	5	5	5	5	1	4	4	4	4	4	5	5	5	5	5	1
2	1	1	1	3	3	3	3	2	5	1	5	4	4	5	5	5	5	4	2	5	4	5	5	1	5	5	5	5	2	2	5	2	5	4	1	5	5	5	5	3	4	5	3	5	1	1
4	2	3	2	1	1	3	5	4	5	1	5	5	5	5	5	5	5	4	4	5	5	5	5	1	4	4	4	5	5	5	5	5	5	5	4	3	2	3	3	4	4	4	4	3	2	1
4	3	4	3	4	4	5	4	4	5	3	5	5	5	5	5	5	5	5	4	5	5	5	5	1	5	4	4	4	4	4	5	4	5	4	1	3	3	3	3	4	4	5	5	3	2	1
3	2	4	3	1	1	4	5	3	5	1	5	4	4	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	1	1	1	1	4	2	3	3	1	1	1
3	3	3	2	1	2	4	4	3	4	3	4	4	4	5	5	5	5	5	5	5	5	5	5	1	4	4	4	4	5	4	4	4	5	5	1	4	4	4	4	5	4	3	4	4	3	1
2	4	2	3	1	2	4	3	3	5	2	5	5	5	5	5	5	5	5	4	4	4	5	5	5	4	4	4	4	3	4	4	4	5	4	1	5	4	4	5	3	3	3	3	5	3	1
3	3	2	1	3	3	4	4	3	5	3	5	4	4	5	5	5	5	4	4	5	4	5	5	1	4	3	4	4	4	4	3	4	4	4	1	3	3	2	2	3	4	2	3	3	2	1
2	1	4	3	2	2	2	2	3	5	1	5	5	5	5	5	5	5	5	3	5	5	5	5	5	5	4	4	5	5	3	5	5	4	4	3	5	4	4	4	5	3	5	5	4	4	3
4	5	4	5	4	4	4	5	5	5	1	5	2	3	5	5	5	5	5	4	5	5	5	5	1	5	5	5	5	5	5	4	5	5	5	1	2	2	2	3	5	4	5	5	2	2	1
5	4	3	3	2	4	2	5	3	3	3	5	3	3	4	4	5	5	4	4	5	5	3	5	1	5	5	5	5	5	5	4	5	5	5	4	4	4	5	5	3	3	4	4	3	5	5
3	3	2	1	2	2	2	4	2	4	4	4	5	5	5	5	5	5	4	3	4	4	5	4	3	5	4	4	5	4	3	4	4	4	4	4	2	2	1	1	3	4	2	1	1	1	1
2	4	1	2	1	2	4	5	2	5	1	5	5	5	5	5	5	5	5	5	5	5	5	5	1	5	5	5	5	5	5	4	5	5	5	1	2	2	3	3	4	3	4	4	2	2	1

Figure 58. Group C: Ops info Survey Data (Part 3)

B. NORMALITY TESTS

The data are first tested for normality. This is critical as the sample sizes are between 19 and 23 active-duty military. The survey data show the number of personnel participating in the experiment (noted as the unique number of data rows). In addition, the data are truncated between 1 and 5, inclusive, and are ordinal in nature. The survey responses are 1–5, for strongly disagree to strongly agree, and hence there is an order to the data, making the data measurement ordinal. However, an argument can be made that the data are quasi-interval, where the *value differential* between 1 and 2 is the same as between 2 and 3, and so forth. Figure 59 shows a visualization of the responses to a randomly selected question from each experiment, and the probability distribution does not look normally distributed. Normality of the dataset is important to justify the use of parametric methods, which predicates the need to test the distribution.

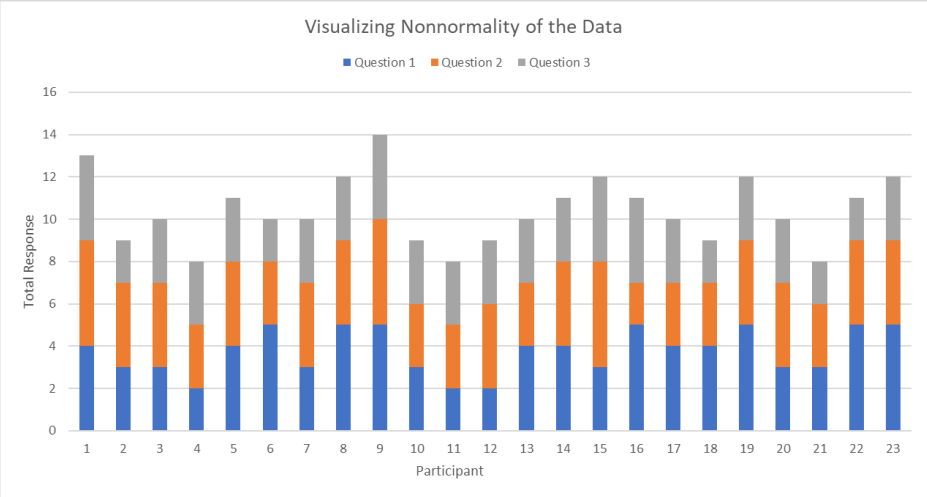

Figure 59. Visualizing Sample Survey Variables

To test for normality of the data, multiple tests are applied, such as the Akaike Information Criterion, Anderson–Darling, Kolmogorov–Smirnov, Kuiper's Statistic, Schwartz Criterion, and the Nonparametric Shapiro–Wilk Test for Normality. The first five tests require more data for a better fit whereas the Shapiro–Wilk test is nonparametric and well suited for less data.

In all cases, the hypotheses tested are:

H_0: The sample is from a Normal Distribution.

H_a: The sample is not from a Normal Distribution.

Following are the various distributional fitting tests (Mun, 2018):

Akaike Information Criterion (AIC): Rewards goodness of fit with a penalty for increased complexity that is a function of the number of estimated parameters (although AIC penalizes the number of parameters less strongly than other methods).

Anderson–Darling (AD): This is one of the most powerful statistical tools for finding departures from normality and for testing normal tails when testing if a normal distribution sufficiently describes a set of data. This test is less powerful than others when applied to non-normal datasets.

Kolmogorov–Smirnov (KS): This is a nonparametric test based on an estimate of the cumulative distribution function (CDF) of a sample dataset. *Nonparametric* means the data do not fit a recognized distributional pattern. Since this test does not rely on the CDF, it applies across a great number of distributions.

Kuiper's Statistic (K): Also referred to as Kuiper's test and shares properties with the KS test. Both the KS and K tests are sensitive in the tails and the median. The K test differs in that it is invariant under cyclic transformations of the independent variable. This makes the K test valuable for testing cyclic variations over time. In comparison, the AD test is also sensitive at the tails and the median but, unlike the K test, is sensitive to cyclic variance of the independent variable.

Schwarz/Bayes Information Criterion (SC/BIC): This test shares most properties of the AIC test in that it considers both goodness of fit and the number of parameters. This test differs in that it has a larger penalty for complexity than AIC.

Shapiro–Wilk–Royston (SWR): This test for normality is an alternative to the standard Shapiro–Wilk test that uses the Royston algorithm to test the null hypothesis. It is nonparametric in nature and can handle situations when few data points are available.

Chi-Square (CS) Normality Test: The CS test is typically used on categorical or ordinal datasets, where the actual data's frequency distribution is compared against the frequency distribution of a specified distribution, such as the normal distribution.

The usual null hypothesis for all the tests above is the dataset follows a normal distribution, and the alternate hypothesis is that the dataset does not follow a normal distribution. As an example, the hypothesis is tested using the chi-square statistic defined as $\chi^2 = \sum_{i=1}^{k}(O_i - E_i)^2/E_i$, where O_i is the observed frequency for bin i and E_i is the expected frequency for bin i. The expected frequency is calculated by $E_i = N\big(F(Y_U) - F(Y_L)\big)$, where F is the cumulative distribution function for the distribution being tested, Y_U is the upper limit for class i, Y_L is the lower limit for class i, and N is the sample size.

C. BAR CHARTS AND HISTOGRAMS

Figure 60, Figure 62, and Figure 62 show the average response for each of the three systems (A: low LOA, B: medium LOA, and C: high LOA) with respect to the 11 technology acceptance model questions, including perceived usefulness, perceived ease of use, and intent to use. In some situations, performing a simple visualization can yield valuable insights as to the behavior of the data. However, in the current situation, no distinguishing intelligence can be gleaned from the three charts, which indicates that additional, more advanced statistical methods and analytics will need to be applied to obtain any statistical significance and useful definitive conclusions.

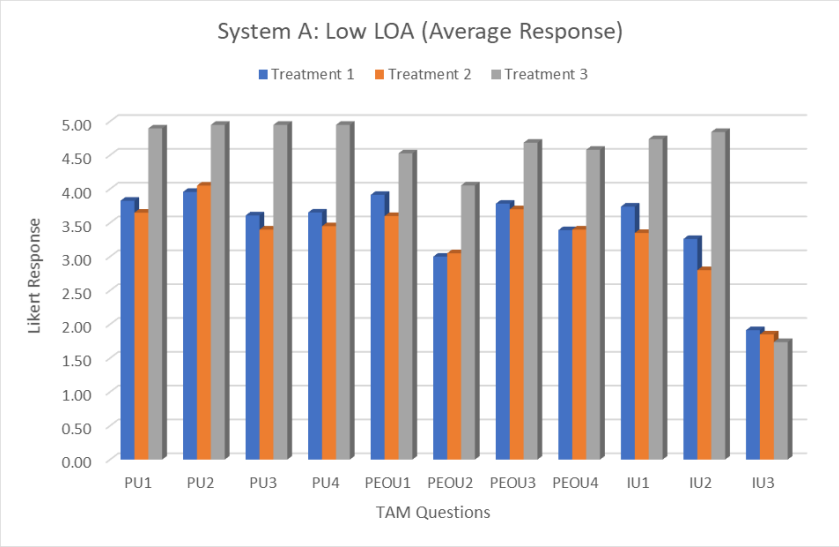

Figure 60. System A's Average Responses in Three Treatments

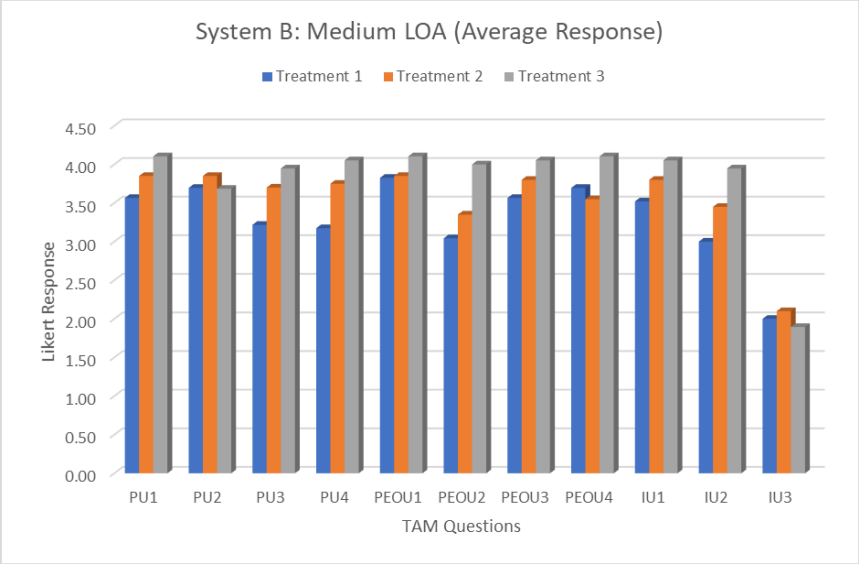

Figure 61. System B's Average Responses in Three Treatments

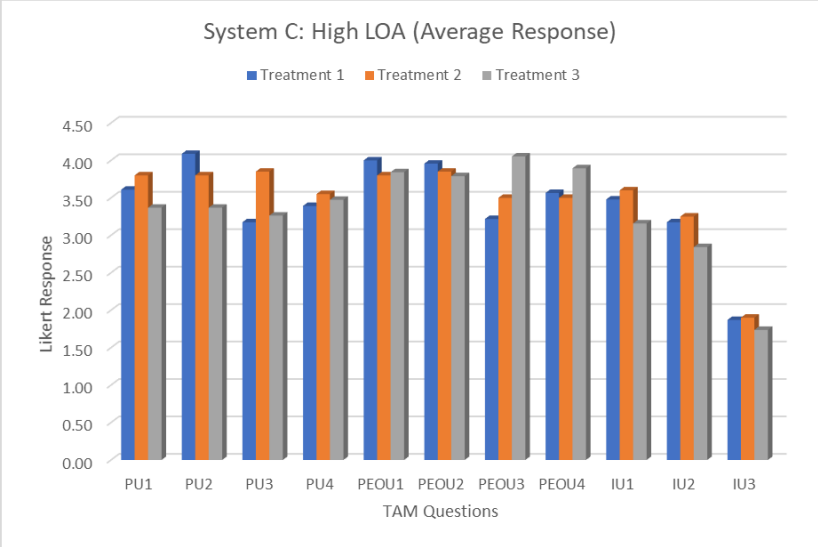

Figure 62. System C's Average Responses in Three Treatments

D. PARAMETRIC NORMALITY TEST

Detailed parametric normality testing is performed. The following tests are applied: Parametric Akaike Information Criterion, Anderson–Darling, Kolmogorov–Smirnov, Kuiper's Statistic, Schwarz Criterion, and the Nonparametric Shapiro–Wilk Test for Normality. The null hypothesis is neither accepted nor rejected in that the data is only somewhat normal. The survey data are only somewhat normally distributed under certain circumstances, and there is no claim of complete normality needed to justify standard modeling approaches. The data are considered ordinal and quasi-interval, with limited truncation between 1 and 5, and are limited to between 19 and 23 observations.

Table 33 shows the results from a randomly selected variable (VAR1), and Table 34 shows the sample results from another randomly selected variable (VAR105). The results are mixed in that certain variables can be deemed normal under some conditions, whereas under different test conditions, the data are not normally distributed. For VAR1, the normal distribution is typically ranked as the top 5 distribution tested, but the mean absolute percentage error (MAPE) is approximately 20%, and the p-value is 0.6147 in the Kolmogorov–Smirnov test. This means that although these are statistically significant, they may not be practically significant enough to justify normality. In addition, the SWR test returns a p-value of 0.0053, indicating nonnormality.

Table 33. VAR1 Normality Tests

Best-Fitting Distributions: VAR1

Rank	Akaike	Anderson	Kolmogorov	Kuiper's	Schwarz
1	Cosine	**Normal**	GenPareto	**Normal**	Cosine
2	Lognml3Arith	Logistic	Weibull	Logistic	Lognml3Arith
3	Weibull	TDist	GumbelMin	TDist	Weibull
4	**Normal**	Weibull	Triangular	Cosine	**Normal**
5	Gamma	GumbelMax	**Normal**	Weibull	Gamma

MAPE %:

Rank	Akaike	Anderson	Kolmogorov	Kuiper's	Schwarz
1	19.0136%	19.0915%	N/A	19.4214%	19.0136%
2	19.3421%	19.2969%	19.5824%	19.4370%	19.3421%
3	19.3665%	19.4732%	24.8250%	19.4732%	19.3665%
4	19.4297%	20.0214%	21.2316%	19.6235%	19.4297%
5	19.4575%	21.8529%	19.6539%	19.6312%	19.4575%

Best Fit Rank : **5**
Fit Name : Normal
Kolmogorov-Smirnov Statistic : 0.153350
Mean : 3.721371
Sigma : 1.250896
p value : **0.614791**
Actual to Theoretical Four Moments :
3.739130 1.053884 -0.190064 -1.168769
3.721371 1.250896 0.000000 0.000000

Nonparametric Shapiro-Wilk Test for Normality
(Royston Algorithm)
Shapiro-Wilks : 0.865946
SW P-value : **0.005368**
Null hypothesis: The data is normally distributed.

Table 34. VAR105 Normality Tests

Best-Fitting Distributions: VAR105

Rank	Akaike	Anderson	Kolmogorov	Kuiper's	Schwarz
1	Cosine	TDist	Weibull	TDist	Cosine
2	Uniform	Gamma	Uniform	GumbelMax	Uniform
3	Triangular	Normal	GumbelMax	Weibull	Triangular
4	Weibull	GumbelMin	LognmlArith	Laplace	Weibull
5	TDist	Logistic	**Normal**	GumbelMin	TDist

MAPE %:

Rank	Akaike	Anderson	Kolmogorov	Kuiper's	Schwarz
1	20.2105%	20.4966%	25.4875%	20.4966%	20.2105%
2	20.3731%	21.5868%	19.8248%	21.8717%	20.3731%
3	20.4260%	22.5328%	25.6700%	22.2282%	20.4260%
4	20.4405%	22.6221%	23.5800%	23.3391%	20.4405%
5	20.4966%	22.9440%	20.7503%	24.0731%	20.4966%

Best Fit Rank : 5
Fit Name : Normal
Kolmogorov-Smirnov Statistic : 0.175000
Mean : 3.647780
Sigma : 1.105387
p value : **0.531299**
Actual to Theoretical Four Moments :
3.550000 1.050063 -0.146220 -1.072526
3.647780 1.105387 0.000000 0.000000

Nonparametric Shapiro-Wilk Test for Normality
(Royston Algorithm)
Shapiro-Wilks : 0.880332
SW P-value : **0.017937**
Null hypothesis: The data is normally distributed.

E. NONPARAMETRIC NORMALITY TEST

Nonparametric normality tests are also considered. Since data are ordinal and quasi-interval, a mixed parametric and nonparametric approach is justified. There are some methods and tests that are considered nonparametric in nature. Compared to parametric tests (e.g., T-test, z-test, F-test, ANOVA), nonparametric tests have multiple advantages and a single disadvantage.

According to Mun (2018), fewer assumptions are required for the underlying data's population. Specifically, a nonparametric test does not require that the population be normally distributed. In fact, it does not require any specific distribution and, hence, is sometimes called distribution free, or tests without specific population parameters (i.e., nonparametric). Smaller sample sizes can be used. Data with nominal and ordinal scales can be tested. Nonparametric methods have lower power and use the data less efficiently. Therefore, if assumptions have been met, it is better to use parametric tests whenever possible. Both parametric and nonparametric tests are conducted whenever appropriate, and their results will be compared for corroboration.

F. INTERRATER RELIABILITY TEST WITH INTERCLASS CORRELATION (ICC)

The next test determines if the survey results are internally consistent and reliable. In addition, this test makes it possible to see if the level of reliability increases as HAL information is provided during the maximum information treatment. ICC is often referred to as the Pearson correlation when there are only one or two raters. When the number of raters is high, the ICC is used to test the reliability of ratings. It does this by checking for variability in the ratings of the same participant. The ICC differs from Pearson in that it simultaneously produces the total variation for and all participants combined. A high ICC indicates a high level of reliability, and the analysis is applied to Likert scales and any other quantitative scales. The columns in the ICC represent users and the data values are listed in the rows. This means that the coded survey results must be transposed prior to ICC analysis (Mun, 2018). Detailed ICC test results are provided in the next Appendix.

Vendor information ICC

i. A1:: VAR1:VAR14
ii. A2:: VAR15:VAR25
iii. A3:: VAR26:VAR36
iv. A4:: VAR37:VAR47
v. A5:: VAR48:VAR51

HAL information ICC

i. B1:: VAR101:VAR114
ii. B2:: VAR115:VAR125
iii. B3:: VAR126:VAR136
iv. B4:: VAR137:VAR147
v. B5:: VAR148:VAR151

Ops information ICC

i. C1:: VAR201:VAR214
ii. C2:: VAR215:VAR228
iii. C3:: VAR229:VAR239
iv. C4:: VAR240:VAR250
v. C5:: VAR251:VAR261
vi. C6:: VAR262:VAR265
vii. C7:: VAR266:VAR275
viii. C8:: VAR276:VAR285
ix. C9:: VAR286:VAR295
x. C10:: VAR296:VAR298

The data need to be transposed to run ICC. In BizStats, the ICC transposed variables are simulated as:

InterraterReliabilityInterClassCorrelationICC (VAR2:VAR24)
InterraterReliabilityInterClassCorrelationICC (VAR27:VAR49)
InterraterReliabilityInterClassCorrelationICC (VAR52:VAR74)
InterraterReliabilityInterClassCorrelationICC (VAR77:VAR99)
InterraterReliabilityInterClassCorrelationICC (VAR102:VAR124)
InterraterReliabilityInterClassCorrelationICC(VAR127:VAR146)
InterraterReliabilityInterClassCorrelationICC(VAR149:VAR168)
InterraterReliabilityInterClassCorrelationICC(VAR171:VAR190)
InterraterReliabilityInterClassCorrelationICC(VAR193:VAR212)
InterraterReliabilityInterClassCorrelationICC (VAR215:VAR234)

InterraterReliabilityInterClassCorrelationICC(VAR237:VAR255)
InterraterReliabilityInterClassCorrelationICC (VAR258:VAR276)
InterraterReliabilityInterClassCorrelationICC (VAR279:VAR297)
InterraterReliabilityInterClassCorrelationICC (VAR300:VAR318)

InterraterReliabilityInterClassCorrelationICC (VAR321:VAR339)
InterraterReliabilityInterClassCorrelationICC (VAR342:VAR360)
InterraterReliabilityInterClassCorrelationICC (VAR363:VAR381)
InterraterReliabilityInterClassCorrelationICC (VAR384:VAR402)
InterraterReliabilityInterClassCorrelationICC (VAR405:VAR423)
InterraterReliabilityInterClassCorrelationICC (VAR426:VAR444)

G. PRINCIPAL COMPONENT ANALYSIS AND FACTOR ANALYSIS

Principal component analysis (PCA) and factor Analysis are ways of identifying patterns and updating data to indicate any similarities or differences. A dataset that contains multiple variables can create high dimensionality for factor analysis, which makes it difficult to identify patterns. When patterns are eventually identified, PCA can compress the data without loss and thereby reduce the dimension. This compression provides for similar levels of information using fewer variables. PCA is used to reduce data dimensionality by identifying covariance among independent variables and then applying an orthogonal transformation that converts the correlated variables into a new set of linearly uncorrelated variables named *principal components*.

According to Mun (2018), the number of computed principal components is always less than or equal to the number of original variables. The orthogonal transformation is conducted to ensure that the first principal component is assigned the largest variance and represents the maximum variability in the data. Each subsequent component receives the next highest variance possible. All components are created as orthogonal and uncorrelated to the preceding components. Thus, PCA presents a new structure of data that best explains the variance. This reduction is useful for retaining variance in a high-dimensional dataset. The PCA does this by rotating a data around a mean so that it aligns with new components (principles). This rotation creates new variables that are made up of linear combinations of the original variables and all are orthogonal to each other.

Factor analysis shares properties with PCA. Factor analysis involves linear combinations of variables using correlations. PCA uses a covariance matrix to determine the eigenvectors and eigenvalues that represent the data. Eigenvectors represents the preferred direction, or main patterns, of the data. Eigenvalues represent a quantitative assessment of how closely a component represents the data. A component with a high eigenvalue is more representative of its data. As an example, PCA is useful when running

multiple regression or basic econometrics when the number of independent variables is large or when there is significant multicollinearity in the independent variables. PCA is run on the independent variables to reduce the quantity of variables and to eliminate any linear correlations among the independent variables. The extracted revised data obtained after running PCA can be used to rerun the linear multiple regression or linear basic econometric analysis. The resulting model will usually have slightly lower R-squared values but potentially higher statistical significance (lower p-value).

The algorithm applied in BizStats is shown below:

PrincipalComponentAnalysis(VAR1:VAR11)
PrincipalComponentAnalysis(VAR12:VAR22)
PrincipalComponentAnalysis(VAR23:VAR33)

H. HOTELLING T-SQUARED WITH EQUAL VARIANCES

The first test compared data in Group A (vendor information) with that of Group B (HAL information) and Group C (maximum information) as a whole. This test looks at the larger picture and employs a high-level analysis to see if the grouped data have any perceivable statistical significance. This method tests multiple features of two groups of variables at a time to see if they are statistically identical. All variables are tested at once in each group versus the second group (Mun, 2018). The null hypothesis tested is that there is zero difference between all the related features (dependent variables) compared across the two groups against their respective goals.

The Hotelling T-Square for Two Dependent Variables with Related Measures test is an extension of the T-test for dependent variables with Bonferroni adjustments applied simultaneously to multiple paired variables. To run the test, exactly two groups are required. Two or more input variables are required in each group. Different variables are arranged in columns and all variables must have at least five data points. All variables in both groups must have an equal number of data rows. The number of group 2 variables needs to be equal to the number of group 1 variables. The numbers of goals in BizStats must match the number of variables in the first group and is an optional input (the default setting is that all goals are equal to 0).

Group A1 vs. Group B1	VAR1:VAR14 against VAR101:VAR114
Group A2 vs. Group B2	VAR15:VAR25 against VAR115:VAR125
Group A3 vs. Group B3	VAR26:VAR36 against VAR126:VAR136
Group A4 vs. Group B4	VAR37:VAR47 against VAR137:VAR147
Group A5 vs. Group B5	VAR48:VAR51 against VAR148:VAR151
Group A6 vs. Group B6	VAR52:VAR54 against VAR152:VAR154
Group A2 vs. Group C3a	VAR15:VAR25 against VAR415:VAR425
Group A3 vs. Group C4a	VAR26:VAR36 against VAR426:VAR436
Group A4 vs. Group C5a	VAR37:VAR47 against VAR437:VAR447
Group B2 vs. Group C3a	VAR115:VAR125 against VAR415:VAR425
Group B3 vs. Group C4b	VAR126:VAR136 against VAR426:VAR436
Group B4 vs. Group C5c	VAR137:VAR147 against VAR437:VAR447

The algorithm applied in BizStats is shown below:

HotellingTSquare2VARIndep.EqualVariancewithRelatedMeasures (VAR1:VAR14 # VAR101:VAR114)
HotellingTSquare2VARIndep.EqualVariancewithRelatedMeasures (VAR15:VAR25 # VAR115:VAR125)
HotellingTSquare2VARIndep.EqualVariancewithRelatedMeasures (VAR26:VAR36 # VAR126:VAR136)
HotellingTSquare2VARIndep.EqualVariancewithRelatedMeasures (VAR37:VAR47 # VAR137:VAR147)
HotellingTSquare2VARIndep.EqualVariancewithRelatedMeasures (VAR48:VAR51 # VAR148:VAR151)
HotellingTSquare2VARIndep.EqualVariancewithRelatedMeasures (VAR52:VAR54 # VAR152:VAR154)
HotellingTSquare2VARIndep.EqualVariancewithRelatedMeasures (VAR15:VAR25 # VAR415:VAR425)
HotellingTSquare2VARIndep.EqualVariancewithRelatedMeasures (VAR26:VAR36 # VAR426:VAR436)
HotellingTSquare2VARIndep.EqualVariancewithRelatedMeasures (VAR37:VAR47 # VAR437:VAR447)
HotellingTSquare2VARIndep.EqualVariancewithRelatedMeasures (VAR115:VAR125 # VAR415:VAR425)
HotellingTSquare2VARIndep.EqualVariancewithRelatedMeasures (VAR126:VAR136 # VAR426:VAR436)
HotellingTSquare2VARIndep.EqualVariancewithRelatedMeasures (VAR137:VAR147 # VAR437:VAR447)

I. MULTIVARIATE BONFERRONI TEST WITH REPETITION

Next, simultaneous Bonferroni tests are run to test independent differences and grouped p-value and confidence interval. The Hotelling test looks at the data as a group as a whole and is coarser than Bonferroni. The Bonferroni test looks at the grouped data as individual variables tested simultaneously such that the p-value is appropriately adjusted.

The null hypothesis tested is that there is no difference, collectively, among all variables simultaneously between the two groups. The Bonferroni test makes an adjustment to the computed p-values when multiple dependent or independent statistical T-tests are being performed simultaneously on a single dataset. Simultaneous confidence intervals are computed and compared against multiple individual tests. This two-variable with repetition corrections test is applied on two groups of multiple variables each. The null hypothesis tested is that the individual expected differences are all equal to zero.

Group A1 vs. Group B1 VAR1:VAR14 against VAR101:VAR114
Group A2 vs. Group B2 VAR15:VAR25 against VAR115:VAR125
Group A3 vs. Group B3 VAR26:VAR36 against VAR126:VAR136
Group A4 vs. Group B4 VAR37:VAR47 against VAR137:VAR147
Group A5 vs. Group B5 VAR48:VAR51 against VAR148:VAR151
Group A6 vs. Group B6 VAR52:VAR54 against VAR152:VAR154
Group A2 vs. Group C3a VAR15:VAR25 against VAR415:VAR425
Group A3 vs. Group C4a VAR26:VAR36 against VAR426:VAR436
Group A4 vs. Group C5a VAR37:VAR47 against VAR437:VAR447
Group B2 vs. Group C3a VAR115:VAR125 against VAR415:VAR425
Group B3 vs. Group C4a VAR126:VAR136 against VAR426:VAR436
Group B4 vs. Group C5a VAR137:VAR147 against VAR437:VAR447

The algorithm applied in BizStats is shown below:

BonferroniTestTwoVariableswithRepetition (VAR1:VAR14 # VAR101:VAR114)
BonferroniTestTwoVariableswithRepetition (VAR15:VAR25 # VAR115:VAR125)
BonferroniTestTwoVariableswithRepetition (VAR26:VAR36 # VAR126:VAR136)
BonferroniTestTwoVariableswithRepetition (VAR37:VAR47 # VAR137:VAR147)
BonferroniTestTwoVariableswithRepetition (VAR48:VAR51 # VAR148:VAR151)
BonferroniTestTwoVariableswithRepetition (VAR52:VAR54 # VAR52:VAR54)
BonferroniTestTwoVariableswithRepetition (VAR15:VAR25 # VAR415:VAR425)
BonferroniTestTwoVariableswithRepetition (VAR26:VAR36 # VAR426:VAR436)
BonferroniTestTwoVariableswithRepetition (VAR37:VAR47 # VAR437:VAR447)
BonferroniTestTwoVariableswithRepetition (VAR115:VAR125 # VAR415:VAR425)
BonferroniTestTwoVariableswithRepetition (VAR126:VAR136 # VAR426:VAR436)
BonferroniTestTwoVariableswithRepetition (VAR137:VAR147 # VAR437:VAR447)

J. ANOVA SINGLE FACTOR MULTIPLE TREATMENTS

This method tests if there is a significant difference among the three LOA systems due to systems presentation (treatment). The analysis of variance (ANOVA) is an extension of the two-variable T-test that tests multiple variables. Since ANOVA is a parametric test, the distribution is assumed to be close to normal. The randomized ANOVA with multiple treatments tests a hypothesis as follows:

H_0: $\mu_1 = \mu_2 = \ldots = \mu_t$ for treatments 1 to t (there is no effect in the treatments).

H_a: Population means are not equal (there is effect in at least one of the treatments).

The following tests the individual questions among the three systems within the same system presentation. For example, in the ops information group, this test determines if any of the three LOA systems have similarities or differences. The test is repeated for all

three system presentations (vendor information group A, HAL information group B, and ops information group C). Note that risk is not tested since it is only captured once per group.

A2(i) vs. A3(i) vs. A4(i) for i =1 to 11	VAR15; VAR26; VAR37 (11)
B2(i) vs. B3(i) vs. B4(i) for i =1 to 11	VAR115; VAR126; VAR137 (11)
C3(i) vs. C4(i) vs. C5(i) for i =1 to 11	VAR229; VAR240; VAR251 (11)
C7(i) vs. C8(i) vs. C9(i) for i =1 to 10	VAR266; VAR276; VAR286 (10)

The following tests the individual question among the three LOA systems, and between the three system presentations (i.e., for each of the survey questions, if each of the three systems has similarities or differences among the vendor information group, HAL information group, and ops information group).

A2(i) vs. B2(i) vs. C3a(i) for i =1 to 11	VAR15; VAR115; VAR415 (11)
A3(i) vs. B3(i) vs. C4a(i) for i =1 to 11	VAR26; VAR126; VAR426 (11)
A4(i) vs. B4(i) vs. C5a(i) for i =1 to 11	VAR37; VAR137; VAR437 (11)

The algorithm applied in BizStats is shown below:

ANOVASingleFactorMultipleTreatments (VAR15; VAR26; VAR37)
ANOVASingleFactorMultipleTreatments (VAR16; VAR27; VAR38)
ANOVASingleFactorMultipleTreatments (VAR17; VAR28; VAR39)
ANOVASingleFactorMultipleTreatments (VAR18; VAR29; VAR40)
ANOVASingleFactorMultipleTreatments (VAR19; VAR30; VAR41)
ANOVASingleFactorMultipleTreatments (VAR20; VAR31; VAR42)
ANOVASingleFactorMultipleTreatments (VAR21; VAR32; VAR43)
ANOVASingleFactorMultipleTreatments (VAR22; VAR33; VAR44)
ANOVASingleFactorMultipleTreatments (VAR23; VAR34; VAR45)
ANOVASingleFactorMultipleTreatments (VAR24; VAR35; VAR46)
ANOVASingleFactorMultipleTreatments (VAR25; VAR36; VAR47)

ANOVASingleFactorMultipleTreatments (VAR115; VAR126; VAR137)
ANOVASingleFactorMultipleTreatments (VAR116; VAR127; VAR138)
ANOVASingleFactorMultipleTreatments (VAR117; VAR128; VAR139)
ANOVASingleFactorMultipleTreatments (VAR118; VAR129; VAR140)
ANOVASingleFactorMultipleTreatments (VAR119; VAR130; VAR141)
ANOVASingleFactorMultipleTreatments (VAR120; VAR131; VAR142)
ANOVASingleFactorMultipleTreatments (VAR121; VAR132; VAR143)
ANOVASingleFactorMultipleTreatments (VAR122; VAR133; VAR144)
ANOVASingleFactorMultipleTreatments (VAR123; VAR134; VAR145)
ANOVASingleFactorMultipleTreatments (VAR124; VAR135; VAR146)
ANOVASingleFactorMultipleTreatments (VAR125; VAR136; VAR147)

ANOVASingleFactorMultipleTreatments (VAR229; VAR240; VAR251)
ANOVASingleFactorMultipleTreatments (VAR230; VAR241; VAR252)
ANOVASingleFactorMultipleTreatments (VAR231; VAR242; VAR253)

ANOVASingleFactorMultipleTreatments (VAR232; VAR243; VAR254)
ANOVASingleFactorMultipleTreatments (VAR233; VAR244; VAR255)
ANOVASingleFactorMultipleTreatments (VAR234; VAR245; VAR256)
ANOVASingleFactorMultipleTreatments (VAR235; VAR246; VAR257)
ANOVASingleFactorMultipleTreatments (VAR236; VAR247; VAR258)
ANOVASingleFactorMultipleTreatments (VAR237; VAR248; VAR259)
ANOVASingleFactorMultipleTreatments (VAR238; VAR249; VAR260)
ANOVASingleFactorMultipleTreatments (VAR239; VAR250; VAR261)

ANOVASingleFactorMultipleTreatments (VAR266; VAR276; VAR286)
ANOVASingleFactorMultipleTreatments (VAR267; VAR277; VAR287)
ANOVASingleFactorMultipleTreatments (VAR268; VAR278; VAR288)
ANOVASingleFactorMultipleTreatments (VAR269; VAR279; VAR289)
ANOVASingleFactorMultipleTreatments (VAR270; VAR280; VAR290)
ANOVASingleFactorMultipleTreatments (VAR271; VAR281; VAR291)
ANOVASingleFactorMultipleTreatments (VAR272; VAR282; VAR292)
ANOVASingleFactorMultipleTreatments (VAR273; VAR283; VAR293)
ANOVASingleFactorMultipleTreatments (VAR274; VAR284; VAR294)
ANOVASingleFactorMultipleTreatments (VAR275; VAR285; VAR295)

ANOVASingleFactorMultipleTreatments (VAR15; VAR115; VAR415)
ANOVASingleFactorMultipleTreatments (VAR16; VAR116; VAR416)
ANOVASingleFactorMultipleTreatments (VAR17; VAR117; VAR417)
ANOVASingleFactorMultipleTreatments (VAR18; VAR118; VAR418)
ANOVASingleFactorMultipleTreatments (VAR19; VAR119; VAR419)
ANOVASingleFactorMultipleTreatments (VAR20; VAR120; VAR420)
ANOVASingleFactorMultipleTreatments (VAR21; VAR121; VAR421)
ANOVASingleFactorMultipleTreatments (VAR22; VAR122; VAR422)
ANOVASingleFactorMultipleTreatments (VAR23; VAR123; VAR423)
ANOVASingleFactorMultipleTreatments (VAR24; VAR124; VAR424)
ANOVASingleFactorMultipleTreatments (VAR25; VAR125; VAR425)
ANOVASingleFactorMultipleTreatments (VAR26; VAR126; VAR426)
ANOVASingleFactorMultipleTreatments (VAR27; VAR127; VAR427)
ANOVASingleFactorMultipleTreatments (VAR28; VAR128; VAR428)
ANOVASingleFactorMultipleTreatments (VAR29; VAR129; VAR429)
ANOVASingleFactorMultipleTreatments (VAR30; VAR130; VAR430)
ANOVASingleFactorMultipleTreatments (VAR31; VAR131; VAR431)
ANOVASingleFactorMultipleTreatments (VAR32; VAR132; VAR432)
ANOVASingleFactorMultipleTreatments (VAR33; VAR133; VAR433)
ANOVASingleFactorMultipleTreatments (VAR34; VAR134; VAR434)
ANOVASingleFactorMultipleTreatments (VAR35; VAR135; VAR435)
ANOVASingleFactorMultipleTreatments (VAR36; VAR136; VAR436)
ANOVASingleFactorMultipleTreatments (VAR37; VAR137; VAR437)
ANOVASingleFactorMultipleTreatments (VAR38; VAR138; VAR438)
ANOVASingleFactorMultipleTreatments (VAR39; VAR139; VAR439)
ANOVASingleFactorMultipleTreatments (VAR40; VAR140; VAR440)
ANOVASingleFactorMultipleTreatments (VAR41; VAR141; VAR441)
ANOVASingleFactorMultipleTreatments (VAR42; VAR142; VAR442)
ANOVASingleFactorMultipleTreatments (VAR43; VAR143; VAR443)
ANOVASingleFactorMultipleTreatments (VAR44; VAR144; VAR444)
ANOVASingleFactorMultipleTreatments (VAR45; VAR145; VAR445)
ANOVASingleFactorMultipleTreatments (VAR46; VAR146; VAR446)
ANOVASingleFactorMultipleTreatments (VAR47; VAR147; VAR447)

K. ANOVA WITH BLOCKING VARIABLES

Using the maximum information survey results, users are blocked by groups to determine if there are differences among the responses as well as between blocking groups (vendor info, HAL info, ops info). This test controls if the composite scores of the three LOA systems differ with varying control of the three groups (e.g., different days, different weather conditions, and potentially slightly different system configurations). It assumes the data are randomly sampled and normally distributed, and that there is a blocking variable in the experience that is identified and that can be controlled by the ANOVA. This analysis is essentially a one-way ANOVA that accounts for the treatment or effectiveness of the blocking variable. According to Mun (2018), "if the calculated p-value for the treatment or block is less than or equal to the significance level used in the test, then reject the null hypothesis and conclude that there is a significant difference among the different treatments or blocks."

The specification tested in this ANOVA is $x_{i,j} = \mu + \tau_j + \beta_i + \varepsilon_{ij}$, which tests the following hypotheses:

H_0: $\tau_j = 0$ for treatments $j = 1$ to t (there is no effect in the treatments).

H_a: $\tau_j \neq 0$ for at least one treatment $j = 1$ to t (one or more treatments has an effect).

The test defines τ as the treatments and β as the blocking variable.

The algorithm applied in BizStats is shown below:

ANOVARandomizedBlocksMultipleTreatments (VAR296; VAR297; VAR298)

L. NONPARAMETRIC KRUSKAL–WALLIS TEST

This test applies the nonparametric equivalence of ANOVA Single Factor Multiple Treatments. It extends the Wilcoxon Signed-Rank test to allow comparison of two or more independent samples. The One-Way ANOVA is the parametric equivalence of this test. The difference between One-Way ANOVA and Kruskal–Wallis is that as a nonparametric test it does not assume that the data are normally distributed, randomly sampled, or have equal variances. The test is two-tailed, and the null hypothesis assumes that there is no

difference among the different groups. It is a more appropriate test since the data are categorical in nature and limited in range from 1–5 or 1–100.

Similar to the ANOVA test, the Kruskal–Wallis tests the following hypotheses:

H_0: $m_1 = m_2 = \ldots = m_K$ for $i = 1$ to k (population medians are identical).

H_a: At least one of the medians, m, differs from the others.

The method starts off with k variables to be tested. For each variable, the data are ranked from smallest to largest, with the smallest value receiving the rank of 1, and all tied ranks are assigned their average values. Then, sum all the ranks for each variable, yielding a list of summed ranks $\Sigma(R_1), \Sigma(R_2), \ldots, \Sigma(RK)$. Then, the H statistic is computed using:

$$H = \frac{12}{N(N+1)}\left[\frac{(\Sigma R_1)^2}{n_1} + \frac{(\Sigma R_2)^2}{n_2} + \ldots + \frac{(\Sigma R_K)^2}{n_K}\right] - 3(N+1)$$

The calculated H is compared to critical H values computed using a chi-square distribution with degrees of freedom $df = k - 1$.

The algorithm applied in BizStats is shown below:

NonparametricKruskalWallisTest (VAR15; VAR26; VAR37)
NonparametricKruskalWallisTest (VAR16; VAR27; VAR38)
NonparametricKruskalWallisTest (VAR17; VAR28; VAR39)
NonparametricKruskalWallisTest (VAR18; VAR29; VAR40)
NonparametricKruskalWallisTest (VAR19; VAR30; VAR41)
NonparametricKruskalWallisTest (VAR20; VAR31; VAR42)
NonparametricKruskalWallisTest (VAR21; VAR32; VAR43)
NonparametricKruskalWallisTest (VAR22; VAR33; VAR44)
NonparametricKruskalWallisTest (VAR23; VAR34; VAR45)
NonparametricKruskalWallisTest (VAR24; VAR35; VAR46)
NonparametricKruskalWallisTest (VAR25; VAR36; VAR47)
NonparametricKruskalWallisTest (VAR115; VAR126; VAR137)
NonparametricKruskalWallisTest (VAR116; VAR127; VAR138)
NonparametricKruskalWallisTest (VAR117; VAR128; VAR139)
NonparametricKruskalWallisTest (VAR118; VAR129; VAR140)
NonparametricKruskalWallisTest (VAR119; VAR130; VAR141)
NonparametricKruskalWallisTest (VAR120; VAR131; VAR142)
NonparametricKruskalWallisTest (VAR121; VAR132; VAR143)
NonparametricKruskalWallisTest (VAR122; VAR133; VAR144)
NonparametricKruskalWallisTest (VAR123; VAR134; VAR145)
NonparametricKruskalWallisTest (VAR124; VAR135; VAR146)
NonparametricKruskalWallisTest (VAR125; VAR136; VAR147)
NonparametricKruskalWallisTest (VAR229; VAR240; VAR251)
NonparametricKruskalWallisTest (VAR230; VAR241; VAR252)
NonparametricKruskalWallisTest (VAR231; VAR242; VAR253)

NonparametricKruskalWallisTest (VAR232; VAR243; VAR254)
NonparametricKruskalWallisTest (VAR233; VAR244; VAR255)
NonparametricKruskalWallisTest (VAR234; VAR245; VAR256)
NonparametricKruskalWallisTest (VAR235; VAR246; VAR257)
NonparametricKruskalWallisTest (VAR236; VAR247; VAR258)
NonparametricKruskalWallisTest (VAR237; VAR248; VAR259)
NonparametricKruskalWallisTest (VAR238; VAR249; VAR260)
NonparametricKruskalWallisTest (VAR239; VAR250; VAR261)
NonparametricKruskalWallisTest (VAR266; VAR276; VAR286)
NonparametricKruskalWallisTest (VAR267; VAR277; VAR287)
NonparametricKruskalWallisTest (VAR268; VAR278; VAR288)
NonparametricKruskalWallisTest (VAR269; VAR279; VAR289)
NonparametricKruskalWallisTest (VAR270; VAR280; VAR290)
NonparametricKruskalWallisTest (VAR271; VAR281; VAR291)
NonparametricKruskalWallisTest (VAR272; VAR282; VAR292)
NonparametricKruskalWallisTest (VAR273; VAR283; VAR293)
NonparametricKruskalWallisTest (VAR274; VAR284; VAR294)
NonparametricKruskalWallisTest (VAR275; VAR285; VAR295)

M. NONPARAMETRIC MANN–WHITNEY TEST

The nonparametric MW test for two independent samples is related to the Wilcoxon Signed-Rank test. It is the nonparametric equivalent of the Two Sample T-Test for Independent Variables. The null hypothesis tested is that there is zero difference between the two variables' medians. A nonparametric test is more appropriate in our current context since data is categorical and truncated to be between integers of 1 and 5, and size is limited to between 19 and 23 data points for each variable.

The algorithm applied in BizStats is shown below:

NonparametricMannWhitneyTestTwoVar (VARx # VARx)

N. NONPARAMETRIC WILCOXON SIGNED RANK TEST

This nonparametric Wilcoxon Signed Rank test is for paired variables. It looks at two variables and determines if the median of the differences is equal. The Wilcoxon test is developed for pre-treatment and post-treatment testing; that is, it is used to see if there is any difference in a variable before a treatment is applied and after a treatment is applied. The parametric counterpart to Wilcoxon is the two sample T-test. The T-test is more powerful but can only be applied when the data are assumed to be normal.

The algorithm applied in BizStats is shown below:

NonparametricWilcoxonSignedRankTestTwoVar (VARx; VARx # 0.000000)

O. MULTIVARIATE NONLINEAR REGRESSION

This method tests independent and dependent variables to determine whether reason-based information (vendor info and HAL info) can be used to explain post-experience (ops info) results. If it is assumed that the ops information (post-experience) results are the actual results, the issue is whether using a quick pre-experience survey sufficiently explains the final actual results, without the need to run detailed field testing. In other words, can trust be determined using perceived values and assumptions by the expert user?

As a side note, the survey uses a 0–100 scale in the final experiment on some of the questions because it can easily revert back to a 1–5 scale. However, the opposite is not true. For instance, if the experiments maintained a 1–5 scale, it would be impossible to granularize the data into a 1–100 scale. By allowing more granularity, it is possible to run multivariate regressions and other econometric models to determine the predictability of some regressors such as those obtained in the less-information and high-information environments. If the variables are kept as integers between 1 and 5, the ability to run some of these models would be limited and testing would be restricted to using logistic regression methods and maximizing likelihood functions. By recoding the survey post-experience to between 1 and 100, the testing gains the flexibility to maneuver between this more granular scale and the 1–5 scale (i.e., 1–20 would be coded as 1, 21–40 would be coded as 2, and so forth).

Finally, the *dependent variable* used in regression is the System Usability Score (VAR296–VAR298). This score is an accumulation of the *independent variable* questions of each of the three LOA systems as follows: (VAR266–VAR275) for the low LOA system, (VAR276–VAR285) for the medium LOA system, and (VAR286–VAR295) for the high LOA system. The SUS questions are *inverted* to test the reliability of the user's inputs. In other words, a 1 stands for strongly disagree and 5 stands for strongly agree, but the questions alternate in terms of directionality. Question 1 asks if the system would be used frequently, where a score of 5 is considered optimal, whereas question 2 asks if the system is unnecessarily complex and, in this case, a score of 1 is optimal. For example, if a user responds: 5, 1, 5, 1, 5, 1, 5, 1, 5, 1 a score of 100 is obtained. The inverse is true,

where the following sequence: 1, 5, 1, 5, 1, 5, 1, 5, 1, 5 would yield a score of 0. The following tests are run:

a. Low LOA System (Vendor info). VAR296 vs. VAR15:VAR25
b. Low LOA System (HAL info). VAR296 vs. VAR115:VAR125
c. Med LOA System (Vendor info). VAR297 vs. VAR26:VAR36
d. Med LOA System (Ops info). VAR297 vs. VAR126:VAR136
e. High LOA System (Vendor info). VAR298 vs. VAR37:VAR47
f. High LOA System (Ops info). VAR298 vs. VAR137:VAR147
g. Risk Scores (C2 from A1 and B1): VAR 215 vs. VAR1; VAR10 ‡ 14
h. Optional analyses:
    i. Individual Low LOA Issues (Vendor info). VAR229 vs. VAR15; VAR115 ‡ for all 11 iterations
    ii. Individual Med LOA Issues (Vendor info). VAR240 vs. VAR26; VAR126 ‡ for all 11 iterations
    iii. Individual HighLOA Issues (Vendor info). VAR251 vs. VAR37; VAR137 ‡ for all 11 iterations

The algorithm applied in BizStats is shown below:

CustomEconometricModel (VAR296 # VAR15:VAR25)
CustomEconometricModel (VAR296 # VAR115:VAR125)
CustomEconometricModel (VAR297 # VAR26:VAR36)
CustomEconometricModel (VAR297 # VAR126:VAR136)
CustomEconometricModel (VAR298 # VAR37:VAR47)
CustomEconometricModel (VAR298 # VAR137:VAR147)
CustomEconometricModel (VAR215 # VAR1;VAR101)
CustomEconometricModel (VAR216 # VAR2;VAR102)
CustomEconometricModel (VAR217 # VAR3;VAR103)
CustomEconometricModel (VAR218 # VAR4;VAR104)
CustomEconometricModel (VAR219 # VAR5;VAR105)
CustomEconometricModel (VAR220 # VAR6;VAR106)
CustomEconometricModel (VAR221 # VAR7;VAR107)
CustomEconometricModel (VAR222 # VAR8;VAR108)
CustomEconometricModel (VAR223 # VAR9;VAR109)
CustomEconometricModel (VAR224 # VAR10;VAR110)
CustomEconometricModel (VAR225 # VAR11;VAR111)
CustomEconometricModel (VAR226 # VAR12;VAR112)
CustomEconometricModel (VAR227 # VAR13;VAR113)
CustomEconometricModel (VAR228 # VAR14;VAR114)

CustomEconometricModel (VAR229 # VAR15;VAR115)
CustomEconometricModel (VAR230 # VAR16;VAR116)

CustomEconometricModel (VAR231 # VAR17;VAR117)
CustomEconometricModel (VAR232 # VAR18;VAR118)
CustomEconometricModel (VAR233 # VAR19;VAR119)
CustomEconometricModel (VAR234 # VAR20;VAR120)
CustomEconometricModel (VAR235 # VAR21;VAR121)
CustomEconometricModel (VAR236 # VAR22;VAR122)
CustomEconometricModel (VAR237 # VAR23;VAR123)
CustomEconometricModel (VAR238 # VAR24;VAR124)
CustomEconometricModel (VAR239 # VAR25;VAR125)

CustomEconometricModel (VAR240 # VAR26;VAR126)
CustomEconometricModel (VAR241 # VAR27;VAR127)
CustomEconometricModel (VAR242 # VAR28;VAR128)
CustomEconometricModel (VAR243 # VAR29;VAR129)
CustomEconometricModel (VAR244 # VAR30;VAR130)
CustomEconometricModel (VAR245 # VAR31;VAR131)
CustomEconometricModel (VAR246 # VAR32;VAR132)
CustomEconometricModel (VAR247 # VAR33;VAR133)
CustomEconometricModel (VAR248 # VAR34;VAR134)
CustomEconometricModel (VAR249 # VAR35;VAR135)
CustomEconometricModel (VAR250 # VAR36;VAR136)

CustomEconometricModel (VAR251 # VAR37;VAR137)
CustomEconometricModel (VAR252 # VAR38;VAR138)
CustomEconometricModel (VAR253 # VAR39;VAR139)
CustomEconometricModel (VAR254 # VAR40;VAR140)
CustomEconometricModel (VAR255 # VAR41;VAR141)
CustomEconometricModel (VAR256 # VAR42;VAR142)
CustomEconometricModel (VAR257 # VAR43;VAR143)
CustomEconometricModel (VAR258 # VAR44;VAR144)
CustomEconometricModel (VAR259 # VAR45;VAR145)
CustomEconometricModel (VAR260 # VAR46;VAR146)
CustomEconometricModel (VAR261 # VAR47;VAR147)

P. COMPLEX ECONOMETRIC MODEL

Complex econometric models are used to determine if some of the final results can be forecasted or predetermined using either the vendor information or HAL information settings, without the need for costly field testing (ops information). These tests might yield valuable insights to identify the key determining factors where decision makers can collect information from a preliminary analysis and have a high confidence that field testing will go in the direction anticipated.

The issue with using standard econometric methods, such as linear and nonlinear multivariate regression (some sample models have been run and are reported in Appendix D), is that the data from the three system presentation treatments (A,B,C) are based on

different active-duty military but from the same unit. This means that row 1 of the data in segment A is from a soldier that is not the same person as in the first row of segment B or segment C. Therefore, without this direct data correspondence, a standard regression will be insufficient and inaccurate at best.

The general linear multivariate regression equation used is the standard form where $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \ldots + \beta_k X_k + \varepsilon$. In this example, the line is within a $k + 1$ dimensional plane. Regression analysis then identifies the single best-fit line by reducing total errors (Mun, 2015), or by using the following equation:

$$Min \sum_{i=1}^{n} (Y_i - \hat{Y}_i)^2$$

where a single line minimizes the sum of the squared errors. To solve this problem with regards to the slope and intercept requires calculating the first derivatives and setting them to zero (Mun, 2016):

$$\frac{d}{d\beta_0} \sum_{i=1}^{n} (Y_i - \hat{Y}_i)^2 = 0 \text{ and } \frac{d}{d\beta_1} \sum_{i=1}^{n} (Y_i - \hat{Y}_i)^2 = 0$$

The general format is that the coefficients can be determined using the following matrix computation: $\mathrm{B} = \left(\mathrm{X}'\mathrm{X}\right)^{-1}\mathrm{X}'\mathrm{Y}$. This, of course, makes multiple assumptions of the data such as normality, homoskedasticity, time-series, and other technical requirements such that the equation is the best linear unbiased estimator (BLUE). This same method is used in this research where the functional form is simplified using natural logarithms to estimate the equation as (Mun, 2016):

$$Y = \hat{\beta}_0 + \hat{\beta}_1 \ln(X_1) + \hat{\beta}_2 \ln(X_2) + \hat{\beta}_3 \ln(X_3) \ldots + \hat{\beta}_k \ln(X_k) + \varepsilon.$$

Finally, because of the noncorrespondence of the data, a second methodology is needed in the form of a bootstrap multivariate regression. Using this methodology with original data $(X_1, Y_1), \ldots, (X_n, Y_n)$, a new dataset is generated that consists of independently and identically distributed (IID) observations of $(X_1^*, Y_1^*), \ldots, (X_n^*, Y_n^*)$. The single (X_i^*, Y_i^*) is considered one iteration that is replicated m times. In other words, the test will generate a

new set of data with n datapoints and bootstrap m times. The estimated coefficients, $\hat{\beta}$, are tabulated, as well as their respective significance p-values. After running a bootstrap simulation thousands of times, the respective distributions of the p-values are tabulated, and their confidence intervals determined. This allows the use of noncorresponding datasets while assuming a sufficiently large simulation IID sampling such that the BLUE condition still holds, and the results are valid (Mun, 2016).

APPENDIX C. DATA ANALYTICS DETAILED RESULTS

This appendix provides detailed results of the statistical analysis performed on the experimental design survey data. The information is provided for the sake of completeness as well as to provide future researchers the opportunities to continue the work while being able to examine the results in more detail.

A. INTER RATER RELIABILITY (ICC): VENDOR INFO GROUP

Model Inputs:
VAR2; VAR3; VAR4; VAR5; VAR6; VAR7; VAR8; VAR9; VAR10; VAR11; VAR12; VAR13; VAR14; VAR15; VAR16; VAR17; VAR18; VAR19; VAR20; VAR21; VAR22; VAR23; VAR24
User 1, User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10, User 11, User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19, User 20, User 21, User 22, User 23

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	13	145.25	11.17	15.69530	0.00000
Columns	22	51.61	2.35	3.29561	0.00000
Error	286	203.60	0.71		
Total	321	400.47			

Interclass Correlation 0.35439

A high ICC indicates a high level of reliability vs. low correlations
mean low reliability and low consistency

Model Inputs:
VAR27; VAR28; VAR29; VAR30; VAR31; VAR32; VAR33; VAR34; VAR35; VAR36; VAR37; VAR38; VAR39; VAR40; VAR41; VAR42; VAR43; VAR44; VAR45; VAR46; VAR47; VAR48; VAR49
User 1, User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10, User 11, User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19, User 20, User 21, User 22, User 23

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	10	79.94	7.99	16.66936	0.00000
Columns	22	89.36	4.06	8.46932	0.00000
Error	220	105.51	0.48		
Total	252	274.81			

Interclass Correlation 0.28864

A high ICC indicates a high level of reliability vs. low correlations
mean low reliability and low consistency

Model Inputs:
VAR52; VAR53; VAR54; VAR55; VAR56; VAR57; VAR58; VAR59; VAR60; VAR61; VAR62; VAR63; VAR64; VAR65; VAR66; VAR67; VAR68; VAR69; VAR70; VAR71; VAR72; VAR73; VAR74
User 1, User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10, User 11, User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19, User 20, User 21, User 22, User 23

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	10	60.91	6.09	10.69666	0.00000
Columns	22	68.99	3.14	5.50704	0.00000
Error	220	125.27	0.57		
Total	252	255.17			

Interclass Correlation 0.23021

A high ICC indicates a high level of reliability vs. low correlations
mean low reliability and low consistency

Model Inputs:
VAR77; VAR78; VAR79; VAR80; VAR81; VAR82; VAR83; VAR84; VAR85; VAR86; VAR87; VAR88; VAR89; VAR90; VAR91; VAR92; VAR93; VAR94; VAR95; VAR96; VAR97; VAR98; VAR99
User 1, User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10, User 11, User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19, User 20, User 21, User 22, User 23

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	10	84.99	8.50	11.86704	0.00000
Columns	22	64.70	2.94	4.10667	0.00000
Error	220	157.56	0.72		
Total	252	307.25			

Interclass Correlation 0.26923

A high ICC indicates a high level of reliability vs. low correlations
mean low reliability and low consistency

Model Inputs:
VAR102; VAR103; VAR104; VAR105; VAR106; VAR107; VAR108; VAR109; VAR110; VAR111; VAR112; VAR113; VAR114; VAR115; VAR116; VAR117; VAR118; VAR119; VAR120; VAR121; VAR122; VAR123; VAR124
User 1, User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10, User 11, User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19, User 20, User 21, User 22, User 23

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	3	14.48	4.83	10.97528	0.00001
Columns	22	72.46	3.29	7.48989	0.00000
Error	66	29.02	0.44		
Total	91	115.96			

Interclass Correlation 0.14191

A high ICC indicates a high level of reliability vs. low correlations
mean low reliability and low consistency

B. INTER RATER RELIABILITY (ICC): HAL INFO GROUP

Model Inputs:
VAR127; VAR128; VAR129; VAR130; VAR131; VAR132; VAR133; VAR134; VAR135; VAR136; VAR137; VAR138; VAR139; VAR140; VAR141; VAR142; VAR143; VAR144; VAR145; VAR146
User 1, User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10, User 11, User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19, User 20

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	13	118.87	9.14	11.34221	0.00000
Columns	19	35.77	1.88	2.33532	0.00167
Error	247	199.13	0.81		
Total	279	353.77			

Interclass Correlation 0.32069

A high ICC indicates a high level of reliability vs. low correlations
mean low reliability and low consistency

Model Inputs:
VAR149; VAR150; VAR151; VAR152; VAR153; VAR154; VAR155; VAR156; VAR157; VAR158; VAR159; VAR160; VAR161; VAR162; VAR163; VAR164; VAR165; VAR166; VAR167; VAR168
User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10, User 11, User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19, User 20, User 21

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	10	67.90	6.79	10.75817	0.00000
Columns	19	66.38	3.49	5.53559	0.00000
Error	190	119.92	0.63		
Total	219	254.20			

Interclass Correlation 0.25676

A high ICC indicates a high level of reliability vs. low correlations
mean low reliability and low consistency

Model Inputs:
VAR171; VAR172; VAR173; VAR174; VAR175; VAR176; VAR177; VAR178; VAR179; VAR180;
VAR181; VAR182; VAR183; VAR184; VAR185; VAR186; VAR187; VAR188; VAR189; VAR190
User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10, User 11,
User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19, User 20,
User 21

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	10	52.20	5.22	9.50497	0.00000
Columns	19	39.90	2.10	3.82427	0.00000
Error	190	104.35	0.55		
Total	219	196.45			

Interclass Correlation 0.25282

A high ICC indicates a high level of reliability vs. low correlations
mean low reliability and low consistency

Model Inputs:
VAR193; VAR194; VAR195; VAR196; VAR197; VAR198; VAR199; VAR200; VAR201; VAR202;
VAR203; VAR204; VAR205; VAR206; VAR207; VAR208; VAR209; VAR210; VAR211; VAR212
User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10, User 11,
User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19, User 20,
User 21

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	10	62.98	6.30	11.55478	0.00000
Columns	19	38.44	2.02	3.71138	0.00000
Error	190	103.56	0.55		
Total	219	204.98			

Interclass Correlation 0.29745

A high ICC indicates a high level of reliability vs. low correlations
mean low reliability and low consistency

Model Inputs:
VAR215; VAR216; VAR217; VAR218; VAR219; VAR220; VAR221; VAR222; VAR223; VAR224; VAR225; VAR226; VAR227; VAR228; VAR229; VAR230; VAR231; VAR232; VAR233; VAR234
User 1, User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10, User 11, User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19, User 20

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	3	9.84	3.28	5.76668	0.00162
Columns	19	22.44	1.18	2.07675	0.01768
Error	57	32.41	0.57		
Total	79	64.69			

Interclass Correlation 0.15810

A high ICC indicates a high level of reliability vs. low correlations mean low reliability and low consistency

C. INTER RATER RELIABILITY (ICC): OPS INFO GROUP

Model Inputs:
VAR237; VAR238; VAR239; VAR240; VAR241; VAR242; VAR243; VAR244; VAR245; VAR246; VAR247; VAR248; VAR249; VAR250; VAR251; VAR252; VAR253; VAR254; VAR255
User 1, User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10, User 11, User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	13	2506.29	192.79	19.83188	0.00000
Columns	18	88.69	4.93	0.50686	0.95359
Error	234	2274.78	9.72		
Total	265	4869.76			

Interclass Correlation 0.50674

A high ICC indicates a high level of reliability vs. low correlations
mean low reliability and low consistency

Model Inputs:
VAR258; VAR259; VAR260; VAR261; VAR262; VAR263; VAR264; VAR265; VAR266; VAR267; VAR268; VAR269; VAR270; VAR271; VAR272; VAR273; VAR274; VAR275; VAR276
User 1, User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10, User 11, User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	13	89070.80	6851.60	19.18701	0.00000
Columns	18	18202.74	1011.26	2.83191	0.00017
Error	234	83560.41	357.10		
Total	265	190833.96			

Interclass Correlation 0.45842

A high ICC indicates a high level of reliability vs. low correlations
mean low reliability and low consistency

Model Inputs:
VAR279; VAR280; VAR281; VAR282; VAR283; VAR284; VAR285; VAR286; VAR287; VAR288;
VAR289; VAR290; VAR291; VAR292; VAR293; VAR294; VAR295; VAR296; VAR297
User 1, User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10,
User 11, User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	10	100378.13	10037.81	46.37263	0.00000
Columns	18	11234.70	624.15	2.88344	0.00017
Error	180	38962.78	216.46		
Total	208	150575.61			

Interclass Correlation 0.67094

A high ICC indicates a high level of reliability vs. low correlations
mean low reliability and low consistency

Model Inputs:
VAR300; VAR301; VAR302; VAR303; VAR304; VAR305; VAR306; VAR307; VAR308; VAR309;
VAR310; VAR311; VAR312; VAR313; VAR314; VAR315; VAR316; VAR317; VAR318
User 1, User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10,
User 11, User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	10	47465.79	4746.58	15.04857	0.00000
Columns	18	75153.83	4175.21	13.23711	0.00000
Error	180	56775.12	315.42		
Total	208	179394.74			

Interclass Correlation 0.25927

A high ICC indicates a high level of reliability vs. low correlations
mean low reliability and low consistency

Model Inputs:
VAR321; VAR322; VAR323; VAR324; VAR325; VAR326; VAR327; VAR328; VAR329; VAR330; VAR331; VAR332; VAR333; VAR334; VAR335; VAR336; VAR337; VAR338; VAR339
User 1, User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10, User 11, User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	10	43467.61	4346.76	11.08887	0.00000
Columns	18	75539.24	4196.62	10.70586	0.00000
Error	180	70558.76	391.99		
Total	208	189565.61			

Interclass Correlation 0.22002

A high ICC indicates a high level of reliability vs. low correlations mean low reliability and low consistency

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Model Inputs:
VAR342; VAR343; VAR344; VAR345; VAR346; VAR347; VAR348; VAR349; VAR350; VAR351; VAR352; VAR353; VAR354; VAR355; VAR356; VAR357; VAR358; VAR359; VAR360
User 1, User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10, User 11, User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	3	13969.41	4656.47	11.86818	0.00000
Columns	18	14010.53	778.36	1.98385	0.02737
Error	54	21186.84	392.35		
Total	75	49166.78			

Interclass Correlation 0.31464

A high ICC indicates a high level of reliability vs. low correlations mean low reliability and low consistency

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Model Inputs:
VAR363; VAR364; VAR365; VAR366; VAR367; VAR368; VAR369; VAR370; VAR371; VAR372; VAR373; VAR374; VAR375; VAR376; VAR377; VAR378; VAR379; VAR380; VAR381
User 1, User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10, User 11, User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	9	233.42	25.94	42.40317	0.00000
Columns	18	7.44	0.41	0.67598	0.83123
Error	162	99.08	0.61		
Total	189	339.94			

Interclass Correlation 0.69251

A high ICC indicates a high level of reliability vs. low correlations mean low reliability and low consistency

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Model Inputs:
VAR384; VAR385; VAR386; VAR387; VAR388; VAR389; VAR390; VAR391; VAR392; VAR393; VAR394; VAR395; VAR396; VAR397; VAR398; VAR399; VAR400; VAR401; VAR402
User 1, User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10, User 11, User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	9	76.86	8.54	6.66005	0.00000
Columns	18	27.21	1.51	1.17887	0.28421
Error	162	207.74	1.28		
Total	189	311.81			

Interclass Correlation 0.22640

A high ICC indicates a high level of reliability vs. low correlations mean low reliability and low consistency

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Model Inputs:
VAR405; VAR406; VAR407; VAR408; VAR409; VAR410; VAR411; VAR412; VAR413; VAR414;
VAR415; VAR416; VAR417; VAR418; VAR419; VAR420; VAR421; VAR422; VAR423
User 1, User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10,
User 11, User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	9	65.79	7.31	7.03169	0.00000
Columns	18	27.38	1.52	1.46315	0.10973
Error	162	168.41	1.04		
Total	189	261.58			

Interclass Correlation 0.23278

A high ICC indicates a high level of reliability vs. low correlations
mean low reliability and low consistency

Model Inputs:
VAR426; VAR427; VAR428; VAR429; VAR430; VAR431; VAR432; VAR433; VAR434; VAR435;
VAR436; VAR437; VAR438; VAR439; VAR440; VAR441; VAR442; VAR443; VAR444
User 1, User 2, User 3, User 4, User 5, User 6, User 7, User 8, User 9, User 10,
User 11, User 12, User 13, User 14, User 15, User 16, User 17, User 18, User 19

ANOVA Randomized Blocks Multiple Treatments

	DF	Sums of Squares	Mean Square	F-Stat	p-Value
Rows	2	11369.96	5684.98	35.66500	0.00000
Columns	18	4384.65	243.59	1.52818	0.13668
Error	36	5738.38	159.40		
Total	56	21492.98			

Interclass Correlation 0.60805

A high ICC indicates a high level of reliability vs. low correlations
mean low reliability and low consistency

D. PRINCIPAL COMPONENT ANALYSIS AND FACTOR ANALYSIS

Model Inputs: VAR1; VAR2; VAR3; VAR4; VAR5; VAR6; VAR7; VAR8; VAR9; VAR10; VAR11
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

* indicates negative values
Standard Deviations:

8.0854	4.9232	4.8809	4.8809	11.7982	17.1356	12.4438	13.5315	16.8051	9.7336	36.8346

Reduced Data Matrix:

0.1045	0.0858	0.0742	0.0742	0.0102	0.0528	0.0679	0.2365	0.0970	0.1017	*0.1180
*0.7467	*0.3801	*0.8658	*0.8658	*0.4759	*0.0810	*0.3008	*0.2722	*0.7221	*0.8411	*0.0557
0.1045	0.0858	0.0742	0.0742	*0.2814	0.0528	0.0679	*0.1026	0.0970	0.1017	*0.1180
0.1045	0.0858	0.0742	0.0742	0.1075	0.1867	*0.1164	0.0669	*0.0395	0.0546	*0.1180
0.1045	0.0858	0.0742	0.0742	*0.2814	0.0528	*0.6695	*0.6112	0.0970	0.1017	*0.1180
0.1045	0.0858	0.0742	0.0742	0.1075	0.0528	0.0679	*0.0178	0.0970	0.1017	*0.1180
0.1045	0.0858	0.0742	0.0742	0.1075	0.3206	0.1601	0.1517	0.0287	*0.0161	*0.1180
0.1045	0.0858	0.0742	0.0742	*0.0870	*0.6166	0.2523	*0.1026	0.0970	*0.1340	*0.1180
0.1045	0.0858	0.0742	0.0742	*0.2814	*0.0810	0.0679	0.2365	0.0970	0.1017	*0.1180
0.1045	0.0858	0.0742	0.0742	0.1075	0.0528	*0.0243	0.0669	0.0970	0.1017	*0.1180
0.1045	0.0858	0.0742	0.0742	0.1075	0.3206	0.2523	0.2365	0.0970	0.1017	0.5048
*0.1792	*0.1472	*0.3958	*0.3958	0.3019	0.1867	*0.0243	*0.0178	0.0970	*0.0161	*0.1180
0.1045	0.0858	0.0742	0.0742	0.3019	*0.0141	*0.2086	*0.1874	0.0970	0.1017	0.5048
0.1045	0.0858	0.0742	0.0742	*0.0870	*0.0141	0.0679	*0.1026	0.0970	0.1017	*0.1180
0.1045	0.0858	0.0742	0.0742	0.3019	*0.3488	0.0679	0.1517	0.0970	0.1017	0.5048
0.1045	0.0858	0.0742	0.0742	0.3019	0.0528	0.2523	0.2365	0.0970	0.1017	*0.1180
*0.4629	*0.8461	0.0742	0.0742	*0.0870	*0.0810	0.2523	0.2365	*0.5856	0.1017	*0.1180
*0.1792	0.0858	0.0742	0.0742	*0.2814	*0.3488	*0.3008	*0.3569	*0.0395	*0.3697	0.1934
0.1045	0.0858	0.0742	0.0742	0.1075	0.2537	0.0679	0.1517	0.0970	0.1017	*0.1180

Correlation Matrix:

1.0000	0.8211	0.7862	0.7862	0.4486	0.1609	0.2051	0.2038	0.9307	0.7677	0.0930
0.8211	1.0000	0.4265	0.4265	0.2325	0.0698	*0.0893	*0.0894	0.8596	0.3009	0.1634
0.7862	0.4265	1.0000	1.0000	0.3055	*0.0116	0.2942	0.2642	0.6332	0.7982	0.1079
0.7862	0.4265	1.0000	1.0000	0.3055	*0.0116	0.2942	0.2642	0.6332	0.7982	0.1079
0.4486	0.2325	0.3055	0.3055	1.0000	0.2826	0.3991	0.4897	0.4656	0.5485	0.3257
0.1609	0.0698	*0.0116	*0.0116	0.2826	1.0000	0.0367	0.2846	0.1219	0.3175	*0.1400
0.2051	*0.0893	0.2942	0.2942	0.3991	0.0367	1.0000	0.8435	0.1202	0.3554	*0.0429
0.2038	*0.0894	0.2642	0.2642	0.4897	0.2846	0.8435	1.0000	0.0908	0.4301	*0.0031
0.9307	0.8596	0.6332	0.6332	0.4656	0.1219	0.1202	0.0908	1.0000	0.6636	0.1240
0.7677	0.3009	0.7982	0.7982	0.5485	0.3175	0.3554	0.4301	0.6636	1.0000	0.0226
0.0930	0.1634	0.1079	0.1079	0.3257	*0.1400	*0.0429	*0.0031	0.1240	0.0226	1.0000

Covariance Matrix:

65.3740	32.6870	31.0249	31.0249	42.7978	22.2992	20.6371	22.2992	126.4543	60.4155	27.7008
32.6870	24.2382	10.2493	10.2493	13.5042	5.8864	*5.4709	*5.9557	71.1219	14.4183	29.6399
31.0249	10.2493	23.8227	23.8227	17.5900	*0.9695	17.8670	17.4515	51.9391	37.9224	19.3906
31.0249	10.2493	23.8227	23.8227	17.5900	*0.9695	17.8670	17.4515	51.9391	37.9224	19.3906
42.7978	13.5042	17.5900	17.5900	139.1967	57.1330	58.5873	78.1856	92.3130	62.9917	141.5512
22.2992	5.8864	*0.9695	*0.9695	57.1330	293.6288	7.8255	65.9972	35.1108	52.9640	*88.3657
20.6371	*5.4709	17.8670	17.8670	58.5873	7.8255	154.8476	142.0360	25.1385	43.0471	*19.6676
22.2992	*5.9557	17.4515	17.4515	78.1856	65.9972	142.0360	183.1025	20.6371	56.6482	*1.5235
126.4543	71.1219	51.9391	51.9391	92.3130	35.1108	25.1385	20.6371	282.4100	108.5457	76.7313
60.4155	14.4183	37.9224	37.9224	62.9917	52.9640	43.0471	56.6482	108.5457	94.7424	8.0886
27.7008	29.6399	19.3906	19.3906	141.5512	*88.3657	*19.6676	*1.5235	76.7313	8.0886	1356.7867

Eigenvalues:

5.0961	2.0709	1.1685	1.1918	0.7425	0.4145	0.1522	0.1187	0.0398	0.0049	*0.0000

Proportions:

46.33%	18.83%	10.62%	10.83%	6.75%	3.77%	1.38%	1.08%	0.36%	0.04%	*0.00%

Cum Proportions:

46.33%	65.15%	75.78%	86.61%	93.36%	97.13%	98.51%	99.59%	99.96%	100.00%	100.00%

Eigenvectors:

0.4170	0.1831	0.0781	*0.0559	0.1468	*0.0400	0.0719	0.0541	*0.5894	0.6362	*0.0000
0.2838	0.3933	*0.0214	*0.2405	0.4625	*0.2607	*0.2374	0.1064	*0.1635	*0.5745	0.0000
0.3849	0.0590	0.0588	0.3617	*0.2746	*0.1070	*0.3192	*0.0768	0.1382	*0.0174	0.7071
0.3849	0.0590	0.0588	0.3617	*0.2746	*0.1070	*0.3192	*0.0768	0.1382	*0.0174	*0.7071
0.2667	*0.2458	*0.3416	*0.3746	*0.0331	0.6638	*0.4049	*0.0606	*0.0363	*0.0284	0.0000
0.0913	*0.2025	0.3854	*0.6702	*0.3534	*0.3863	*0.0968	*0.2534	0.0617	0.0391	0.0000
0.1799	*0.5343	*0.0816	0.2102	0.4074	*0.1510	0.1484	*0.6285	*0.1162	*0.1101	0.0000
0.1888	*0.5804	*0.0431	*0.0023	0.2027	*0.2709	*0.0697	0.6848	0.1700	0.0918	*0.0000
0.3810	0.2461	0.0148	*0.1663	0.2718	0.1229	0.3580	*0.0952	0.7000	0.2241	*0.0000
0.3894	*0.1123	0.1543	0.0230	*0.3442	0.2321	0.6061	0.1767	*0.2236	*0.4365	0.0000
0.0708	0.0887	*0.8299	*0.1241	*0.2972	*0.3905	0.1975	*0.0439	*0.0146	0.0310	*0.0000

Eigenvalues (Arranged and Ranked):

5.0961	2.0709	1.1918	1.1685	0.7425	0.4145	0.1522	0.1187	0.0398	0.0049	*0.0000

Proportions Ranked:

46.33%	18.83%	10.83%	10.62%	6.75%	3.77%	1.38%	1.08%	0.36%	0.04%	*0.00%

Cum Proportions Ranked:

46.33%	65.15%	75.99%	86.61%	93.36%	97.13%	98.51%	99.59%	99.96%	100.00%	100.00%

Eigenvectors (Arranged and Ranked):

0.4170	0.1831	*0.0559	0.0781	0.1468	*0.0400	0.0719	0.0541	*0.5894	0.6362	*0.0000
0.2838	0.3933	*0.2405	*0.0214	0.4625	*0.2607	*0.2374	0.1064	*0.1635	*0.5745	0.0000
0.3849	0.0590	0.3617	0.0588	*0.2746	*0.1070	*0.3192	*0.0768	0.1382	*0.0174	0.7071
0.3849	0.0590	0.3617	0.0588	*0.2746	*0.1070	*0.3192	*0.0768	0.1382	*0.0174	*0.7071
0.2667	*0.2458	*0.3746	*0.3416	*0.0331	0.6638	*0.4049	*0.0606	*0.0363	*0.0284	0.0000
0.0913	*0.2025	*0.6702	0.3854	*0.3534	*0.3863	*0.0968	*0.2534	0.0617	0.0391	0.0000
0.1799	*0.5343	0.2102	*0.0816	0.4074	*0.1510	0.1484	*0.6285	*0.1162	*0.1101	0.0000
0.1888	*0.5804	*0.0023	*0.0431	0.2027	*0.2709	*0.0697	0.6848	0.1700	0.0918	*0.0000
0.3810	0.2461	*0.1663	0.0148	0.2718	0.1229	0.3580	*0.0952	0.7000	0.2241	*0.0000
0.3894	*0.1123	0.0230	0.1543	*0.3442	0.2321	0.6061	0.1767	*0.2236	*0.4365	0.0000
0.0708	0.0887	*0.1241	*0.8299	*0.2972	*0.3905	0.1975	*0.0439	*0.0146	0.0310	*0.0000

Revised Data:

0.2577	*0.1231	0.1313	0.0025	0.0973	*0.0487	*0.0028	0.1225	0.0269	0.0043	*0.0000
*1.9322	*0.0245	*0.0786	*0.2156	0.1666	*0.1134	*0.0152	0.0267	*0.0528	*0.0045	0.0000
0.1159	0.1454	0.2455	0.1126	0.0382	*0.1505	0.1389	*0.0920	*0.0201	*0.0185	0.0000
0.1603	*0.0055	0.1627	*0.1404	*0.0836	0.0101	*0.1481	0.0872	*0.0608	0.0015	*0.0000
*0.1127	0.8346	0.3275	*0.0413	*0.3653	0.0986	0.0649	0.0232	*0.0209	0.0160	*0.0000
0.2356	0.0006	0.1090	*0.0333	0.0425	0.0847	*0.0245	*0.0575	*0.0198	*0.0218	0.0000
0.2368	*0.2048	0.1782	*0.1851	0.0418	*0.1143	*0.1444	*0.0815	*0.0066	0.0302	*0.0000
0.0481	0.1611	*0.1303	0.5217	0.4246	0.1546	0.0095	*0.0917	*0.0372	0.0324	*0.0000
0.1677	*0.0243	0.1793	0.2015	0.1543	*0.1906	0.1282	0.1741	0.0293	0.0073	*0.0000
0.2350	0.0006	0.1129	*0.0529	0.0222	0.0756	*0.0441	0.0585	0.0053	*0.0039	*0.0000
0.3853	*0.2445	*0.3307	*0.2519	*0.1105	*0.3587	0.0822	*0.0944	0.0094	0.0110	0.0000
*0.3091	*0.2108	0.0111	*0.4861	0.1006	0.3213	0.1337	*0.0341	0.0938	0.0091	0.0000
0.2437	0.2678	*0.4703	*0.1963	*0.2724	0.0840	*0.0030	*0.0220	*0.0368	0.0042	*0.0000
0.1617	0.1111	0.1533	0.0846	0.0554	0.0044	0.0667	*0.0868	*0.0313	*0.0267	0.0000
0.3269	*0.0090	*0.6364	0.0853	0.0273	0.0797	0.0468	0.1213	*0.0319	*0.0082	*0.0000
0.3686	*0.2933	0.0166	*0.0680	0.1627	0.1170	*0.0936	*0.0110	*0.0051	*0.0243	0.0000
*0.5085	*0.8091	0.0633	0.5369	*0.4770	0.0924	0.0129	*0.0184	0.0099	0.0030	*0.0000
*0.3669	0.5663	*0.2236	0.2939	*0.0307	*0.1073	*0.1527	*0.0319	0.1272	*0.0127	*0.0000
0.2860	*0.1385	0.1791	*0.1683	0.0059	*0.0388	*0.0557	0.0077	0.0214	0.0016	*0.0000

Model Inputs: VAR12; VAR13; VAR14; VAR15; VAR16; VAR17; VAR18; VAR19; VAR20; VAR21; VAR22
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

* indicates negative values

Standard Deviations:

22.2645	25.7626	22.5703	25.7948	20.0967	22.9114	21.6174	23.3040	28.8755	25.8163	34.2045

Reduced Data Matrix:

*0.2820	*0.3398	*0.2434	*0.1451	0.2313	0.2477	0.1480	0.2228	0.0293	0.0514	*0.1606
*0.4881	*0.5179	*0.4467	*0.5009	*0.4536	*0.6535	*0.7010	*0.5648	*0.5269	*0.5706	*0.1271
*0.4881	*0.3398	*0.5483	*0.5898	0.0030	0.1476	0.0419	0.1244	*0.5269	*0.5706	0.1747
*0.2820	*0.2507	*0.2434	*0.2340	*0.2253	0.1476	*0.3826	*0.2694	*0.3680	*0.2151	*0.1606
*0.1790	*0.2507	*0.1418	*0.1451	*0.2253	*0.1528	*0.1704	*0.1710	*0.2091	*0.1263	*0.1606
0.2332	0.1055	0.1632	0.1217	0.0030	0.0474	*0.0642	0.0259	0.0293	0.0514	*0.1606
0.0786	0.1500	0.1123	0.0772	0.0601	0.1976	0.1480	0.1244	0.1087	0.1403	*0.1606
0.2332	0.2836	0.2648	0.2106	*0.4536	*0.3531	0.2541	*0.4663	0.1882	*0.0374	*0.1606
0.0271	0.0164	0.0615	0.1217	0.2313	0.1476	0.1480	0.2228	0.1882	0.2292	0.3089
0.2332	0.1055	*0.0401	*0.0117	0.0030	*0.0527	0.0950	*0.0725	0.1087	0.0514	*0.0265
0.0271	0.1945	0.2648	0.2106	0.2313	0.2477	0.1480	0.2228	0.1882	0.2292	0.5101
0.0271	0.0164	0.0107	0.0328	0.1742	*0.0527	*0.0112	*0.0233	0.1087	0.0959	*0.1606
*0.0244	0.0609	0.0107	*0.0117	*0.3395	*0.0026	*0.0112	*0.0233	0.1882	0.0070	*0.1606
0.0271	*0.0726	*0.0401	*0.0562	0.0030	*0.0026	*0.1704	*0.0725	*0.0502	*0.0374	*0.1606
0.1302	0.0609	0.0615	0.1217	0.2313	*0.2530	0.2541	0.2228	0.0293	0.0514	0.1747
0.2332	0.2836	0.2648	0.2106	0.2313	0.0474	0.2541	0.2228	0.1882	0.2292	*0.1606
0.2332	0.2836	0.2648	0.2106	0.2313	0.2477	0.0419	0.2228	0.1882	0.2292	0.3760
0.1302	0.0164	0.0615	0.2106	*0.0541	*0.1528	*0.0642	*0.0725	0.0293	0.0070	0.3760
0.1302	0.1945	0.1632	0.1662	0.1172	0.1976	0.0419	0.1244	0.1087	0.1847	*0.1606

Correlation Matrix:

1.0000	0.9275	0.9162	0.9179	0.3308	0.1458	0.5990	0.2986	0.8486	0.8045	0.1208
0.9275	1.0000	0.9448	0.8966	0.3472	0.2884	0.6839	0.3798	0.8576	0.8010	0.2024
0.9162	0.9448	1.0000	0.9697	0.3446	0.2346	0.5929	0.3400	0.8864	0.8702	0.1980
0.9179	0.8966	0.9697	1.0000	0.4068	0.2399	0.6205	0.3844	0.9110	0.9085	0.2491
0.3308	0.3472	0.3446	0.4068	1.0000	0.6517	0.5761	0.9060	0.4427	0.6311	0.4226
0.1458	0.2884	0.2346	0.2399	0.6517	1.0000	0.4378	0.7579	0.3356	0.5053	0.2220
0.5990	0.6839	0.5929	0.6205	0.5761	0.4378	1.0000	0.6689	0.7271	0.6616	0.2453
0.2986	0.3798	0.3400	0.3844	0.9060	0.7579	0.6689	1.0000	0.4744	0.6133	0.4224
0.8486	0.8576	0.8864	0.9110	0.4427	0.3356	0.7271	0.4744	1.0000	0.9316	0.1613
0.8045	0.8010	0.8702	0.9085	0.6311	0.5053	0.6616	0.6133	0.9316	1.0000	0.2017
0.1208	0.2024	0.1980	0.2491	0.4226	0.2220	0.2453	0.4224	0.1613	0.2017	1.0000

Covariance Matrix:

495.7064	531.9945	460.3878	527.1468	147.9917	74.3767	288.2964	154.9169	545.5679	462.3961	91.9668
531.9945	663.7119	549.3767	595.8449	179.7784	170.2216	380.8864	228.0471	637.9501	532.7562	178.3241
460.3878	549.3767	509.4183	564.5429	156.3019	121.3296	289.2659	178.8089	577.7008	507.0637	152.8393
527.1468	595.8449	564.5429	665.3740	210.8726	141.7590	345.9834	231.0942	678.5319	604.9861	219.8061
147.9917	179.7784	156.3019	210.8726	403.8781	300.0693	250.2770	424.3075	256.9252	327.4238	290.5125
74.3767	170.2216	121.3296	141.7590	300.0693	524.9307	216.8283	404.6399	222.0222	298.8920	173.9612
288.2964	380.8864	289.2659	345.9834	250.2770	216.8283	467.3130	336.9806	453.8781	369.2521	181.3712
154.9169	228.0471	178.8089	231.0942	424.3075	404.6399	336.9806	543.0748	319.2521	368.9751	336.7036
545.5679	637.9501	577.7008	678.5319	256.9252	222.0222	453.8781	319.2521	833.7950	694.4598	159.2798
462.3961	532.7562	507.0637	604.9861	327.4238	298.8920	369.2521	368.9751	694.4598	666.4820	178.1163
91.9668	178.3241	152.8393	219.8061	290.5125	173.9612	181.3712	336.7036	159.2798	178.1163	1169.9446

Eigenvalues:

6.8627	2.0948	0.8565	0.4456	0.3382	0.1983	0.0082	0.0103	0.0471	0.0709	0.0675

Proportions:

62.39%	19.04%	7.79%	4.05%	3.07%	1.80%	0.07%	0.09%	0.43%	0.64%	0.61%

Cum Proportions:

62.39%	81.43%	89.22%	93.27%	96.34%	98.15%	98.22%	98.31%	98.74%	99.39%	100.00%

Eigenvectors:

0.3300	*0.2870	*0.0298	0.0066	*0.0967	*0.4597	0.2622	*0.0074	0.3556	0.6122	*0.1308
0.3437	*0.2177	*0.0417	0.0290	0.3039	*0.4485	*0.4378	0.2237	*0.4883	*0.1457	*0.1925
0.3448	*0.2542	*0.0701	*0.1815	0.0436	*0.0895	0.6217	*0.2025	*0.0745	*0.5635	0.1344
0.3520	*0.2178	*0.1042	*0.1530	*0.1070	0.1336	*0.5764	*0.2706	0.4823	*0.1831	0.3059
0.2493	0.4511	0.0192	0.0086	*0.5879	*0.2601	*0.0412	*0.1992	*0.3780	0.1005	0.3554
0.1931	0.4535	0.3431	*0.4459	0.5924	*0.0334	0.0339	*0.1329	0.0606	0.1852	0.1780
0.3042	0.1132	0.0974	0.8102	0.2806	0.1246	0.0943	0.0912	0.0900	0.0020	0.3304
0.2559	0.4823	0.0825	0.1187	*0.1480	*0.0988	*0.0221	0.0189	0.3466	*0.3359	*0.6446
0.3543	*0.1484	0.0829	0.0397	*0.0216	0.5629	*0.0000	*0.4277	*0.3493	0.2789	*0.3794
0.3631	*0.0188	0.1277	*0.2577	*0.2242	0.3702	0.0711	0.7635	*0.0041	0.0469	0.0870
0.1240	0.2848	*0.9078	*0.0732	0.1927	0.1170	0.0597	0.0621	*0.0153	0.1250	*0.0031

Eigenvalues (Arranged and Ranked):

6.8627	2.0948	0.8565	0.4456	0.3382	0.1983	0.0709	0.0675	0.0471	0.0103	0.0082

Proportions Ranked:

62.39%	19.04%	7.79%	4.05%	3.07%	1.80%	0.64%	0.61%	0.43%	0.09%	0.07%

Cum Proportions Ranked:

62.39%	81.43%	89.22%	93.27%	96.34%	98.15%	98.79%	99.40%	99.83%	99.93%	100.00%

Eigenvectors (Arranged and Ranked):

0.3300	*0.2870	*0.0298	0.0066	*0.0967	*0.4597	0.6122	*0.1308	0.3556	*0.0074	0.2622
0.3437	*0.2177	*0.0417	0.0290	0.3039	*0.4485	*0.1457	*0.1925	*0.4883	0.2237	*0.4378
0.3448	*0.2542	*0.0701	*0.1815	0.0436	*0.0895	*0.5635	0.1344	*0.0745	*0.2025	0.6217
0.3520	*0.2178	*0.1042	*0.1530	*0.1070	0.1336	*0.1831	0.3059	0.4823	*0.2706	*0.5764
0.2493	0.4511	0.0192	0.0086	*0.5879	*0.2601	0.1005	0.3554	*0.3780	*0.1992	*0.0412
0.1931	0.4535	0.3431	*0.4459	0.5924	*0.0334	0.1852	0.1780	0.0606	*0.1329	0.0339
0.3042	0.1132	0.0974	0.8102	0.2806	0.1246	0.0020	0.3304	0.0900	0.0912	0.0943
0.2559	0.4823	0.0825	0.1187	*0.1480	*0.0988	*0.3359	*0.6446	0.3466	0.0189	*0.0221
0.3543	*0.1484	0.0829	0.0397	*0.0216	0.5629	0.2789	*0.3794	*0.3493	*0.4277	*0.0000
0.3631	*0.0188	0.1277	*0.2577	*0.2242	0.3702	0.0469	0.0870	*0.0041	0.7635	0.0711
0.1240	0.2848	*0.9078	*0.0732	0.1927	0.1170	0.1250	*0.0031	*0.0153	0.0621	0.0597

Revised Data:

*0.1282	0.5382	0.3318	0.0922	*0.0949	0.2292	0.0091	*0.0298	0.0239	0.0257	0.0507
*1.6760	*0.3246	*0.2294	*0.0726	*0.1948	0.0153	0.0046	*0.0019	*0.0676	*0.0478	*0.0442
*0.9729	0.7536	*0.0815	0.2729	0.2351	*0.1531	*0.0042	*0.0152	*0.0128	0.0017	*0.0141
*0.7870	0.0533	0.1349	*0.2863	0.1431	*0.0403	*0.0213	0.0271	0.0256	0.0055	0.0957
*0.5663	*0.1115	0.0657	*0.0166	*0.0283	0.0642	0.0316	0.0427	0.0767	*0.0447	0.0237
0.2184	*0.1808	0.1316	*0.1141	*0.0350	*0.1490	0.0352	*0.0396	0.0749	0.0039	*0.0262
0.3430	0.0284	0.2419	*0.0003	0.0747	*0.0249	*0.0039	0.0176	*0.0068	*0.0332	*0.0037
0.1497	*0.8757	*0.0463	0.2624	0.2238	0.0509	0.0090	*0.0163	*0.0255	*0.0095	0.1013
0.4550	0.2977	*0.1661	*0.0208	*0.0439	0.1492	0.0072	0.0238	*0.0036	0.0351	0.0001
0.1500	*0.1486	0.0175	0.0985	*0.0056	*0.0553	0.0075	0.0380	*0.0299	0.1967	*0.0266
0.6619	0.2906	*0.3454	*0.1255	0.1077	0.0832	0.0198	*0.0024	*0.0598	*0.0780	0.0376
0.1071	*0.0427	0.1437	*0.0018	*0.1888	0.0189	*0.0246	*0.0200	*0.0974	0.0325	0.0362
*0.0328	*0.2471	0.1505	0.0053	0.1843	0.1604	*0.0154	*0.0038	0.0109	*0.0218	*0.1907
*0.1710	*0.0612	0.1243	*0.1121	*0.0823	*0.0594	0.0194	*0.0274	*0.0006	0.0481	*0.0048
0.3218	0.0776	*0.2122	0.2951	*0.2304	*0.0625	*0.0094	0.0198	0.0549	*0.0517	*0.0129
0.6710	*0.0577	0.1953	0.1029	*0.1033	*0.1101	*0.0020	0.0106	*0.0224	*0.0855	*0.0050
0.7116	0.1619	*0.2438	*0.1977	0.0592	*0.0804	0.0168	*0.0021	*0.0375	0.0182	*0.0412
0.1224	*0.1358	*0.4345	*0.0632	*0.0233	0.0368	*0.0407	*0.0267	0.0995	0.0500	0.0200
0.4222	*0.0155	0.2221	*0.1185	0.0027	*0.0728	*0.0388	0.0057	*0.0024	*0.0454	0.0041

Model Inputs:
VAR23; VAR24; VAR25; VAR26; VAR27; VAR28; VAR29; VAR30; VAR31; VAR32; VAR33
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

* indicates negative values

Standard Deviations:
24.4723 24.5090 27.1397 30.1083 19.3237 19.7526 22.6530 22.1366 32.2602 31.6408 32.2194

Reduced Data Matrix:

0.1505	0.3350	0.2491	0.2687	0.2312	0.3576	0.2532	0.2918	*0.0337	0.2049	0.3897
*0.2245	*0.1330	*0.1735	*0.1123	*0.4811	*0.4554	*0.3545	*0.3300	*0.2470	*0.0851	*0.0731
0.2442	0.2414	0.1646	0.1163	*0.1250	0.0092	0.1519	0.0845	0.1085	0.2049	*0.1443
0.0567	0.1478	0.1223	0.2687	0.2312	0.2415	0.1519	0.1882	0.2508	0.3354	*0.1443
0.1505	0.2414	0.2491	0.1925	0.1125	0.3576	0.1519	0.1882	0.3219	0.3499	0.4254
*0.3182	*0.3202	*0.3426	*0.3409	0.1125	0.1253	0.1519	0.0845	*0.3893	*0.3751	0.2117
0.1036	0.1010	0.1223	0.0782	0.1125	0.2415	0.1013	0.1364	0.2152	0.2412	*0.1443
0.3380	0.3350	0.3337	0.2687	*0.2437	0.0092	0.2532	*0.2264	0.3219	*0.2301	*0.1443
*0.0370	*0.3202	*0.0890	*0.1123	0.1125	0.1253	0.0506	0.0845	*0.0337	*0.1576	*0.1443
*0.0370	*0.0394	*0.0044	*0.0361	*0.0062	0.0092	0.1519	0.1364	*0.0337	*0.0851	*0.1443
*0.4120	*0.4138	*0.4271	*0.4171	*0.0062	*0.4554	*0.2532	*0.2264	*0.3181	*0.3026	*0.1443
0.1036	0.1478	0.1223	0.0401	0.2312	0.0672	*0.1519	*0.0191	0.1441	0.0599	*0.1443
0.3380	0.1010	0.1223	0.2687	*0.2437	*0.2231	*0.2532	*0.2264	0.3219	*0.0126	*0.1443
*0.0370	*0.0394	*0.2580	*0.2647	*0.2437	0.0092	*0.3545	*0.2264	*0.0337	*0.0851	*0.1443
0.2442	0.1478	0.0801	0.0782	0.3499	*0.2231	0.2532	0.2918	0.1441	0.1687	0.2117
*0.2245	*0.2266	*0.1735	*0.1123	0.3499	0.1253	0.2532	0.2918	*0.2115	*0.1939	*0.1443
0.1505	0.1478	0.3337	0.2687	*0.2437	*0.2231	*0.0506	0.0845	*0.0337	0.3499	0.5678
*0.3651	*0.2266	*0.3426	*0.4171	*0.2437	0.0092	*0.4557	*0.5373	*0.3893	*0.3026	*0.0019
*0.2245	*0.2266	*0.0890	*0.0361	*0.0062	*0.1070	*0.0506	*0.0709	*0.1048	*0.0851	*0.1443

Correlation Matrix:

1.0000	0.8871	0.8923	0.8729	0.0457	0.2324	0.4177	0.3339	0.8963	0.6440	0.1789
0.8871	1.0000	0.9027	0.8592	0.0453	0.3548	0.4100	0.3180	0.7919	0.7293	0.3185
0.8923	0.9027	1.0000	0.9583	0.0948	0.3321	0.5158	0.4342	0.8147	0.7556	0.3580
0.8729	0.8592	0.9583	1.0000	0.1133	0.2851	0.5035	0.4508	0.8276	0.7576	0.2836
0.0457	0.0453	0.0948	0.1133	1.0000	0.5389	0.6493	0.7913	0.1353	0.2232	0.1097
0.2324	0.3548	0.3321	0.2851	0.5389	1.0000	0.5440	0.5269	0.3177	0.3188	0.1699
0.4177	0.4100	0.5158	0.5035	0.6493	0.5440	1.0000	0.8449	0.3763	0.3246	0.2398
0.3339	0.3180	0.4342	0.4508	0.7913	0.5269	0.8449	1.0000	0.3028	0.5428	0.3572
0.8963	0.7919	0.8147	0.8276	0.1353	0.3177	0.3763	0.3028	1.0000	0.6491	*0.0189
0.6440	0.7293	0.7556	0.7576	0.2232	0.3188	0.3246	0.5428	0.6491	1.0000	0.4353
0.1789	0.3185	0.3580	0.2836	0.1097	0.1699	0.2398	0.3572	*0.0189	0.4353	1.0000

Covariance Matrix:

598.8920	532.0637	592.6593	643.1440	21.6066	112.3269	231.5789	180.8864	707.6177	498.6704	141.0665
532.0637	600.6925	600.4155	634.0028	21.4681	171.7452	227.6316	172.5069	626.1080	565.5817	251.5235
592.6593	600.4155	736.5651	783.0332	49.7230	178.0471	317.1053	260.8726	713.2964	648.8227	313.0194
643.1440	634.0028	783.0332	906.5097	65.9280	169.5291	343.4211	300.4848	803.8781	721.7729	275.0693
21.6066	21.4681	49.7230	65.9280	373.4072	205.6787	284.2105	338.5042	84.3490	136.4543	68.2825
112.3269	171.7452	178.0471	169.5291	205.6787	390.1662	243.4211	230.4017	202.4238	199.2659	108.1025
231.5789	227.6316	317.1053	343.4211	284.2105	243.4211	513.1579	423.6842	275.0000	232.6316	175.0000
180.8864	172.5069	260.8726	300.4848	338.5042	230.4017	423.6842	490.0277	216.2742	380.2216	254.7784
707.6177	626.1080	713.2964	803.8781	84.3490	202.4238	275.0000	216.2742	1040.7202	662.5623	*19.6676
498.6704	565.5817	648.8227	721.7729	136.4543	199.2659	232.6316	380.2216	662.5623	1001.1413	443.7535
141.0665	251.5235	313.0194	275.0693	68.2825	108.1025	175.0000	254.7784	*19.6676	443.7535	1038.0886

Eigenvalues:

6.0552	2.2509	1.0725	0.5861	0.4586	0.2184	0.1292	0.1157	0.0666	0.0320	0.0148

Proportions:

55.05%	20.46%	9.75%	5.33%	4.17%	1.99%	1.17%	1.05%	0.61%	0.29%	0.13%

Cum Proportions:

55.05%	75.51%	85.26%	90.59%	94.76%	96.74%	97.92%	98.97%	99.57%	99.87%	100.00%

Eigenvectors:

0.3537	*0.2475	*0.1379	*0.0953	0.1383	*0.3637	*0.0508	*0.4055	0.5314	*0.0935	*0.4195
0.3592	*0.2186	0.0260	0.1763	0.1098	*0.1431	*0.7667	0.1402	*0.1323	0.2344	0.2811
0.3801	*0.1765	0.0478	*0.0253	0.1609	0.1317	0.1421	0.3583	0.0835	*0.7444	0.2617
0.3743	*0.1759	*0.0093	*0.1330	0.0602	0.2436	0.3328	0.5074	0.1865	0.5655	*0.1594
0.1486	0.5550	*0.1601	*0.1403	*0.3112	*0.5516	*0.0661	0.4361	*0.0091	*0.0821	*0.1487
0.2083	0.3401	*0.1595	0.8661	0.0648	0.1364	0.1293	*0.0576	0.1391	0.0177	*0.0539
0.2747	0.3787	*0.1174	*0.2590	0.5399	0.2486	*0.0982	*0.1491	*0.4488	*0.0459	*0.3340
0.2696	0.4502	0.0628	*0.3061	*0.1200	0.2260	*0.0151	*0.3244	0.3799	0.1335	0.5421
0.3373	*0.2137	*0.3429	0.0131	*0.1609	*0.3026	0.4224	*0.2833	*0.4906	0.1091	0.3066
0.3325	*0.0666	0.2475	0.0109	*0.6880	0.3540	*0.1429	*0.1491	*0.1962	*0.1311	*0.3558
0.1527	0.0946	0.8545	0.1036	0.1821	*0.3434	0.2210	*0.0805	*0.1182	0.0792	0.0098

Eigenvalues (Arranged and Ranked):

6.0552	2.2509	1.0725	0.5861	0.4586	0.2184	0.1292	0.1157	0.0666	0.0320	0.0148

Proportions Ranked:

55.05%	20.46%	9.75%	5.33%	4.17%	1.99%	1.17%	1.05%	0.61%	0.29%	0.13%

Cum Proportions Ranked:

55.05%	75.51%	85.26%	90.59%	94.76%	96.74%	97.92%	98.97%	99.57%	99.87%	100.00%

Eigenvectors (Arranged and Ranked):

0.3537	*0.2475	*0.1379	*0.0953	0.1383	*0.3637	*0.0508	*0.4055	0.5314	*0.0935	*0.4195
0.3592	*0.2186	0.0260	0.1763	0.1098	*0.1431	*0.7667	0.1402	*0.1323	0.2344	0.2811
0.3801	*0.1765	0.0478	*0.0253	0.1609	0.1317	0.1421	0.3583	0.0835	*0.7444	0.2617
0.3743	*0.1759	*0.0093	*0.1330	0.0602	0.2436	0.3328	0.5074	0.1865	0.5655	*0.1594
0.1486	0.5550	*0.1601	*0.1403	*0.3112	*0.5516	*0.0661	0.4361	*0.0091	*0.0821	*0.1487
0.2083	0.3401	*0.1595	0.8661	0.0648	0.1364	0.1293	*0.0576	0.1391	0.0177	*0.0539
0.2747	0.3787	*0.1174	*0.2590	0.5399	0.2486	*0.0982	*0.1491	*0.4488	*0.0459	*0.3340
0.2696	0.4502	0.0628	*0.3061	*0.1200	0.2260	*0.0151	*0.3244	0.3799	0.1335	0.5421
0.3373	*0.2137	*0.3429	0.0131	*0.1609	*0.3026	0.4224	*0.2833	*0.4906	0.1091	0.3066
0.3325	*0.0666	0.2475	0.0109	*0.6880	0.3540	*0.1429	*0.1491	*0.1962	*0.1311	*0.3558
0.1527	0.0946	0.8545	0.1036	0.1821	*0.3434	0.2210	*0.0805	*0.1182	0.0792	0.0098

Revised Data:

0.7422	0.3059	0.2872	0.1672	0.1022	*0.0054	*0.0953	0.1070	0.0817	0.0459	*0.0061
*0.7107	*0.5182	0.1920	*0.1286	*0.0269	0.1608	*0.0442	0.0181	*0.0159	0.0375	0.0187
0.4098	*0.1839	*0.1244	*0.0514	0.0204	0.1429	*0.1575	*0.1020	0.0232	*0.0348	*0.0379
0.5715	0.1479	*0.2085	0.0536	*0.2343	0.1179	0.0149	0.0717	*0.0660	0.0656	*0.0331
0.7803	0.1066	0.2543	0.2454	*0.0685	*0.0621	0.1078	*0.0731	*0.1201	0.0041	0.0328
*0.6017	0.5980	0.1934	0.0682	0.2494	*0.0423	0.0281	*0.0706	0.0010	0.0377	*0.0040
0.4111	0.0855	*0.2038	0.1103	*0.1581	0.0797	*0.0030	*0.0538	*0.0304	*0.0438	*0.0064
0.4515	*0.4683	*0.3215	0.0153	0.4739	*0.0433	*0.0044	0.0494	*0.0786	*0.0174	0.0045
*0.2102	0.2809	*0.1958	0.0009	0.0165	0.0109	0.1763	*0.0672	0.0847	*0.0613	*0.0301
*0.0247	0.1427	*0.1383	*0.0871	0.0935	0.1126	*0.0299	*0.0467	0.0137	*0.0149	0.0512
*1.0692	0.0595	0.0296	*0.2485	*0.1002	*0.0828	*0.0145	0.0259	*0.0808	*0.0090	0.0073
0.1992	*0.0500	*0.1940	0.0663	*0.1853	*0.1663	*0.0588	0.1305	0.0560	*0.0604	0.0475
0.1720	*0.6651	*0.1873	*0.0883	*0.0238	*0.1183	0.1336	*0.0027	0.0870	0.0757	*0.0123
*0.4788	*0.2592	*0.0736	0.2252	*0.1170	*0.0534	*0.0711	*0.1640	0.0415	0.0389	0.0291
0.4900	0.2029	0.1147	*0.3812	*0.0547	*0.2315	*0.0860	*0.0599	*0.0343	0.0014	*0.0326
*0.2003	0.6640	*0.1683	*0.1145	0.0514	0.0618	*0.0066	0.0535	0.0456	0.0253	0.0205
0.4516	*0.3303	0.6657	*0.1421	*0.0011	0.0831	0.0681	0.0140	0.0452	*0.0508	0.0046
*1.0334	*0.1697	0.1463	0.3750	0.0097	*0.0692	*0.0466	0.0729	*0.0160	*0.0334	*0.0487
*0.3501	0.0506	*0.0677	*0.0857	*0.0471	0.1049	0.0891	0.0970	*0.0373	*0.0065	*0.0051

E. HOTELLING

Model Inputs: VAR1; VAR2; VAR3; VAR4; VAR5; VAR6; VAR7; VAR8; VAR9; VAR10; VAR11; VAR12; VAR13; VAR14
VAR101; VAR102; VAR103; VAR104; VAR105; VAR106; VAR107; VAR108; VAR109; VAR110; VAR111; VAR112; VAR113; VAR114
HA1, HA2, HA3, HA4, AL1, AL2, AL3, AL4, AL5, LN1, LN2, LN3, LN4, LN5
HA1, HA2, HA3, HA4, AL1, AL2, AL3, AL4, AL5, LN1, LN2, LN3, LN4, LN5

Hotelling T2 18.04674
F Statistic 0.88033
P-value 0.58634

Null hypothesis tested is that there is zero difference between
all the related variables compared across the two groups.

Covariance GROUP 1

1.11067	0.05336	0.03360	0.39130	0.32609	-0.05336	-0.20158	0.09289	0.23518	0.24308	-0.24111	-0.05731	0.12846	0.03953
0.05336	0.58498	0.16798	0.22925	0.08498	0.14229	-0.14427	-0.03557	0.13043	0.16996	-0.02372	-0.05929	0.27866	-0.07510
0.03360	0.16798	0.40711	0.06522	-0.05929	0.15020	0.05731	0.14427	0.34980	0.19960	0.03557	0.17984	0.01383	0.06719
0.39130	0.22925	0.06522	0.52964	0.09289	0.04348	0.01779	0.23913	0.18379	0.09486	-0.03755	0.15613	0.22530	0.05534
0.32609	0.08498	-0.05929	0.09289	0.85771	0.32411	-0.00791	-0.35375	-0.00593	-0.01186	-0.34190	-0.19565	-0.13043	-0.16601
-0.05336	0.14229	0.15020	0.04348	0.32411	0.58498	0.18972	0.03557	0.36957	0.19368	0.16008	0.15020	0.03953	0.02964
-0.20158	-0.14427	0.05731	0.01779	-0.00791	0.18972	0.92885	0.45257	0.17391	0.16601	0.10474	0.55731	-0.12846	0.14229
0.09289	-0.03557	0.14427	0.23913	-0.35375	0.03557	0.45257	1.60474	0.41897	0.15613	0.22134	0.82609	0.30830	0.18577
0.23518	0.13043	0.34980	0.18379	-0.00593	0.36957	0.17391	0.41897	0.94862	0.44269	0.06719	0.39526	0.09684	0.19763
0.24308	0.16996	0.19960	0.09486	-0.01186	0.19368	0.16601	0.15613	0.44269	0.61265	0.22530	0.33597	0.10277	0.03162
-0.24111	-0.02372	0.03557	-0.03755	-0.34190	0.16008	0.10474	0.22134	0.06719	0.22530	1.26877	0.30830	0.02372	-0.11858
-0.05731	-0.05929	0.17984	0.15613	-0.19565	0.15020	0.55731	0.82609	0.39526	0.33597	0.30830	1.04348	0.05929	0.20356
0.12846	0.27866	0.01383	0.22530	-0.13043	0.03953	-0.12846	0.30830	0.09684	0.10277	0.02372	0.05929	0.67589	0.25692
0.03953	-0.07510	0.06719	0.05534	-0.16601	0.02964	0.14229	0.18577	0.19763	0.03162	-0.11858	0.20356	0.25692	0.44269

Covariance GROUP 2

0.82895	0.21053	0.10526	0.03947	0.43421	-0.10526	-0.07895	0.34211	0.03947	0.14474	-0.27632	0.15789	0.18421	0.18421
0.21053	0.67368	0.18947	0.16842	0.17895	0.11579	-0.62105	0.14737	-0.06316	-0.20000	0.03158	0.10526	0.02105	0.00000
0.10526	0.18947	0.80000	-0.08421	-0.06316	0.17895	-0.40000	0.03158	0.24211	0.07368	-0.04211	0.00000	-0.16842	0.05263
0.03947	0.16842	-0.08421	0.55526	0.15000	0.04211	-0.08947	0.35263	-0.05526	0.02895	0.11316	0.10526	0.05789	-0.02632
0.43421	0.17895	-0.06316	0.15000	1.10263	-0.17895	-0.20526	0.78421	-0.01842	0.20263	0.37105	0.57895	-0.17368	-0.13158
-0.10526	0.11579	0.17895	0.04211	-0.17895	1.09474	0.14737	0.32632	0.16842	0.25263	0.33684	0.26316	-0.07368	-0.05263
-0.07895	-0.62105	-0.40000	-0.08947	-0.20526	0.14737	1.04211	0.01053	-0.01579	0.33158	-0.11053	0.10526	0.13684	0.10526
0.34211	0.14737	0.03158	0.35263	0.78421	0.32632	0.01053	1.67368	0.17368	0.24737	0.68947	0.94737	-0.40000	-0.26316
0.03947	-0.06316	0.24211	-0.05526	-0.01842	0.16842	-0.01579	0.17368	0.55526	-0.05526	0.07105	0.15789	-0.26842	0.07895
0.14474	-0.20000	0.07368	0.02895	0.20263	0.25263	0.33158	0.24737	-0.05526	0.55526	0.06053	0.21053	0.05789	0.07895
-0.27632	0.03158	-0.04211	0.11316	0.37105	0.33684	-0.11053	0.68947	0.07105	0.06053	1.20789	0.73684	-0.40526	-0.23684
0.15789	0.10526	0.00000	0.10526	0.57895	0.26316	0.10526	0.94737	0.15789	0.21053	0.73684	1.15789	-0.26316	0.00000
0.18421	0.02105	-0.16842	0.05789	-0.17368	-0.07368	0.13684	-0.40000	-0.26842	0.05789	-0.40526	-0.26316	0.64211	0.26316
0.18421	0.00000	0.05263	-0.02632	-0.13158	-0.05263	0.10526	-0.26316	0.07895	0.07895	-0.23684	0.00000	0.26316	0.47368

Covariance POOLED

0.98012	0.12619	0.06681	0.22826	0.37619	-0.07741	-0.14475	0.20838	0.14449	0.19751	-0.25742	0.04242	0.15429	0.10657
0.12619	0.62609	0.17794	0.20106	0.12853	0.13001	-0.36522	0.04920	0.04072	-0.00148	0.00191	0.01697	0.15928	-0.04030
0.06681	0.17794	0.58918	-0.00403	-0.06108	0.16352	-0.15461	0.09205	0.29989	0.14125	-0.00042	0.09650	-0.07063	0.06045
0.22826	0.20106	-0.00403	0.54152	0.11935	0.04284	-0.03192	0.29173	0.07301	0.06432	0.03229	0.13256	0.14772	0.01750
0.37619	0.12853	-0.06108	0.11935	0.97121	0.09099	-0.09936	0.17359	-0.01172	0.08754	-0.01151	0.16331	-0.15048	-0.15005
-0.07741	0.13001	0.16352	0.04284	0.09099	0.82121	0.17010	0.17031	0.27635	0.22100	0.24199	0.20255	-0.01294	-0.00848
-0.14475	-0.36522	-0.15461	-0.03192	-0.09936	0.17010	0.98134	0.24772	0.08600	0.24274	0.00498	0.34783	-0.00551	0.12513
0.20838	0.04920	0.09205	0.29173	0.17359	0.17031	0.24772	1.63669	0.30530	0.19841	0.43828	0.88229	-0.01994	-0.02227
0.14449	0.04072	0.29989	0.07301	-0.01172	0.27635	0.08600	0.30530	0.76633	0.21193	0.06898	0.28526	-0.07243	0.14263
0.19751	-0.00148	0.14125	0.06432	0.08754	0.22100	0.24274	0.19841	0.21193	0.58606	0.14894	0.27784	0.08197	0.05355
-0.25742	0.00191	-0.00042	0.03229	-0.01151	0.24199	0.00498	0.43828	0.06898	0.14894	1.24056	0.50689	-0.17508	-0.17338
0.04242	0.01697	0.09650	0.13256	0.16331	0.20255	0.34783	0.88229	0.28526	0.27784	0.50689	1.09650	-0.09014	0.10923
0.15429	0.15928	-0.07063	0.14772	-0.15048	-0.01294	-0.00551	-0.01994	-0.07243	0.08197	-0.17508	-0.09014	0.66023	0.25981
0.10657	-0.04030	0.06045	0.01750	-0.15005	-0.00848	0.12513	-0.02227	0.14263	0.05355	-0.17338	0.10923	0.25981	0.45705

Model Inputs:
VAR15; VAR16; VAR17; VAR18; VAR19; VAR20; VAR21; VAR22; VAR23; VAR24; VAR25
VAR115; VAR116; VAR117; VAR118; VAR119; VAR120; VAR121; VAR122; VAR123; VAR124; VAR125
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Hotelling T-Square: Two Independent Variable
Equal Variance with Multiple Related Measures

Hotelling T2 8.98333
F Statistic 0.61748
P-value 0.79980

Null hypothesis tested is that there is zero difference between
all the related variables compared across the two groups.

Covariance GROUP 1

0.96838	0.67391	0.70158	0.39130	0.43874	0.31818	0.32411	0.38933	0.95257	0.63834	0.12055
0.67391	0.77075	0.52767	0.30237	0.22332	0.13636	0.17194	0.33597	0.66996	0.46640	0.08696
0.70158	0.52767	0.88538	0.40316	0.46443	0.13636	0.13834	0.38735	0.80237	0.47036	0.19170
0.39130	0.30237	0.40316	0.60079	0.33202	0.00000	-0.03360	0.18775	0.54150	0.50395	0.01383
0.43874	0.22332	0.46443	0.33202	0.44664	0.13636	0.02569	0.21739	0.56719	0.34190	0.12846
0.31818	0.13636	0.13636	0.00000	0.13636	0.72727	0.18182	0.31818	0.45455	0.22727	0.13636
0.32411	0.17194	0.13834	-0.03360	0.02569	0.18182	0.45059	0.22530	0.25889	0.15020	-0.06522
0.38933	0.33597	0.38735	0.18775	0.21739	0.31818	0.22530	0.61265	0.47036	0.30237	0.12648
0.95257	0.66996	0.80237	0.54150	0.56719	0.45455	0.25889	0.47036	1.29249	0.75296	0.38538
0.63834	0.46640	0.47036	0.50395	0.34190	0.22727	0.15020	0.30237	0.75296	0.83794	0.16008
0.12055	0.08696	0.19170	0.01383	0.12846	0.13636	-0.06522	0.12648	0.38538	0.16008	1.26482

Covariance GROUP 2

1.08158	0.33421	0.30526	0.79737	0.58947	0.22895	0.31053	0.30526	0.55000	0.61053	-0.26579
0.33421	0.57632	0.13684	0.34474	0.02105	0.05000	0.33158	0.24211	0.29737	0.32632	0.21842
0.30526	0.13684	0.98947	0.38947	0.06316	-0.38947	0.38947	0.25263	0.48421	0.50526	0.01053
0.79737	0.34474	0.38947	0.99737	0.45263	0.18684	0.24737	0.23158	0.62368	0.67368	-0.08684
0.58947	0.02105	0.06316	0.45263	0.77895	0.49474	0.08421	0.22105	0.09474	0.28421	-0.27368
0.22895	0.05000	-0.38947	0.18684	0.49474	0.89211	-0.03684	0.24211	-0.12368	0.06316	0.00789
0.31053	0.33158	0.38947	0.24737	0.08421	-0.03684	0.74737	0.38947	0.47895	0.35789	0.37368
0.30526	0.24211	0.25263	0.23158	0.22105	0.24211	0.38947	0.56842	0.32632	0.34737	0.11579
0.55000	0.29737	0.48421	0.62368	0.09474	-0.12368	0.47895	0.32632	0.87105	0.65263	0.26579
0.61053	0.32632	0.50526	0.67368	0.28421	0.06316	0.35789	0.34737	0.65263	0.80000	0.17895
-0.26579	0.21842	0.01053	-0.08684	-0.27368	0.00789	0.37368	0.11579	0.26579	0.17895	1.50263

Covariance POOLED

1.02084	0.51649	0.51792	0.57948	0.50859	0.27683	0.31782	0.35037	0.76601	0.62545	-0.05848
0.51649	0.68065	0.34655	0.32200	0.12959	0.09634	0.24592	0.29247	0.49730	0.40148	0.14788
0.51792	0.34655	0.93362	0.39682	0.27847	-0.10732	0.25472	0.32492	0.65493	0.48653	0.10774
0.57948	0.32200	0.39682	0.78457	0.38791	0.08659	0.09661	0.20806	0.57959	0.58261	-0.03282
0.50859	0.12959	0.27847	0.38791	0.60064	0.30244	0.05281	0.21909	0.34825	0.31516	-0.05790
0.27683	0.09634	-0.10732	0.08659	0.30244	0.80366	0.08049	0.28293	0.18659	0.15122	0.07683
0.31782	0.24592	0.25472	0.09661	0.05281	0.08049	0.58812	0.30138	0.36087	0.24645	0.13818
0.35037	0.29247	0.32492	0.20806	0.21909	0.28293	0.30138	0.59215	0.40361	0.32322	0.12153
0.76601	0.49730	0.65493	0.57959	0.34825	0.18659	0.36087	0.40361	1.09719	0.70647	0.32996
0.62545	0.40148	0.48653	0.58261	0.31516	0.15122	0.24645	0.32322	0.70647	0.82036	0.16882
-0.05848	0.14788	0.10774	-0.03282	-0.05790	0.07683	0.13818	0.12153	0.32996	0.16882	1.37503

Model Inputs:
VAR26; VAR27; VAR28; VAR29; VAR30; VAR31; VAR32; VAR33; VAR34; VAR35; VAR36
VAR126; VAR127; VAR128; VAR129; VAR130; VAR131; VAR132; VAR133; VAR134; VAR135; VAR136
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Hotelling T-Square: Two Independent Variable
Equal Variance with Multiple Related Measures

Hotelling T2 16.90438
F Statistic 1.16194
P-value   0.35151

Null hypothesis tested is that there is zero difference between
all the related variables compared across the two groups.

Covariance GROUP 1

0.71146	0.54348	0.28063	0.21542	0.23913	0.06522	0.34783	0.17984	0.60079	0.22727	0.31818
0.54348	0.76680	0.06917	0.05534	0.26285	0.10474	0.45257	0.22134	0.30237	0.00000	0.22727
0.28063	0.06917	0.54150	0.50593	-0.00593	-0.10079	0.14427	0.06917	0.29051	0.50000	0.18182
0.21542	0.05534	0.50593	0.69565	0.07708	-0.00791	0.26087	0.19170	0.31423	0.59091	0.27273
0.23913	0.26285	-0.00593	0.07708	0.33202	0.09881	0.23913	0.17194	0.36759	0.09091	0.09091
0.06522	0.10474	-0.10079	-0.00791	0.09881	0.67984	0.01976	0.05929	-0.06917	-0.09091	0.18182
0.34783	0.45257	0.14427	0.26087	0.23913	0.01976	0.80237	0.49802	0.46443	0.09091	0.13636
0.17984	0.22134	0.06917	0.19170	0.17194	0.05929	0.49802	0.58498	0.43874	0.18182	0.22727
0.60079	0.30237	0.29051	0.31423	0.36759	-0.06917	0.46443	0.43874	1.44269	0.59091	0.63636
0.22727	0.00000	0.50000	0.59091	0.09091	-0.09091	0.09091	0.18182	0.59091	0.81818	0.40909
0.31818	0.22727	0.18182	0.27273	0.09091	0.18182	0.13636	0.22727	0.63636	0.40909	1.45455

Covariance GROUP 2

0.45000	0.23947	0.26842	0.38158	0.29211	0.00263	0.07368	0.08684	0.33684	0.12368	0.01579
0.23947	0.45000	0.32105	0.27632	0.18684	0.00263	0.12632	0.08684	0.33684	0.22895	-0.03684
0.26842	0.32105	0.43158	0.34211	0.21579	-0.04737	0.09474	0.06842	0.41053	0.30000	-0.23158
0.38158	0.27632	0.34211	0.51316	0.32895	0.09211	0.10526	0.09211	0.36842	0.17105	-0.23684
0.29211	0.18684	0.21579	0.32895	0.55526	0.37105	0.23158	0.19211	0.17895	0.17632	-0.08947
0.00263	0.00263	-0.04737	0.09211	0.37105	1.08158	0.02105	0.16579	0.02105	-0.06053	-0.35263
0.07368	0.12632	0.09474	0.10526	0.23158	0.02105	0.37895	0.16842	0.11579	0.25263	0.17895
0.08684	0.08684	0.06842	0.09211	0.19211	0.16579	0.16842	0.26053	0.16842	0.21316	-0.05789
0.33684	0.33684	0.41053	0.36842	0.17895	0.02105	0.11579	0.16842	0.69474	0.35789	0.07368
0.12368	0.22895	0.30000	0.17105	0.17632	-0.06053	0.25263	0.21316	0.35789	0.47105	0.00526
0.01579	-0.03684	-0.23158	-0.23684	-0.08947	-0.35263	0.17895	-0.05789	0.07368	0.00526	2.30526

Covariance POOLED

0.59030	0.40260	0.27497	0.29242	0.26368	0.03621	0.22078	0.13674	0.47847	0.17927	0.17805
0.40260	0.61999	0.18590	0.15774	0.22762	0.05742	0.30138	0.15901	0.31835	0.10610	0.10488
0.27497	0.18590	0.49056	0.43001	0.09682	-0.07603	0.12131	0.06882	0.34613	0.40732	-0.00976
0.29242	0.15774	0.43001	0.61108	0.19380	0.03844	0.18876	0.14555	0.33934	0.39634	0.03659
0.26368	0.22762	0.09682	0.19380	0.43547	0.22497	0.23563	0.18128	0.28017	0.13049	0.00732
0.03621	0.05742	-0.07603	0.03844	0.22497	0.86601	0.02036	0.10864	-0.02736	-0.07683	-0.06585
0.22078	0.30138	0.12131	0.18876	0.23563	0.02036	0.60615	0.34528	0.30286	0.16585	0.15610
0.13674	0.15901	0.06882	0.14555	0.18128	0.10864	0.34528	0.43462	0.31347	0.19634	0.09512
0.47847	0.31835	0.34613	0.33934	0.28017	-0.02736	0.30286	0.31347	1.09608	0.48293	0.37561
0.17927	0.10610	0.40732	0.39634	0.13049	-0.07683	0.16585	0.19634	0.48293	0.65732	0.22195
0.17805	0.10488	-0.00976	0.03659	0.00732	-0.06585	0.15610	0.09512	0.37561	0.22195	1.84878

Model Inputs:
VAR37; VAR38; VAR39; VAR40; VAR41; VAR42; VAR43; VAR44; VAR45; VAR46; VAR47
VAR137; VAR138; VAR139; VAR140; VAR141; VAR142; VAR143; VAR144; VAR145; VAR146; VAR147
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Hotelling T-Square: Two Independent Variable
Equal Variance with Multiple Related Measures

Hotelling T2 20.82888
F Statistic 1.43170
P-value   0.20840

Null hypothesis tested is that there is zero difference between
all the related variables compared across the two groups.

Covariance GROUP 1

0.70356	0.21739	0.52569	0.56917	-0.09091	-0.01779	0.27075	0.09486	0.37747	0.34387	0.03755
0.21739	0.53755	0.12055	0.23715	0.00000	0.00395	0.02569	0.22134	0.18379	0.21146	-0.07905
0.52569	0.12055	0.69565	0.56522	-0.18182	-0.26482	0.05138	0.16996	0.36759	0.37747	0.16008
0.56917	0.23715	0.56522	0.88538	0.00000	0.01779	0.32016	0.31423	0.66798	0.65613	0.00791
-0.09091	0.00000	-0.18182	0.00000	0.54545	0.22727	0.18182	0.22727	0.31818	0.22727	-0.13636
-0.01779	0.00395	-0.26482	0.01779	0.22727	1.13439	0.41897	0.52569	0.47628	0.09881	-0.50593
0.27075	0.02569	0.05138	0.32016	0.18182	0.41897	0.99605	0.18972	0.39130	0.27866	-0.15217
0.09486	0.22134	0.16996	0.31423	0.22727	0.52569	0.18972	1.07510	0.53557	0.39723	0.03162
0.37747	0.18379	0.36759	0.66798	0.31818	0.47628	0.39130	0.53557	1.35178	0.77668	0.01976
0.34387	0.21146	0.37747	0.65613	0.22727	0.09881	0.27866	0.39723	0.77668	0.78656	0.11462
0.03755	-0.07905	0.16008	0.00791	-0.13636	-0.50593	-0.15217	0.03162	0.01976	0.11462	1.39130

Covariance GROUP 2

0.48421	0.32632	0.33684	0.22105	0.01053	0.07368	-0.10526	-0.05263	0.23158	0.31579	0.24211
0.32632	0.48421	0.44211	0.27368	0.11579	0.07368	-0.15789	0.15789	0.17895	0.31579	0.24211
0.33684	0.44211	0.66053	0.29737	0.17895	0.13421	-0.18421	0.13158	0.25263	0.35526	0.35263
0.22105	0.27368	0.29737	0.47105	0.16842	0.13947	-0.02632	-0.02632	0.38947	0.38158	-0.15263
0.01053	0.11579	0.17895	0.16842	0.69474	0.28421	0.21053	0.26316	0.02105	0.15789	-0.07368
0.07368	0.07368	0.13421	0.13947	0.28421	0.55526	0.23684	0.13158	0.20000	0.30263	-0.06842
-0.10526	-0.15789	-0.18421	-0.02632	0.21053	0.23684	0.68421	0.15789	-0.10526	-0.13158	-0.26316
-0.05263	0.15789	0.13158	-0.02632	0.26316	0.13158	0.15789	0.68421	-0.10526	0.02632	0.21053
0.23158	0.17895	0.25263	0.38947	0.02105	0.20000	-0.10526	-0.10526	0.77895	0.42105	-0.20000
0.31579	0.31579	0.35526	0.38158	0.15789	0.30263	-0.13158	0.02632	0.42105	0.61842	0.07895
0.24211	0.24211	0.35263	-0.15263	-0.07368	-0.06842	-0.26316	0.21053	-0.20000	0.07895	1.35789

Covariance POOLED

0.60191	0.26787	0.43818	0.40785	-0.04390	0.02460	0.09650	0.02651	0.30986	0.33086	0.13234
0.26787	0.51283	0.26957	0.25408	0.05366	0.03627	-0.05938	0.19194	0.18155	0.25981	0.06978
0.43818	0.26957	0.67937	0.44109	-0.01463	-0.07990	-0.05779	0.15217	0.31432	0.36718	0.24931
0.40785	0.25408	0.44109	0.69337	0.07805	0.07418	0.15960	0.15642	0.53892	0.52890	-0.06649
-0.04390	0.05366	-0.01463	0.07805	0.61463	0.25366	0.19512	0.24390	0.18049	0.19512	-0.10732
0.02460	0.03627	-0.07990	0.07418	0.25366	0.86601	0.33457	0.34305	0.34825	0.19327	-0.30318
0.09650	-0.05938	-0.05779	0.15960	0.19512	0.33457	0.85154	0.17497	0.16119	0.08855	-0.20361
0.02651	0.19194	0.15217	0.15642	0.24390	0.34305	0.17497	0.89396	0.23860	0.22534	0.11453
0.30986	0.18155	0.31432	0.53892	0.18049	0.34825	0.16119	0.23860	1.08632	0.61188	-0.08208
0.33086	0.25981	0.36718	0.52890	0.19512	0.19327	0.08855	0.22534	0.61188	0.70864	0.09809
0.13234	0.06978	0.24931	-0.06649	-0.10732	-0.30318	-0.20361	0.11453	-0.08208	0.09809	1.37582

Model Inputs:
VAR48; VAR49; VAR50; VAR51
VAR148; VAR149; VAR150; VAR151
C1, C2, C3, C4
C1, C2, C3, C4

Hotelling T-Square: Two Independent Variable
Equal Variance with Multiple Related Measures

Hotelling T2 2.31670
F Statistic 0.53680
P-value   0.70953

Null hypothesis tested is that there is zero difference between
all the related variables compared across the two groups.

Covariance GROUP 1

1.69170	1.05336	0.65810	0.65613
1.05336	1.53360	0.76285	0.69763
0.65810	0.76285	0.80237	0.45257
0.65613	0.69763	0.45257	0.58498

Covariance GROUP 2

1.41053	0.25263	0.13684	0.09474
0.25263	0.55526	0.22895	0.21316
0.13684	0.22895	0.36579	-0.00789
0.09474	0.21316	-0.00789	0.55526

Covariance POOLED

1.56140	0.68229	0.41654	0.39597
0.68229	1.08022	0.51543	0.47312
0.41654	0.51543	0.60005	0.23918
0.39597	0.47312	0.23918	0.57121

Model Inputs:
VAR52; VAR53; VAR54
VAR152; VAR153; VAR154
D1, D2, D3
D1, D2, D3

Hotelling T-Square: Two Independent Variable
Equal Variance with Multiple Related Measures

Hotelling T2 2.85372
F Statistic 0.90484
P-value 0.44753

Null hypothesis tested is that there is zero difference between
all the related variables compared across the two groups.

Covariance GROUP 1

0.00000	0.00000	0.00000
0.00000	15.56621	13.61660
0.00000	13.61660	17.73419

Covariance GROUP 2

0.23947	-0.26711	-1.00395
-0.26711	9.35461	10.39408
-1.00395	10.39408	15.11776

Covariance POOLED

0.11098	-0.12378	-0.46524
-0.12378	12.68766	12.12324
-0.46524	12.12324	16.52170

Hotelling T-Square: Two Independent Variable Equal Variance with Multiple Related Measures
Hotelling T2 139.29684
F Statistic 9.49751
P-value 0.00000

HotellingTSquare2VARIndep.EqualVariancewithRelatedMeasures (VAR15:VAR25 # VAR415:VAR425)
Null hypothesis tested is that there is zero difference between all the related variables compared across the two groups.

Covariance GROUP 1

0.96838	0.67391	0.70158	0.39130	0.43874	0.31818	0.32411	0.38933	0.95257	0.63834	0.12055
0.67391	0.77075	0.52767	0.30237	0.22332	0.13636	0.17194	0.33597	0.66996	0.46640	0.08696
0.70158	0.52767	0.88538	0.40316	0.46443	0.13636	0.13834	0.38735	0.80237	0.47036	0.19170
0.39130	0.30237	0.40316	0.60079	0.33202	0.00000	-0.03360	0.18775	0.54150	0.50395	0.01383
0.43874	0.22332	0.46443	0.33202	0.44664	0.13636	0.02569	0.21739	0.56719	0.34190	0.12846
0.31818	0.13636	0.13636	0.00000	0.13636	0.72727	0.18182	0.31818	0.45455	0.22727	0.13636
0.32411	0.17194	0.13834	-0.03360	0.02569	0.18182	0.45059	0.22530	0.25889	0.15020	-0.06522
0.38933	0.33597	0.38735	0.18775	0.21739	0.31818	0.22530	0.61265	0.47036	0.30237	0.12648
0.95257	0.66996	0.80237	0.54150	0.56719	0.45455	0.25889	0.47036	1.29249	0.75296	0.38538
0.63834	0.46640	0.47036	0.50395	0.34190	0.22727	0.15020	0.30237	0.75296	0.83794	0.16008
0.12055	0.08696	0.19170	0.01383	0.12846	0.13636	-0.06522	0.12648	0.38538	0.16008	1.26482

Covariance GROUP 2

0.09942	0.04971	0.04971	0.04971	0.11404	0.00585	0.02047	0.00877	0.24854	0.09357	0.08187
0.04971	0.05263	-0.00292	-0.00292	0.02924	0.00292	-0.01754	-0.02339	0.09649	-0.00877	0.04094
0.04971	-0.00292	0.05263	0.05263	0.08480	0.00292	0.03801	0.03216	0.15205	0.10234	0.04094
0.04971	-0.00292	0.05263	0.05263	0.08480	0.00292	0.03801	0.03216	0.15205	0.10234	0.04094
0.11404	0.02924	0.08480	0.08480	0.37427	0.19298	0.11988	0.23392	0.31287	0.19883	0.25731
0.00585	0.00292	0.00292	0.00292	0.19298	0.60819	0.01754	0.19006	0.01462	0.06433	-0.15205
0.02047	-0.01754	0.03801	0.03801	0.11988	0.01754	0.33918	0.24854	0.07895	0.11404	-0.08772
0.00877	-0.02339	0.03216	0.03216	0.23392	0.19006	0.24854	0.36842	0.04971	0.09649	-0.00585
0.24854	0.09649	0.15205	0.15205	0.31287	0.01462	0.07895	0.04971	0.64912	0.28947	0.20468
0.09357	-0.00877	0.10234	0.10234	0.19883	0.06433	0.11404	0.09649	0.28947	0.25146	0.01170
0.08187	0.04094	0.04094	0.04094	0.25731	-0.15205	-0.08772	-0.00585	0.20468	0.01170	2.31579

Covariance POOLED

0.57735	0.39302	0.40824	0.23759	0.29262	0.17763	0.18747	0.21808	0.63576	0.39319	0.10315
0.39302	0.44760	0.28890	0.16499	0.13598	0.07632	0.08667	0.17426	0.41190	0.25257	0.06625
0.40824	0.28890	0.51064	0.24542	0.29359	0.07632	0.09319	0.22752	0.50973	0.30475	0.12386
0.23759	0.16499	0.24542	0.35412	0.22077	0.00132	-0.00137	0.11773	0.36625	0.32323	0.02603
0.29262	0.13598	0.29359	0.22077	0.41407	0.16184	0.06808	0.22483	0.45275	0.27752	0.18644
0.17763	0.07632	0.07632	0.00132	0.16184	0.67368	0.10789	0.26053	0.25658	0.15395	0.00658
0.18747	0.08667	0.09319	-0.00137	0.06808	0.10789	0.40046	0.23576	0.17792	0.13392	-0.07534
0.21808	0.17426	0.22752	0.11773	0.22483	0.26053	0.23576	0.50275	0.28106	0.20973	0.06693
0.63576	0.41190	0.50973	0.36625	0.45275	0.25658	0.17792	0.28106	1.00297	0.54439	0.30406
0.39319	0.25257	0.30475	0.32323	0.27752	0.15395	0.13392	0.20973	0.54439	0.57403	0.09331
0.10315	0.06625	0.12386	0.02603	0.18644	0.00658	-0.07534	0.06693	0.30406	0.09331	1.73776

Hotelling T-Square: Two Independent Variable Equal Variance with Multiple Related Measures
Hotelling T2 39.97638
F Statistic 2.72566
P-value 0.01441

HotellingTSquare2VARIndep.EqualVariancewithRelatedMeasures (VAR26:VAR36 # VAR426:VAR436)
Null hypothesis tested is that there is zero difference between all the related variables compared across the two groups.

Covariance GROUP 1

0.71146	0.54348	0.28063	0.21542	0.23913	0.06522	0.34783	0.17984	0.60079	0.22727	0.31818
0.54348	0.76680	0.06917	0.05534	0.26285	0.10474	0.45257	0.22134	0.30237	0.00000	0.22727
0.28063	0.06917	0.54150	0.50593	-0.00593	-0.10079	0.14427	0.06917	0.29051	0.50000	0.18182
0.21542	0.05534	0.50593	0.69565	0.07708	-0.00791	0.26087	0.19170	0.31423	0.59091	0.27273
0.23913	0.26285	-0.00593	0.07708	0.33202	0.09881	0.23913	0.17194	0.36759	0.09091	0.09091
0.06522	0.10474	-0.10079	-0.00791	0.09881	0.67984	0.01976	0.05929	-0.06917	-0.09091	0.18182
0.34783	0.45257	0.14427	0.26087	0.23913	0.01976	0.80237	0.49802	0.46443	0.09091	0.13636
0.17984	0.22134	0.06917	0.19170	0.17194	0.05929	0.49802	0.58498	0.43874	0.18182	0.22727
0.60079	0.30237	0.29051	0.31423	0.36759	-0.06917	0.46443	0.43874	1.44269	0.59091	0.63636
0.22727	0.00000	0.50000	0.59091	0.09091	-0.09091	0.09091	0.18182	0.59091	0.81818	0.40909
0.31818	0.22727	0.18182	0.27273	0.09091	0.18182	0.13636	0.22727	0.63636	0.40909	1.45455

Covariance GROUP 2

1.09942	1.20175	1.06140	1.27193	0.43275	0.11111	0.71637	0.43275	1.16082	1.00585	0.12281
1.20175	1.67251	1.31579	1.51754	0.64620	0.38889	1.01754	0.70175	1.51754	1.31579	0.46491
1.06140	1.31579	1.27485	1.39181	0.45029	0.22222	0.66959	0.39474	1.33626	1.21930	0.10526
1.27193	1.51754	1.39181	1.71930	0.66082	0.33333	0.94152	0.66082	1.55263	1.44737	0.45029
0.43275	0.64620	0.45029	0.66082	1.09942	0.83333	0.71637	1.09942	0.71637	0.83918	0.56725
0.11111	0.38889	0.22222	0.33333	0.83333	1.33333	0.50000	1.05556	0.44444	0.61111	0.38889
0.71637	1.01754	0.66959	0.94152	0.71637	0.50000	1.27485	0.88304	1.10819	0.89181	0.45029
0.43275	0.70175	0.39474	0.66082	1.09942	1.05556	0.88304	1.32164	0.71637	0.78363	0.67836
1.16082	1.51754	1.33626	1.55263	0.71637	0.44444	1.10819	0.71637	1.83041	1.55848	0.17251
1.00585	1.31579	1.21930	1.44737	0.83918	0.61111	0.89181	0.78363	1.55848	1.49708	0.27193
0.12281	0.46491	0.10526	0.45029	0.56725	0.38889	0.45029	0.67836	0.17251	0.27193	1.98830

Covariance POOLED

0.88604	0.83970	0.63198	0.69085	0.32626	0.08587	0.51367	0.29365	0.85280	0.57763	0.23026
0.83970	1.17437	0.63015	0.71333	0.43535	0.23261	0.70681	0.43753	0.84920	0.59211	0.33421
0.63198	0.63015	0.87151	0.90458	0.19937	0.04457	0.38066	0.21568	0.76110	0.82368	0.14737
0.69085	0.71333	0.90458	1.15629	0.33976	0.14565	0.56716	0.40280	0.87151	0.97632	0.35263
0.32626	0.43535	0.19937	0.33976	0.67735	0.42935	0.45389	0.58930	0.52454	0.42763	0.30526
0.08587	0.23261	0.04457	0.14565	0.42935	0.97391	0.23587	0.50761	0.16196	0.22500	0.27500
0.51367	0.70681	0.38066	0.56716	0.45389	0.23587	1.01499	0.67128	0.75412	0.45132	0.27763
0.29365	0.43753	0.21568	0.40280	0.58930	0.50761	0.67128	0.91648	0.56367	0.45263	0.43026
0.85280	0.84920	0.76110	0.87151	0.52454	0.16196	0.75412	0.56367	1.61716	1.02632	0.42763
0.57763	0.59211	0.82368	0.97632	0.42763	0.22500	0.45132	0.45263	1.02632	1.12368	0.34737
0.23026	0.33421	0.14737	0.35263	0.30526	0.27500	0.27763	0.43026	0.42763	0.34737	1.69474

Hotelling T-Square: Two Independent Variable Equal Variance with Multiple Related Measures
Hotelling T2 27.94832
F Statistic 1.90557
P-value 0.07928

HotellingTSquare2VARIndep.EqualVariancewithRelatedMeasures (VAR37:VAR47 # VAR437:VAR447)
Null hypothesis tested is that there is zero difference between all the related variables compared across the two groups.

Covariance GROUP 1

0.70356	0.21739	0.52569	0.56917	-0.09091	-0.01779	0.27075	0.09486	0.37747	0.34387	0.03755
0.21739	0.53755	0.12055	0.23715	0.00000	0.00395	0.02569	0.22134	0.18379	0.21146	-0.07905
0.52569	0.12055	0.69565	0.56522	-0.18182	-0.26482	0.05138	0.16996	0.36759	0.37747	0.16008
0.56917	0.23715	0.56522	0.88538	0.00000	0.01779	0.32016	0.31423	0.66798	0.65613	0.00791
-0.09091	0.00000	-0.18182	0.00000	0.54545	0.22727	0.18182	0.22727	0.31818	0.22727	-0.13636
-0.01779	0.00395	-0.26482	0.01779	0.22727	1.13439	0.41897	0.52569	0.47628	0.09881	-0.50593
0.27075	0.02569	0.05138	0.32016	0.18182	0.41897	0.99605	0.18972	0.39130	0.27866	-0.15217
0.09486	0.22134	0.16996	0.31423	0.22727	0.52569	0.18972	1.07510	0.53557	0.39723	0.03162
0.37747	0.18379	0.36759	0.66798	0.31818	0.47628	0.39130	0.53557	1.35178	0.77668	0.01976
0.34387	0.21146	0.37747	0.65613	0.22727	0.09881	0.27866	0.39723	0.77668	0.78656	0.11462
0.03755	-0.07905	0.16008	0.00791	-0.13636	-0.50593	-0.15217	0.03162	0.01976	0.11462	1.39130

Covariance GROUP 2

1.57895	1.41228	1.50877	1.48246	0.06140	0.41520	0.59064	0.48538	1.66082	1.17251	0.38012
1.41228	1.57895	1.56433	1.53801	0.00585	0.52632	0.59064	0.48538	1.49415	1.28363	0.60234
1.50877	1.56433	1.98246	1.92398	0.21053	0.50292	0.81871	0.80702	1.73392	1.54386	0.79532
1.48246	1.53801	1.92398	2.04094	0.19006	0.43860	0.75146	0.77485	1.75439	1.57895	0.63158
0.06140	0.00585	0.21053	0.19006	0.80702	0.35380	0.56433	0.76023	0.24854	0.36257	0.17836
0.41520	0.52632	0.50292	0.43860	0.35380	0.84211	0.56725	0.53216	0.70175	0.57602	0.16374
0.59064	0.59064	0.81871	0.75146	0.56433	0.56725	1.38596	1.11696	0.76901	0.73099	0.51462
0.48538	0.48538	0.80702	0.77485	0.76023	0.53216	1.11696	1.32164	0.79532	1.03801	0.52632
1.66082	1.49415	1.73392	1.75439	0.24854	0.70175	0.76901	0.79532	2.25146	1.47076	0.09942
1.17251	1.28363	1.54386	1.57895	0.36257	0.57602	0.73099	1.03801	1.47076	2.25146	0.95614
0.38012	0.60234	0.79532	0.63158	0.17836	0.16374	0.51462	0.52632	0.09942	0.95614	1.76023

Covariance POOLED

1.09748	0.75509	0.96808	0.98015	-0.02237	0.17706	0.41470	0.27059	0.95498	0.71676	0.19170
0.75509	1.00618	0.77025	0.82254	0.00263	0.23902	0.27992	0.34016	0.77346	0.69394	0.22757
0.96808	0.77025	1.27471	1.17666	-0.00526	0.08066	0.39668	0.45664	0.98244	0.90235	0.44594
0.98015	0.82254	1.17666	1.40538	0.08553	0.20715	0.51424	0.52151	1.15686	1.07140	0.28856
-0.02237	0.00263	-0.00526	0.08553	0.66316	0.28421	0.35395	0.46711	0.28684	0.28816	0.00526
0.17706	0.23902	0.08066	0.20715	0.28421	1.00286	0.48570	0.52860	0.57775	0.31356	-0.20458
0.41470	0.27992	0.39668	0.51424	0.35395	0.48570	1.17151	0.60698	0.56127	0.48221	0.14788
0.27059	0.34016	0.45664	0.52151	0.46711	0.52860	0.60698	1.18604	0.65246	0.68558	0.25423
0.95498	0.77346	0.98244	1.15686	0.28684	0.57775	0.56127	0.65246	1.75664	1.08902	0.05561
0.71676	0.69394	0.90235	1.07140	0.28816	0.31356	0.48221	0.68558	1.08902	1.44577	0.49331
0.19170	0.22757	0.44594	0.28856	0.00526	-0.20458	0.14788	0.25423	0.05561	0.49331	1.55732

Hotelling T-Square: Two Independent Variable Equal Variance with Multiple Related Measures
Hotelling T2 108.67832
F Statistic 7.20962
P-value 0.00001

HotellingTSquare2VARIndep.EqualVariancewithRelatedMeasures (VAR115:VAR125 # VAR415:VAR425)
Null hypothesis tested is that there is zero difference between all the related variables compared across the two groups.

Covariance GROUP 1

1.08158	0.33421	0.30526	0.79737	0.58947	0.22895	0.31053	0.30526	0.55000	0.61053	-0.26579
0.33421	0.57632	0.13684	0.34474	0.02105	0.05000	0.33158	0.24211	0.29737	0.32632	0.21842
0.30526	0.13684	0.98947	0.38947	0.06316	-0.38947	0.38947	0.25263	0.48421	0.50526	0.01053
0.79737	0.34474	0.38947	0.99737	0.45263	0.18684	0.24737	0.23158	0.62368	0.67368	-0.08684
0.58947	0.02105	0.06316	0.45263	0.77895	0.49474	0.08421	0.22105	0.09474	0.28421	-0.27368
0.22895	0.05000	-0.38947	0.18684	0.49474	0.89211	-0.03684	0.24211	-0.12368	0.06316	0.00789
0.31053	0.33158	0.38947	0.24737	0.08421	-0.03684	0.74737	0.38947	0.47895	0.35789	0.37368
0.30526	0.24211	0.25263	0.23158	0.22105	0.24211	0.38947	0.56842	0.32632	0.34737	0.11579
0.55000	0.29737	0.48421	0.62368	0.09474	-0.12368	0.47895	0.32632	0.87105	0.65263	0.26579
0.61053	0.32632	0.50526	0.67368	0.28421	0.06316	0.35789	0.34737	0.65263	0.80000	0.17895
-0.26579	0.21842	0.01053	-0.08684	-0.27368	0.00789	0.37368	0.11579	0.26579	0.17895	1.50263

Covariance GROUP 2

0.09942	0.04971	0.04971	0.04971	0.11404	0.00585	0.02047	0.00877	0.24854	0.09357	0.08187
0.04971	0.05263	-0.00292	-0.00292	0.02924	0.00292	-0.01754	-0.02339	0.09649	-0.00877	0.04094
0.04971	-0.00292	0.05263	0.05263	0.08480	0.00292	0.03801	0.03216	0.15205	0.10234	0.04094
0.04971	-0.00292	0.05263	0.05263	0.08480	0.00292	0.03801	0.03216	0.15205	0.10234	0.04094
0.11404	0.02924	0.08480	0.08480	0.37427	0.19298	0.11988	0.23392	0.31287	0.19883	0.25731
0.00585	0.00292	0.00292	0.00292	0.19298	0.60819	0.01754	0.19006	0.01462	0.06433	-0.15205
0.02047	-0.01754	0.03801	0.03801	0.11988	0.01754	0.33918	0.24854	0.07895	0.11404	-0.08772
0.00877	-0.02339	0.03216	0.03216	0.23392	0.19006	0.24854	0.36842	0.04971	0.09649	-0.00585
0.24854	0.09649	0.15205	0.15205	0.31287	0.01462	0.07895	0.04971	0.64912	0.28947	0.20468
0.09357	-0.00877	0.10234	0.10234	0.19883	0.06433	0.11404	0.09649	0.28947	0.25146	0.01170
0.08187	0.04094	0.04094	0.04094	0.25731	-0.15205	-0.08772	-0.00585	0.20468	0.01170	2.31579

Covariance POOLED

0.60377	0.19580	0.18094	0.43364	0.35818	0.12041	0.16942	0.16102	0.40334	0.35903	-0.09666
0.19580	0.32155	0.06885	0.17560	0.02504	0.02710	0.16174	0.11294	0.19964	0.16330	0.13208
0.18094	0.06885	0.53371	0.22560	0.07368	-0.19858	0.21849	0.14538	0.32262	0.30925	0.02532
0.43364	0.17560	0.22560	0.53777	0.27368	0.09737	0.14552	0.13457	0.39424	0.39573	-0.02468
0.35818	0.02504	0.07368	0.27368	0.58208	0.34794	0.10156	0.22731	0.20085	0.24267	-0.01536
0.12041	0.02710	-0.19858	0.09737	0.34794	0.75398	-0.01038	0.21679	-0.05640	0.06373	-0.06991
0.16942	0.16174	0.21849	0.14552	0.10156	-0.01038	0.54879	0.32091	0.28435	0.23926	0.14922
0.16102	0.11294	0.14538	0.13457	0.22731	0.21679	0.32091	0.47112	0.19175	0.22532	0.05661
0.40334	0.19964	0.32262	0.39424	0.20085	-0.05640	0.28435	0.19175	0.76309	0.47596	0.23606
0.35903	0.16330	0.30925	0.39573	0.24267	0.06373	0.23926	0.22532	0.47596	0.53314	0.09758
-0.09666	0.13208	0.02532	-0.02468	-0.01536	-0.06991	0.14922	0.05661	0.23606	0.09758	1.89822

Hotelling T-Square: Two Independent Variable Equal Variance with Multiple Related Measures
Hotelling T2 25.97472
F Statistic 1.72314
P-value 0.12146

HotellingTSquare2VARIndep.EqualVariancewithRelatedMeasures (VAR126:VAR136 # VAR426:VAR436)
Null hypothesis tested is that there is zero difference between all the related variables compared across the two groups.

Covariance GROUP 1

0.45000	0.23947	0.26842	0.38158	0.29211	0.00263	0.07368	0.08684	0.33684	0.12368	0.01579
0.23947	0.45000	0.32105	0.27632	0.18684	0.00263	0.12632	0.08684	0.33684	0.22895	-0.03684
0.26842	0.32105	0.43158	0.34211	0.21579	-0.04737	0.09474	0.06842	0.41053	0.30000	-0.23158
0.38158	0.27632	0.34211	0.51316	0.32895	0.09211	0.10526	0.09211	0.36842	0.17105	-0.23684
0.29211	0.18684	0.21579	0.32895	0.55526	0.37105	0.23158	0.19211	0.17895	0.17632	-0.08947
0.00263	0.00263	-0.04737	0.09211	0.37105	1.08158	0.02105	0.16579	0.02105	-0.06053	-0.35263
0.07368	0.12632	0.09474	0.10526	0.23158	0.02105	0.37895	0.16842	0.11579	0.25263	0.17895
0.08684	0.08684	0.06842	0.09211	0.19211	0.16579	0.16842	0.26053	0.16842	0.21316	-0.05789
0.33684	0.33684	0.41053	0.36842	0.17895	0.02105	0.11579	0.16842	0.69474	0.35789	0.07368
0.12368	0.22895	0.30000	0.17105	0.17632	-0.06053	0.25263	0.21316	0.35789	0.47105	0.00526
0.01579	-0.03684	-0.23158	-0.23684	-0.08947	-0.35263	0.17895	-0.05789	0.07368	0.00526	2.30526

Covariance GROUP 2

1.09942	1.20175	1.06140	1.27193	0.43275	0.11111	0.71637	0.43275	1.16082	1.00585	0.12281
1.20175	1.67251	1.31579	1.51754	0.64620	0.38889	1.01754	0.70175	1.51754	1.31579	0.46491
1.06140	1.31579	1.27485	1.39181	0.45029	0.22222	0.66959	0.39474	1.33626	1.21930	0.10526
1.27193	1.51754	1.39181	1.71930	0.66082	0.33333	0.94152	0.66082	1.55263	1.44737	0.45029
0.43275	0.64620	0.45029	0.66082	1.09942	0.83333	0.71637	1.09942	0.71637	0.83918	0.56725
0.11111	0.38889	0.22222	0.33333	0.83333	1.33333	0.50000	1.05556	0.44444	0.61111	0.38889
0.71637	1.01754	0.66959	0.94152	0.71637	0.50000	1.27485	0.88304	1.10819	0.89181	0.45029
0.43275	0.70175	0.39474	0.66082	1.09942	1.05556	0.88304	1.32164	0.71637	0.78363	0.67836
1.16082	1.51754	1.33626	1.55263	0.71637	0.44444	1.10819	0.71637	1.83041	1.55848	0.17251
1.00585	1.31579	1.21930	1.44737	0.83918	0.61111	0.89181	0.78363	1.55848	1.49708	0.27193
0.12281	0.46491	0.10526	0.45029	0.56725	0.38889	0.45029	0.67836	0.17251	0.27193	1.98830

Covariance POOLED

0.76593	0.70761	0.65420	0.81472	0.36053	0.05541	0.38634	0.25512	0.73770	0.55284	0.06785
0.70761	1.04474	0.80498	0.88016	0.41031	0.19054	0.55989	0.38599	0.91124	0.75768	0.20725
0.65420	0.80498	0.84182	0.85277	0.32987	0.08378	0.37440	0.22717	0.86088	0.74723	-0.06771
0.81472	0.88016	0.85277	1.09993	0.49040	0.20946	0.51209	0.36878	0.94452	0.79196	0.09744
0.36053	0.41031	0.32987	0.49040	0.81999	0.59595	0.46743	0.63350	0.44040	0.49879	0.23001
0.05541	0.19054	0.08378	0.20946	0.59595	1.20405	0.25405	0.59865	0.22703	0.26622	0.00811
0.38634	0.55989	0.37440	0.51209	0.46743	0.25405	0.81479	0.51607	0.59858	0.56358	0.31095
0.25512	0.38599	0.22717	0.36878	0.63350	0.59865	0.51607	0.77674	0.43499	0.49068	0.30028
0.73770	0.91124	0.86088	0.94452	0.44040	0.22703	0.59858	0.43499	1.24723	0.94196	0.12176
0.55284	0.75768	0.74723	0.79196	0.49879	0.26622	0.56358	0.49068	0.94196	0.97020	0.13499
0.06785	0.20725	-0.06771	0.09744	0.23001	0.00811	0.31095	0.30028	0.12176	0.13499	2.15107

Hotelling T-Square: Two Independent Variable Equal Variance with Multiple Related Measures
Hotelling T2 18.33992
F Statistic 1.21665
P-value 0.32320

HotellingTSquare2VARIndep.EqualVariancewithRelatedMeasures (VAR137:VAR147 # VAR437:VAR447)
Null hypothesis tested is that there is zero difference between all the related variables compared across the two groups.

Covariance GROUP 1

0.48421	0.32632	0.33684	0.22105	0.01053	0.07368	-0.10526	-0.05263	0.23158	0.31579	0.24211
0.32632	0.48421	0.44211	0.27368	0.11579	0.07368	-0.15789	0.15789	0.17895	0.31579	0.24211
0.33684	0.44211	0.66053	0.29737	0.17895	0.13421	-0.18421	0.13158	0.25263	0.35526	0.35263
0.22105	0.27368	0.29737	0.47105	0.16842	0.13947	-0.02632	-0.02632	0.38947	0.38158	-0.15263
0.01053	0.11579	0.17895	0.16842	0.69474	0.28421	0.21053	0.26316	0.02105	0.15789	-0.07368
0.07368	0.07368	0.13421	0.13947	0.28421	0.55526	0.23684	0.13158	0.20000	0.30263	-0.06842
-0.10526	-0.15789	-0.18421	-0.02632	0.21053	0.23684	0.68421	0.15789	-0.10526	-0.13158	-0.26316
-0.05263	0.15789	0.13158	-0.02632	0.26316	0.13158	0.15789	0.68421	-0.10526	0.02632	0.21053
0.23158	0.17895	0.25263	0.38947	0.02105	0.20000	-0.10526	-0.10526	0.77895	0.42105	-0.20000
0.31579	0.31579	0.35526	0.38158	0.15789	0.30263	-0.13158	0.02632	0.42105	0.61842	0.07895
0.24211	0.24211	0.35263	-0.15263	-0.07368	-0.06842	-0.26316	0.21053	-0.20000	0.07895	1.35789

Covariance GROUP 2

1.57895	1.41228	1.50877	1.48246	0.06140	0.41520	0.59064	0.48538	1.66082	1.17251	0.38012
1.41228	1.57895	1.56433	1.53801	0.00585	0.52632	0.59064	0.48538	1.49415	1.28363	0.60234
1.50877	1.56433	1.98246	1.92398	0.21053	0.50292	0.81871	0.80702	1.73392	1.54386	0.79532
1.48246	1.53801	1.92398	2.04094	0.19006	0.43860	0.75146	0.77485	1.75439	1.57895	0.63158
0.06140	0.00585	0.21053	0.19006	0.80702	0.35380	0.56433	0.76023	0.24854	0.36257	0.17836
0.41520	0.52632	0.50292	0.43860	0.35380	0.84211	0.56725	0.53216	0.70175	0.57602	0.16374
0.59064	0.59064	0.81871	0.75146	0.56433	0.56725	1.38596	1.11696	0.76901	0.73099	0.51462
0.48538	0.48538	0.80702	0.77485	0.76023	0.53216	1.11696	1.32164	0.79532	1.03801	0.52632
1.66082	1.49415	1.73392	1.75439	0.24854	0.70175	0.76901	0.79532	2.25146	1.47076	0.09942
1.17251	1.28363	1.54386	1.57895	0.36257	0.57602	0.73099	1.03801	1.47076	2.25146	0.95614
0.38012	0.60234	0.79532	0.63158	0.17836	0.16374	0.51462	0.52632	0.09942	0.95614	1.76023

Covariance POOLED

1.01679	0.85462	0.90697	0.83471	0.03528	0.23983	0.23329	0.20910	0.92688	0.73257	0.30925
0.85462	1.01679	0.98805	0.88876	0.06230	0.29388	0.20626	0.31721	0.81878	0.78663	0.41735
0.90697	0.98805	1.30363	1.08869	0.19431	0.31358	0.30370	0.46017	0.97326	0.93350	0.56799
0.83471	0.88876	1.08869	1.23478	0.17895	0.28499	0.35206	0.36344	1.05349	0.96408	0.22888
0.03528	0.06230	0.19431	0.17895	0.74936	0.31807	0.38265	0.50498	0.13172	0.25747	0.04893
0.23983	0.29388	0.31358	0.28499	0.31807	0.69481	0.39758	0.32646	0.44410	0.43563	0.04452
0.23329	0.20626	0.30370	0.35206	0.38265	0.39758	1.02560	0.62447	0.32006	0.28805	0.11522
0.20910	0.31721	0.46017	0.36344	0.50498	0.32646	0.62447	0.99431	0.33286	0.51849	0.36415
0.92688	0.81878	0.97326	1.05349	0.13172	0.44410	0.32006	0.33286	1.49531	0.93172	-0.05434
0.73257	0.78663	0.93350	0.96408	0.25747	0.43563	0.28805	0.51849	0.93172	1.41287	0.50569
0.30925	0.41735	0.56799	0.22888	0.04893	0.04452	0.11522	0.36415	-0.05434	0.50569	1.55363

F. BONFERRONI TESTS

Model Inputs:
VAR1; VAR2; VAR3; VAR4; VAR5; VAR6; VAR7; VAR8; VAR9; VAR10; VAR11; VAR12; VAR13; VAR14
VAR101; VAR102; VAR103; VAR104; VAR105; VAR106; VAR107; VAR108; VAR109; VAR110; VAR111; VAR112; VAR113; VAR114
HA1, HA2, HA3, HA4, AL1, AL2, AL3, AL4, AL5, LN1, LN2, LN3, LN4, LN5
HA1, HA2, HA3, HA4, AL1, AL2, AL3, AL4, AL5, LN1, LN2, LN3, LN4, LN5

Simultaneous Confidence Intervals

Mean Difference of Null	0	0	0	0	0	0	0	0	0	0	0	0	0	
Mean Difference	0.4891	0.0957	-0.2435	-0.2152	0.1457	-0.0957	0.3609	0.0739	-0.1543	-0.2587	-0.6674	-0.0435	0.0043	-0.0217
Variance Group 1	1.1107	0.5850	0.4071	0.5296	0.8577	0.5850	0.9289	1.6047	0.9486	0.6126	1.2688	1.0435	0.6759	0.4427
Variance Group 2	0.8289	0.6737	0.8000	0.5553	1.1026	1.0947	1.0421	1.6737	0.5553	0.5553	1.2079	1.1579	0.6421	0.4737
Pooled Variance	0.9900	0.7913	0.7676	0.7359	0.9855	0.9062	0.9906	1.2793	0.8754	0.7655	1.1138	1.0471	0.8125	0.6761
F-Critical	2.0635	2.0635	2.0635	2.0635	2.0635	2.0635	2.0635	2.0635	2.0635	2.0635	2.0635	2.0635	2.0635	2.0635
T-Critical	6.5040	6.5040	6.5040	6.5040	6.5040	6.5040	6.5040	6.5040	6.5040	6.5040	6.5040	6.5040	6.5040	6.5040
Standard Error	0.3027	0.2419	0.2347	0.2250	0.3013	0.2771	0.3029	0.3911	0.2676	0.2341	0.3405	0.3202	0.2484	0.2067
Lower Confidence	-1.4796	-1.4778	-1.7699	-1.6786	-1.8141	-1.8977	-1.6090	-2.4701	-1.8951	-1.7810	-2.8823	-2.1258	-1.6115	-1.3661
Upper Confidence	2.4578	1.6691	1.2829	1.2481	2.1054	1.7064	2.3308	2.6179	1.5864	1.2636	1.5475	2.0388	1.6201	1.3226
Within Confidence?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Bonferroni Test

	VAR1	VAR2	VAR3	VAR4	VAR5	VAR6	VAR7	VAR8	VAR9	VAR10	VAR11	VAR12	VAR13	VAR14	
Bonferroni Critical	3.0917	3.0917	3.0917	3.0917	3.0917	3.0917	3.0917	3.0917	3.0917	3.0917	3.0917	3.0917	3.0917	3.0917	
Lower Confidence	-3.7485	-3.2912	-3.5290	-3.3651	-4.0727	-3.9746	-3.8794	-5.4021	-3.9014	-3.5355	-5.4349	-4.5256	-3.4737	-2.9155
Upper Confidence	4.7268	3.4825	3.0421	2.9346	4.3640	3.7833	4.6011	5.5500	3.5927	3.0181	4.1001	4.4387	3.4824	2.8720
Within Confidence?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	

Null hypothesis: the individual expected differences are equal to zero

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Model Inputs:

VAR15; VAR16; VAR17; VAR18; VAR19; VAR20; VAR21; VAR22; VAR23; VAR24; VAR25
VAR115; VAR116; VAR117; VAR118; VAR119; VAR120; VAR121; VAR122; VAR123; VAR124; VAR125
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Simultaneous Confidence Intervals

Mean Difference of Null	0	0	0	0	0	0	0	0	0	0	
Mean Difference	0.1761	-0.0935	0.2087	0.2022	0.3130	-0.0500	0.0826	-0.0087	0.3891	0.4609	0.0630
Variance Group 1	0.9684	0.7708	0.8854	0.6008	0.4466	0.7273	0.4506	0.6126	1.2925	0.8379	1.2648
Variance Group 2	1.0816	0.5763	0.9895	0.9974	0.7789	0.8921	0.7474	0.5684	0.8711	0.8000	1.5026
Pooled Variance	1.0104	0.8250	0.9662	0.8858	0.7750	0.8965	0.7669	0.7695	1.0475	0.9057	1.1726
F-Critical	2.1141	2.1141	2.1141	2.1141	2.1141	2.1141	2.1141	2.1141	2.1141	2.1141	2.1141
T-Critical	5.5458	5.5458	5.5458	5.5458	5.5458	5.5458	5.5458	5.5458	5.5458	5.5458	5.5458
Standard Error	0.3089	0.2522	0.2954	0.2708	0.2370	0.2741	0.2345	0.2353	0.3203	0.2769	0.3585
Lower Confidence	-1.5371	-1.4924	-1.4296	-1.2997	-1.0011	-1.5700	-1.2177	-1.3135	-1.3869	-1.0749	-1.9252
Upper Confidence	1.8893	1.3054	1.8470	1.7041	1.6271	1.4700	1.3829	1.2961	2.1652	1.9966	2.0513
Within Confidence?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Bonferroni Test

	VAR1	VAR2	VAR3	VAR4	VAR5	VAR6	VAR7	VAR8	VAR9	VAR10	VAR11		
Bonferroni Critical	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026
Lower Confidence	-3.2219	-2.8681	-3.0409	-2.7768	-2.2934	-3.0650	-2.4966	-2.5967	-3.1337	-2.5853	-3.8807		
Upper Confidence	3.5741	2.6812	3.4583	3.1811	2.9195	2.9650	2.6618	2.5793	3.9119	3.5070	4.0067		
Within Confidence?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		

Null hypothesis: the individual expected differences are equal to zero

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Model Inputs:
VAR26; VAR27; VAR28; VAR29; VAR30; VAR31; VAR32; VAR33; VAR34; VAR35; VAR36
VAR126; VAR127; VAR128; VAR129; VAR130; VAR131; VAR132; VAR133; VAR134; VAR135; VAR136
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Simultaneous Confidence Intervals

Mean Difference of Null	0	0	0	0	0	0	0	0	0	0	0		
Mean Difference	-0.2848	-0.1543	-0.4826	-0.5761	-0.0239	-0.3065	-0.2348	0.1457	-0.2783	-0.4500	-0.1000		
Variance Group 1	0.7115	0.7668	0.5415	0.6957	0.3320	0.6798	0.8024	0.5850	1.4427	0.8182	1.4545		
Variance Group 2	0.4500	0.4500	0.4316	0.5132	0.5553	1.0816	0.3789	0.2605	0.6947	0.4711	2.3053		
Pooled Variance	0.7683	0.7874	0.7004	0.7817	0.6599	0.9306	0.7786	0.6593	1.0469	0.8108	1.3597		
F-Critical	2.1141	2.1141	2.1141	2.1141	2.1141	2.1141	2.1141	2.1141	2.1141	2.1141	2.1141		
T-Critical	5.5458	5.5458	5.5458	5.5458	5.5458	5.5458	5.5458	5.5458	5.5458	5.5458	5.5458		
Standard Error	0.2349	0.2407	0.2141	0.2390	0.2018	0.2845	0.2380	0.2016	0.3201	0.2479	0.4157		
Lower Confidence	-1.5875	-1.4894	-1.6702	-1.9016	-1.1428	-1.8844	-1.5549	-0.9722	-2.0534	-1.8247	-2.4055		
Upper Confidence	1.0180	1.1807	0.7050	0.7494	1.0950	1.2714	1.0853	1.2635	1.4969	0.9247	2.2055		
Within Confidence?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		

Bonferroni Test

	VAR1	VAR2	VAR3	VAR4	VAR5	VAR6	VAR7	VAR8	VAR9	VAR10	VAR11		
Bonferroni Critical	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026		
Lower Confidence	-2.8687	-2.8025	-2.8382	-3.2051	-2.2433	-3.4363	-2.8532	-2.0715	-3.7993	-3.1767	-4.6729		
Upper Confidence	2.2992	2.4938	1.8730	2.0530	2.1954	2.8232	2.3836	2.3629	3.2428	2.2767	4.4729		
Within Confidence?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		

Null hypothesis: the individual expected differences are equal to zero

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Model Inputs:
VAR37; VAR38; VAR39; VAR40; VAR41; VAR42; VAR43; VAR44; VAR45; VAR46; VAR47
VAR137; VAR138; VAR139; VAR140; VAR141; VAR142; VAR143; VAR144; VAR145; VAR146; VAR147
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Simultaneous Confidence Intervals

Mean Difference of Null	0	0	0	0	0	0	0	0	0	0	
Mean Difference	-0.1913	0.2870	-0.6761	-0.1587	0.2000	0.1065	-0.2826	0.0652	-0.1217	-0.0761	-0.0304
Variance Group 1	0.7036	0.5375	0.6957	0.8854	0.5455	1.1344	0.9960	1.0751	1.3518	0.7866	1.3913
Variance Group 2	0.4842	0.4842	0.6605	0.4711	0.6947	0.5553	0.6842	0.6842	0.7789	0.6184	1.3579
Pooled Variance	0.7758	0.7161	0.8242	0.8327	0.7840	0.9306	0.9228	0.9455	1.0423	0.8418	1.1730
F-Critical	2.1141	2.1141	2.1141	2.1141	2.1141	2.1141	2.1141	2.1141	2.1141	2.1141	2.1141
T-Critical	5.5458	5.5458	5.5458	5.5458	5.5458	5.5458	5.5458	5.5458	5.5458	5.5458	5.5458
Standard Error	0.2372	0.2189	0.2520	0.2546	0.2397	0.2845	0.2821	0.2891	0.3187	0.2574	0.3586
Lower Confidence	-1.5068	-0.9273	-2.0737	-1.5706	-1.1293	-1.4714	-1.8473	-1.5379	-1.8890	-1.5035	-2.0193
Upper Confidence	1.1242	1.5012	0.7215	1.2532	1.5293	1.6844	1.2821	1.6684	1.6455	1.3513	1.9584
Within Confidence?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Bonferroni Test

	VAR1	VAR2	VAR3	VAR4	VAR5	VAR6	VAR7	VAR8	VAR9	VAR10	VAR11		
Bonferroni Critical	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026	3.0026	
Lower Confidence	-2.8005	-2.1215	-3.4481	-2.9592	-2.4367	-3.0232	-3.3861	-3.1146	-3.6271	-2.9072	-3.9753		
Upper Confidence	2.4179	2.6954	2.0960	2.6418	2.8367	3.2363	2.8209	3.2451	3.3836	2.7551	3.9144		
Within Confidence?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		

Null hypothesis: the individual expected differences are equal to zero

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Model Inputs:
VAR48; VAR49; VAR50; VAR51
VAR148; VAR149; VAR150; VAR151
C1, C2, C3, C4
C1, C2, C3, C4

Simultaneous Confidence Intervals

Mean Difference of Null	0	0	0	0
Mean Difference	0.0522	-0.3283	-0.0152	-0.0457
Variance Group 1	1.6917	1.5336	0.8024	0.5850
Variance Group 2	1.4105	0.5553	0.3658	0.5553
Pooled Variance	1.2496	1.0393	0.7746	0.7558
F-Critical	2.6190	2.6190	2.6190	2.6190
T-Critical	3.3620	3.3620	3.3620	3.3620
Standard Error	0.3820	0.3178	0.2368	0.2311
Lower Confidence	-1.2323	-1.3966	-0.8115	-0.8225
Upper Confidence	1.3366	0.7401	0.7810	0.7312
Within Confidence?	Yes	Yes	Yes	Yes

Bonferroni Test

	VAR1	VAR2	VAR3	VAR4
Bonferroni Critical	2.6127	2.6127	2.6127	2.6127
Lower Confidence	-1.4760	-1.5993	-0.9626	-0.9700
Upper Confidence	1.5803	0.9428	0.9321	0.8786
Within Confidence?	Yes	Yes	Yes	Yes

Null hypothesis: the individual expected differences are equal to zero

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Model Inputs:
VAR52; VAR53; VAR54
VAR52; VAR53; VAR54
D1, D2, D3
D1, D2, D3

Simultaneous Confidence Intervals

Mean Difference of Null	0	0	0
Mean Difference	0.0000	0.0000	0.0000
Variance Group 1	0.0000	15.5662	17.7342
Variance Group 2	0.0000	15.5662	17.7342
Pooled Variance	0.0000	3.9454	4.2112
F-Critical	2.8270	2.8270	2.8270
T-Critical	2.9808	2.9808	2.9808
Standard Error	0.0000	1.1634	1.2418
Lower Confidence	0.0000	-3.4679	-3.7016
Upper Confidence	0.0000	3.4679	3.7016
Within Confidence?	Yes	Yes	Yes

Bonferroni Test

	VAR1	VAR2	VAR3
Bonferroni Critical	2.4890	2.4890	2.4890
Lower Confidence	0.0000	-3.4903	-3.7254
Upper Confidence	0.0000	3.4903	3.7254
Within Confidence?	Yes	Yes	Yes

Null hypothesis: the individual expected differences are equal to zero

Model Inputs:
VAR15; VAR16; VAR17; VAR18; VAR19; VAR20; VAR21; VAR22; VAR23; VAR24; VAR25
VAR415; VAR416; VAR417; VAR418; VAR419; VAR420; VAR421; VAR422; VAR423; VAR424; VAR425
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Simultaneous Confidence Intervals: BonferroniTestTwoVariableswithRepetition (VAR15:VAR25 # VAR415:VAR425)

Mean Difference of Null	0	0	0	0	0	0	0	0	0	0	0
Mean Difference	-1.0686	-0.9908	-1.3387	-1.2952	-0.6133	-1.0526	-0.9016	-1.1876	-0.9977	-1.5812	0.1762
Variance Group 1	0.9684	0.7708	0.8854	0.6008	0.4466	0.7273	0.4506	0.6126	1.2925	0.8379	1.2648
Variance Group 2	0.0994	0.0526	0.0526	0.0526	0.3743	0.6082	0.3392	0.3684	0.6491	0.2515	2.3158
Pooled Variance	0.7598	0.6690	0.7146	0.5951	0.6435	0.8208	0.6328	0.7090	1.0015	0.7576	1.3182
F-Critical	2.1256	2.1256	2.1256	2.1256	2.1256	2.1256	2.1256	2.1256	2.1256	2.1256	2.1256
T-Critical	5.5834	5.5834	5.5834	5.5834	5.5834	5.5834	5.5834	5.5834	5.5834	5.5834	5.5834
Standard Error	0.2356	0.2074	0.2215	0.1845	0.1995	0.2545	0.1962	0.2198	0.3105	0.2349	0.4087
Lower Confidence	-2.3839	-2.1489	-2.5756	-2.3253	-1.7271	-2.4734	-1.9970	-2.4150	-2.7312	-2.8927	-2.1056
Upper Confidence	0.2466	0.1672	-0.1017	-0.2651	0.5006	0.3681	0.1938	0.0397	0.7358	-0.2698	2.4580
Within Confidence?	Yes	Yes	Low	Low	Yes	Yes	Yes	Yes	Yes	Low	Yes

Bonferroni Test

	VAR1	VAR2	VAR3	VAR4	VAR5	VAR6	VAR7	VAR8	VAR9	VAR10	VAR11
Bonferroni Critical	3.0069	3.0069	3.0069	3.0069	3.0069	3.0069	3.0069	3.0069	3.0069	3.0069	3.0069
Lower Confidence	-3.6598	-3.2723	-3.7756	-3.3245	-2.8077	-3.8516	-3.0596	-3.6056	-4.4130	-4.1649	-4.3192
Upper Confidence	1.5225	1.2907	1.0982	0.7341	1.5811	1.7464	1.2564	1.2303	2.4175	1.0025	4.6716
Within Confidence?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Null hypothesis: the individual expected differences are equal to zero

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Model Inputs:
VAR26; VAR27; VAR28; VAR29; VAR30; VAR31; VAR32; VAR33; VAR34; VAR35; VAR36
VAR426; VAR427; VAR428; VAR429; VAR430; VAR431; VAR432; VAR433; VAR434; VAR435; VAR436
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Simultaneous Confidence Intervals: BonferroniTestTwoVariableswithRepetition (VAR26:VAR36 # VAR426:VAR436)

Mean Difference of Null	0	0	0	0	0	0	0	0	0	0	0
Mean Difference	-0.5400	0.0114	-0.7300	-0.8787	-0.2792	-0.9565	-0.4874	-0.4096	-0.5309	-0.9474	0.1053
Variance Group 1	0.7115	0.7668	0.5415	0.6957	0.3320	0.6798	0.8024	0.5850	1.4427	0.8182	1.4545
Variance Group 2	1.0994	1.6725	1.2749	1.7193	1.0994	1.3333	1.2749	1.3216	1.8304	1.4971	1.9883
Pooled Variance	0.9413	1.0837	0.9335	1.0753	0.8230	0.9869	1.0075	0.9573	1.2717	1.0600	1.3018
F-Critical	2.1256	2.1256	2.1256	2.1256	2.1256	2.1256	2.1256	2.1256	2.1256	2.1256	2.1256
T-Critical	5.5834	5.5834	5.5834	5.5834	5.5834	5.5834	5.5834	5.5834	5.5834	5.5834	5.5834
Standard Error	0.2918	0.3360	0.2894	0.3334	0.2551	0.3059	0.3123	0.2968	0.3942	0.3286	0.4036
Lower Confidence	-2.1694	-1.8644	-2.3459	-2.7400	-1.7038	-2.6648	-2.2313	-2.0667	-2.7321	-2.7823	-2.1481
Upper Confidence	1.0893	1.8873	0.8860	0.9826	1.1454	0.7517	1.2565	1.2475	1.6703	0.8875	2.3587
Within Confidence?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Bonferroni Test

	VAR1	VAR2	VAR3	VAR4	VAR5	VAR6	VAR7	VAR8	VAR9	VAR10	VAR11
Bonferroni Critical	3.0069	3.0069	3.0069	3.0069	3.0069	3.0069	3.0069	3.0069	3.0069	3.0069	3.0069
Lower Confidence	-3.7500	-3.6841	-3.9135	-4.5457	-3.0858	-4.3219	-3.9231	-3.6743	-4.8675	-4.5623	-4.3342
Upper Confidence	2.6699	3.7070	2.4536	2.7883	2.5274	2.4089	2.9482	2.8550	3.8057	2.6676	4.5447
Within Confidence?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Null hypothesis: the individual expected differences are equal to zero

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Model Inputs:
VAR37; VAR38; VAR39; VAR40; VAR41; VAR42; VAR43; VAR44; VAR45; VAR46; VAR47
VAR437; VAR438; VAR439; VAR440; VAR441; VAR442; VAR443; VAR444; VAR445; VAR446; VAR447
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Simultaneous Confidence Intervals: BonferroniTestTwoVariableswithRepetition (VAR37:VAR47 # VAR437:VAR447)

Mean Difference of Null	0	0	0	0	0	0	0	0	0	0	0
Mean Difference	0.2403	0.7185	-0.0892	-0.0824	0.1579	0.1670	-0.8352	-0.3295	0.3204	0.3318	0.1327
Variance Group 1	0.7036	0.5375	0.6957	0.8854	0.5455	1.1344	0.9960	1.0751	1.3518	0.7866	1.3913
Variance Group 2	1.5789	1.5789	1.9825	2.0409	0.8070	0.8421	1.3860	1.3216	2.2515	2.2515	1.7602
Pooled Variance	1.0476	1.0031	1.1290	1.1855	0.8143	1.0014	1.0824	1.0891	1.3254	1.2024	1.2479
F-Critical	2.1256	2.1256	2.1256	2.1256	2.1256	2.1256	2.1256	2.1256	2.1256	2.1256	2.1256
T-Critical	5.5834	5.5834	5.5834	5.5834	5.5834	5.5834	5.5834	5.5834	5.5834	5.5834	5.5834
Standard Error	0.3248	0.3110	0.3500	0.3675	0.2525	0.3105	0.3355	0.3376	0.4109	0.3728	0.3869
Lower Confidence	-1.5731	-1.0178	-2.0436	-2.1344	-1.2517	-1.5664	-2.7088	-2.2146	-1.9738	-1.7495	-2.0274
Upper Confidence	2.0536	2.4548	1.8651	1.9696	1.5675	1.9005	1.0383	1.5556	2.6145	2.4131	2.2928
Within Confidence?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Bonferroni Test

	VAR1	VAR2	VAR3	VAR4	VAR5	VAR6	VAR7	VAR8	VAR9	VAR10	VAR11
Bonferroni Critical	3.0069	3.0069	3.0069	3.0069	3.0069	3.0069	3.0069	3.0069	3.0069	3.0069	3.0069
Lower Confidence	-3.3323	-2.7022	-3.9394	-4.1251	-2.6192	-3.2480	-4.5263	-4.0434	-4.1994	-3.7686	-4.1229
Upper Confidence	3.8128	4.1392	3.7610	3.9603	2.9350	3.5821	2.8558	3.3843	4.8401	4.4322	4.3884
Within Confidence?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Null hypothesis: the individual expected differences are equal to zero

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Model Inputs:
VAR115; VAR116; VAR117; VAR118; VAR119; VAR120; VAR121; VAR122; VAR123; VAR124; VAR125
VAR415; VAR416; VAR417; VAR418; VAR419; VAR420; VAR421; VAR422; VAR423; VAR424; VAR425
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Simultaneous Confidence Intervals: BonferroniTestTwoVariableswithRepetition (VAR115:VAR125 # VAR415:VAR425)

Mean Difference of Null	0	0	0	0	0	0	0	0	0	0	0
Mean Difference	-1.2447	-0.8974	-1.5474	-1.4974	-0.9263	-1.0026	-0.9842	-1.1789	-1.3868	-2.0421	0.1132
Variance Group 1	1.0816	0.5763	0.9895	0.9974	0.7789	0.8921	0.7474	0.5684	0.8711	0.8000	1.5026
Variance Group 2	0.0994	0.0526	0.0526	0.0526	0.3743	0.6082	0.3392	0.3684	0.6491	0.2515	2.3158
Pooled Variance	0.7770	0.5671	0.7306	0.7333	0.7629	0.8683	0.7408	0.6864	0.8735	0.7302	1.3778
F-Critical	2.1655	2.1655	2.1655	2.1655	2.1655	2.1655	2.1655	2.1655	2.1655	2.1655	2.1655
T-Critical	5.7135	5.7135	5.7135	5.7135	5.7135	5.7135	5.7135	5.7135	5.7135	5.7135	5.7135
Standard Error	0.2489	0.1817	0.2340	0.2349	0.2444	0.2782	0.2373	0.2199	0.2799	0.2339	0.4414
Lower Confidence	-2.6670	-1.9353	-2.8846	-2.8396	-2.3228	-2.5920	-2.3402	-2.4353	-2.9858	-3.3786	-2.4087
Upper Confidence	0.1775	0.1406	-0.2102	-0.1551	0.4701	0.5867	0.3717	0.0774	0.2121	-0.7056	2.6350
Within Confidence?	Yes	Yes	Low	Low	Yes	Yes	Yes	Yes	Yes	Low	Yes

Bonferroni Test

	VAR1	VAR2	VAR3	VAR4	VAR5	VAR6	VAR7	VAR8	VAR9	VAR10	VAR11
Bonferroni Critical	3.0214	3.0214	3.0214	3.0214	3.0214	3.0214	3.0214	3.0214	3.0214	3.0214	3.0214
Lower Confidence	-3.9830	-2.8957	-4.1218	-4.0816	-3.6149	-4.0626	-3.5948	-3.5978	-4.4652	-4.6152	-4.7420
Upper Confidence	1.4935	1.1009	1.0271	1.0869	1.7623	2.0573	1.6264	1.2399	1.6915	0.5310	4.9684
Within Confidence?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Null hypothesis: the individual expected differences are equal to zero
---

Model Inputs:

VAR126; VAR127; VAR128; VAR129; VAR130; VAR131; VAR132; VAR133; VAR134; VAR135; VAR136
VAR426; VAR427; VAR428; VAR429; VAR430; VAR431; VAR432; VAR433; VAR434; VAR435; VAR436
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Simultaneous Confidence Intervals: BonferroniTestTwoVariableswithRepetition (VAR126:VAR136 # VAR426:VAR436)

Mean Difference of Null	0	0	0	0	0	0	0	0	0	0	0
Mean Difference	-0.2553	0.1658	-0.2474	-0.3026	-0.2553	-0.6500	-0.2526	-0.5553	-0.2526	-0.4974	0.2053
Variance Group 1	0.4500	0.4500	0.4316	0.5132	0.5553	1.0816	0.3789	0.2605	0.6947	0.4711	2.3053
Variance Group 2	1.0994	1.6725	1.2749	1.7193	1.0994	1.3333	1.2749	1.3216	1.8304	1.4971	1.9883
Pooled Variance	0.8752	1.0221	0.9175	1.0488	0.9055	1.0973	0.9027	0.8813	1.1168	0.9850	1.4667
F-Critical	2.1655	2.1655	2.1655	2.1655	2.1655	2.1655	2.1655	2.1655	2.1655	2.1655	2.1655
T-Critical	5.7135	5.7135	5.7135	5.7135	5.7135	5.7135	5.7135	5.7135	5.7135	5.7135	5.7135
Standard Error	0.2804	0.3274	0.2939	0.3360	0.2901	0.3515	0.2892	0.2823	0.3578	0.3156	0.4699
Lower Confidence	-1.8572	-1.7051	-1.9267	-2.2223	-1.9127	-2.6585	-1.9048	-2.1684	-2.2968	-2.3003	-2.4793
Upper Confidence	1.3466	2.0367	1.4320	1.6170	1.4022	1.3585	1.3996	1.0579	1.7915	1.3055	2.8898
Within Confidence?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Bonferroni Test

	VAR1	VAR2	VAR3	VAR4	VAR5	VAR6	VAR7	VAR8	VAR9	VAR10	VAR11
Bonferroni Critical	3.0214	3.0214	3.0214	3.0214	3.0214	3.0214	3.0214	3.0214	3.0214	3.0214	3.0214
Lower Confidence	-3.3394	-3.4362	-3.4806	-3.9985	-3.4463	-4.5168	-3.4336	-3.6611	-4.1882	-3.9684	-4.9632
Upper Confidence	2.8288	3.7677	2.9859	3.3932	2.9358	3.2168	2.9283	2.5505	3.6829	2.9737	5.3737
Within Confidence?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Null hypothesis: the individual expected differences are equal to zero

---

Model Inputs:
VAR137; VAR138; VAR139; VAR140; VAR141; VAR142; VAR143; VAR144; VAR145; VAR146; VAR147
VAR437; VAR438; VAR439; VAR440; VAR441; VAR442; VAR443; VAR444; VAR445; VAR446; VAR447
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Simultaneous Confidence Intervals: BonferroniTestTwoVariableswithRepetition (VAR137:VAR147 # VAR437:VAR447)

Mean Difference of Null	0	0	0	0	0	0	0	0	0	0	0
Mean Difference	0.4316	0.4316	0.5868	0.0763	-0.0421	0.0605	-0.5526	-0.3947	0.4421	0.4079	0.1632
Variance Group 1	0.4842	0.4842	0.6605	0.4711	0.6947	0.5553	0.6842	0.6842	0.7789	0.6184	1.3579
Variance Group 2	1.5789	1.5789	1.9825	2.0409	0.8070	0.8421	1.3860	1.3216	2.2515	2.2515	1.7602
Pooled Variance	1.0084	1.0084	1.1418	1.1112	0.8657	0.8336	1.0127	0.9972	1.2228	1.1886	1.2464
F-Critical	2.1655	2.1655	2.1655	2.1655	2.1655	2.1655	2.1655	2.1655	2.1655	2.1655	2.1655
T-Critical	5.7135	5.7135	5.7135	5.7135	5.7135	5.7135	5.7135	5.7135	5.7135	5.7135	5.7135
Standard Error	0.3230	0.3230	0.3658	0.3560	0.2773	0.2670	0.3244	0.3194	0.3917	0.3808	0.3993
Lower Confidence	-1.4141	-1.4141	-1.5030	-1.9576	-1.6266	-1.4652	-2.4063	-2.2199	-1.7961	-1.7678	-2.1183
Upper Confidence	2.2772	2.2772	2.6767	2.1102	1.5424	1.5862	1.3010	1.4304	2.6803	2.5836	2.4446
Within Confidence?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Bonferroni Test

	VAR1	VAR2	VAR3	VAR4	VAR5	VAR6	VAR7	VAR8	VAR9	VAR10	VAR11
Bonferroni Critical	3.0214	3.0214	3.0214	3.0214	3.0214	3.0214	3.0214	3.0214	3.0214	3.0214	3.0214
Lower Confidence	-3.1219	-3.1219	-3.4367	-3.8396	-3.0927	-2.8769	-4.1214	-3.9087	-3.8671	-3.7809	-4.2293
Upper Confidence	3.9850	3.9850	4.6104	3.9922	3.0084	2.9979	3.0162	3.1192	4.7513	4.5966	4.5556
Within Confidence?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Null hypothesis: the individual expected differences are equal to zero

G. ANOVA SINGLE FACTOR MULTIPLE TREATMENTS I: COMPARING THREE LOA WITHIN THE SAME SYSTEM PRESENTATION

Model Inputs:
VAR15; VAR26; VAR37
PU1, PU1, PU1

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.90	0.45	0.5655	0.5708
Within Groups	66	52.43	0.79		
Total	68	53.33	0.78		

F Critical @ 0.10 2.384818
F Critical @ 0.05 3.135918
F Critical @ 0.01 4.941981
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR16; VAR27; VAR38
PU2, PU2, PU2

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	1.83	0.91	1.3200	0.2741
Within Groups	66	45.65	0.69		
Total	68	47.48	0.70		

F Critical @ 0.10 2.384818
F Critical @ 0.05 3.135918
F Critical @ 0.01 4.941981
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR17; VAR28; VAR39
PU3, PU3, PU3

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	2.64	1.32	1.8641	0.1631
Within Groups	66	46.70	0.71		
Total	68	49.33	0.73		

F Critical @ 0.10 2.384818
F Critical @ 0.05 3.135918
F Critical @ 0.01 4.941981
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR18; VAR29; VAR40
PU4, PU4, PU4

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	2.64	1.32	1.8134	0.1711
Within Groups	66	48.00	0.73		
Total	68	50.64	0.74		

F Critical @ 0.10 2.384818
F Critical @ 0.05 3.135918
F Critical @ 0.01 4.941981
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR19; VAR30; VAR41
PEOU1, PEOU1, PEOU1

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.35	0.17	0.3940	0.6759
Within Groups	66	29.13	0.44		
Total	68	29.48	0.43		

F Critical @ 0.10 2.384818
F Critical @ 0.05 3.135918
F Critical @ 0.01 4.941981
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR20; VAR31; VAR42
PEOU2, PEOU2, PEOU2

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	13.42	6.71	7.9207	0.0008
Within Groups	66	55.91	0.85		
Total	68	69.33	1.02		

F Critical @ 0.10 2.384818
F Critical @ 0.05 3.135918
F Critical @ 0.01 4.941981

Model Inputs:
VAR21; VAR32; VAR43
PEOU3, PEOU3, PEOU3

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	3.74	1.87	2.4938	0.0903
Within Groups	66	49.48	0.75		
Total	68	53.22	0.78		

F Critical @ 0.10 2.384818
F Critical @ 0.05 3.135918
F Critical @ 0.01 4.941981

Model Inputs:
VAR22; VAR33; VAR44
PEOU4, PEOU4, PEOU4

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	1.07	0.54	0.7078	0.4964
Within Groups	66	50.00	0.76		
Total	68	51.07	0.75		

F Critical @ 0.10 2.384818
F Critical @ 0.05 3.135918
F Critical @ 0.01 4.941981
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR23; VAR34; VAR45
IU1, IU1, IU1

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.90	0.45	0.3298	0.7203
Within Groups	66	89.91	1.36		
Total	68	90.81	1.34		

F Critical @ 0.10 2.384818
F Critical @ 0.05 3.135918
F Critical @ 0.01 4.941981
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR24; VAR35; VAR46
IU2, IU2, IU2

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.81	0.41	0.4984	0.6098
Within Groups	66	53.74	0.81		
Total	68	54.55	0.80		

F Critical @ 0.10 2.384818
F Critical @ 0.05 3.135918
F Critical @ 0.01 4.941981
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR25; VAR36; VAR47
IU3, IU3, IU3

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.20	0.10	0.0740	0.9287
Within Groups	66	90.43	1.37		
Total	68	90.64	1.33		

F Critical @ 0.10 2.384818
F Critical @ 0.05 3.135918
F Critical @ 0.01 4.941981
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR115; VAR126; VAR137
PU1, PU1, PU1

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.43	0.22	0.3225	0.7257
Within Groups	57	38.30	0.67		
Total	59	38.73	0.66		

F Critical @ 0.10 2.398157
F Critical @ 0.05 3.158843
F Critical @ 0.01 4.998109
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR116; VAR127; VAR138
PU2, PU2, PU2

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.70	0.35	0.6951	0.5032
Within Groups	57	28.70	0.50		
Total	59	29.40	0.50		

F Critical @ 0.10 2.398157
F Critical @ 0.05 3.158843
F Critical @ 0.01 4.998109
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR117; VAR128; VAR139
PU3, PU3, PU3

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	2.10	1.05	1.5133	0.2289
Within Groups	57	39.55	0.69		
Total	59	41.65	0.71		

F Critical @ 0.10 2.398157
F Critical @ 0.05 3.158843
F Critical @ 0.01 4.998109
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR118; VAR129; VAR140
PU4, PU4, PU4

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.93	0.47	0.7065	0.4976
Within Groups	57	37.65	0.66		
Total	59	38.58	0.65		

F Critical @ 0.10 2.398157
F Critical @ 0.05 3.158843
F Critical @ 0.01 4.998109
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR119; VAR130; VAR141
PEOU1, PEOU1, PEOU1

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.70	0.35	0.5175	0.5988
Within Groups	57	38.55	0.68		
Total	59	39.25	0.67		

F Critical @ 0.10 2.398157
F Critical @ 0.05 3.158843
F Critical @ 0.01 4.998109
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR120; VAR131; VAR142
PEOU2, PEOU2, PEOU2

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	6.53	3.27	3.8751	0.0264
Within Groups	57	48.05	0.84		
Total	59	54.58	0.93		

F Critical @ 0.10 2.398157
F Critical @ 0.05 3.158843
F Critical @ 0.01 4.998109

Model Inputs:
VAR121; VAR132; VAR143
PEOU3, PEOU3, PEOU3

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.93	0.47	0.7733	0.4663
Within Groups	57	34.40	0.60		
Total	59	35.33	0.60		

F Critical @ 0.10 2.398157
F Critical @ 0.05 3.158843
F Critical @ 0.01 4.998109
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR122; VAR133; VAR144
PEOU4, PEOU4, PEOU4

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.23	0.12	0.2313	0.7942
Within Groups	57	28.75	0.50		
Total	59	28.98	0.49		

F Critical @ 0.10 2.398157
F Critical @ 0.05 3.158843
F Critical @ 0.01 4.998109
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR123; VAR134; VAR145
IU1, IU1, IU1

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	2.03	1.02	1.3008	0.2803
Within Groups	57	44.55	0.78		
Total	59	46.58	0.79		

F Critical @ 0.10 2.398157
F Critical @ 0.05 3.158843
F Critical @ 0.01 4.998109
The treatment has NO significant effects on at any of its levels

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Model Inputs:
VAR124; VAR135; VAR146
IU2, IU2, IU2

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	4.43	2.22	3.5195	0.0362
Within Groups	57	35.90	0.63		
Total	59	40.33	0.68		

F Critical @ 0.10 2.398157
F Critical @ 0.05 3.158843
F Critical @ 0.01 4.998109

Model Inputs:
VAR125; VAR136; VAR147
IU3, IU3, IU3

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.70	0.35	0.2033	0.8167
Within Groups	57	98.15	1.72		
Total	59	98.85	1.68		

F Critical @ 0.10 2.398157
F Critical @ 0.05 3.158843
F Critical @ 0.01 4.998109
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR229; VAR240; VAR251
PU1, PU1, PU1

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	10050.00	5025.00	12.3120	0.0000
Within Groups	54	22039.47	408.14		
Total	56	32089.47	573.03		

F Critical @ 0.10 2.403620
F Critical @ 0.05 3.168246
F Critical @ 0.01 5.021217

Model Inputs:
VAR230; VAR241; VAR252
PU2, PU2, PU2

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	13097.37	6548.68	14.4431	0.0000
Within Groups	54	24484.21	453.41		
Total	56	37581.58	671.10		

F Critical @ 0.10 2.403620
F Critical @ 0.05 3.168246
F Critical @ 0.01 5.021217

Model Inputs:
VAR231; VAR242; VAR253
PU3, PU3, PU3

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	14028.95	7014.47	15.6999	0.0000
Within Groups	54	24126.32	446.78		
Total	56	38155.26	681.34		

F Critical @ 0.10	2.403620
F Critical @ 0.05	3.168246
F Critical @ 0.01	5.021217

Model Inputs:
VAR232; VAR243; VAR254
PU4, PU4, PU4

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	11129.82	5564.91	9.9116	0.0002
Within Groups	54	30318.42	561.45		
Total	56	41448.25	740.15		

F Critical @ 0.10	2.403620
F Critical @ 0.05	3.168246
F Critical @ 0.01	5.021217

Model Inputs:
VAR233; VAR244; VAR255
PEOU1, PEOU1, PEOU1

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	1911.40	955.70	2.9637	0.0601
Within Groups	54	17413.16	322.47		
Total	56	19324.56	345.08		

F Critical @ 0.10	2.403620
F Critical @ 0.05	3.168246
F Critical @ 0.01	5.021217

Model Inputs:
VAR234; VAR245; VAR256
PEOU2, PEOU2, PEOU2

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	532.46	266.23	0.6260	0.5386
Within Groups	54	22965.79	425.29		
Total	56	23498.25	419.61		

F Critical @ 0.10 2.403620
F Critical @ 0.05 3.168246
F Critical @ 0.01 5.021217
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR235; VAR246; VAR257
PEOU3, PEOU3, PEOU3

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	1485.09	742.54	1.8589	0.1657
Within Groups	54	21571.05	399.46		
Total	56	23056.14	411.72		

F Critical @ 0.10 2.403620
F Critical @ 0.05 3.168246
F Critical @ 0.01 5.021217
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR236; VAR247; VAR258
PEOU4, PEOU4, PEOU4

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	1950.00	975.00	2.2784	0.1122
Within Groups	54	23107.89	427.92		
Total	56	25057.89	447.46		

F Critical @ 0.10 2.403620
F Critical @ 0.05 3.168246
F Critical @ 0.01 5.021217
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR237; VAR248; VAR259
IU1, IU1, IU1

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	13911.40	6955.70	9.1653	0.0004
Within Groups	54	40981.58	758.92		
Total	56	54892.98	980.23		

F Critical @ 0.10	2.403620
F Critical @ 0.05	3.168246
F Critical @ 0.01	5.021217

Model Inputs:
VAR238; VAR249; VAR260
IU2, IU2, IU2

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	18351.19	9175.60	14.7972	0.0000
Within Groups	54	33484.95	620.09		
Total	56	51836.14	925.65		

F Critical @ 0.10	2.403620
F Critical @ 0.05	3.168246
F Critical @ 0.01	5.021217

Model Inputs:
VAR239; VAR250; VAR261
IU3, IU3, IU3

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	255.26	127.63	0.1018	0.9034
Within Groups	54	67731.58	1254.29		
Total	56	67986.84	1214.05		

F Critical @ 0.10	2.403620
F Critical @ 0.05	3.168246
F Critical @ 0.01	5.021217

The treatment has NO significant effects on at any of its levels

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Model Inputs:
VAR266; VAR276; VAR286
Q1, Q1, Q1

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	53.72	26.86	25.4695	0.0000
Within Groups	54	56.95	1.05		
Total	56	110.67	1.98		

F Critical @ 0.10	2.403620
F Critical @ 0.05	3.168246
F Critical @ 0.01	5.021217

Model Inputs:
VAR267; VAR277; VAR287
Q2, Q2, Q2

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	6.88	3.44	3.8017	0.0285
Within Groups	54	48.84	0.90		
Total	56	55.72	0.99		

F Critical @ 0.10	2.403620
F Critical @ 0.05	3.168246
F Critical @ 0.01	5.021217

Model Inputs:
VAR268; VAR278; VAR288
Q3, Q3, Q3

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	10.56	5.28	9.4063	0.0003
Within Groups	54	30.32	0.56		
Total	56	40.88	0.73		

F Critical @ 0.10	2.403620
F Critical @ 0.05	3.168246
F Critical @ 0.01	5.021217

Model Inputs:
VAR269; VAR279; VAR289
Q4, Q4, Q4

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	16.46	8.23	6.9653	0.0020
Within Groups	54	63.79	1.18		
Total	56	80.25	1.43		

F Critical @ 0.10	2.403620
F Critical @ 0.05	3.168246
F Critical @ 0.01	5.021217

Model Inputs:
VAR270; VAR280; VAR290
Q5, Q5, Q5

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	24.11	12.05	12.2436	0.0000
Within Groups	54	53.16	0.98		
Total	56	77.26	1.38		

F Critical @ 0.10	2.403620
F Critical @ 0.05	3.168246
F Critical @ 0.01	5.021217

Model Inputs:
VAR271; VAR281; VAR291
Q6, Q6, Q6

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	55.82	27.91	36.7154	0.0000
Within Groups	54	41.05	0.76		
Total	56	96.88	1.73		

F Critical @ 0.10	2.403620
F Critical @ 0.05	3.168246
F Critical @ 0.01	5.021217

Model Inputs:
VAR272; VAR282; VAR292
Q7, Q7, Q7

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	6.04	3.02	3.5668	0.0351
Within Groups	54	45.68	0.85		
Total	56	51.72	0.92		

F Critical @ 0.10	2.403620
F Critical @ 0.05	3.168246
F Critical @ 0.01	5.021217

Model Inputs:
VAR273; VAR283; VAR293
Q8, Q8, Q8

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	24.67	12.33	10.2379	0.0002
Within Groups	54	65.05	1.20		
Total	56	89.72	1.60		

F Critical @ 0.10	2.403620
F Critical @ 0.05	3.168246
F Critical @ 0.01	5.021217

Model Inputs:
VAR274; VAR284; VAR294
Q9, Q9, Q9

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	38.14	19.07	17.3457	0.0000
Within Groups	54	59.37	1.10		
Total	56	97.51	1.74		

F Critical @ 0.10	2.403620
F Critical @ 0.05	3.168246
F Critical @ 0.01	5.021217

Model Inputs:
VAR275; VAR285; VAR295
Q10, Q10, Q10

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.67	0.33	0.2464	0.7825
Within Groups	54	73.05	1.35		
Total	56	73.72	1.32		

F Critical @ 0.10	2.403620
F Critical @ 0.05	3.168246
F Critical @ 0.01	5.021217

The treatment has NO significant effects on at any of its levels

H. ANOVA SINGLE FACTOR MULTIPLE TREATMENTS II: COMPARING THREE LOA AMONG ALL THREE SYSTEM PRESENTATIONS

Model Inputs:
VAR15; VAR115; VAR415
PU1, PU1, PU1

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	17.78	8.89	12.0149	0.0000
Within Groups	59	43.64	0.74		
Total	61	61.42	1.01		

F Critical @ 0.10	2.394832
F Critical @ 0.05	3.153123
F Critical @ 0.01	4.984078

Model Inputs:
VAR16; VAR116; VAR416
PU2, PU2, PU2

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	11.92	5.96	12.1872	0.0000
Within Groups	59	28.85	0.49		
Total	61	40.77	0.67		

F Critical @ 0.10	2.394832
F Critical @ 0.05	3.153123
F Critical @ 0.01	4.984078

Model Inputs:
VAR17; VAR117; VAR417
PU3, PU3, PU3

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	27.63	13.81	20.7788	0.0000
Within Groups	59	39.23	0.66		
Total	61	66.85	1.10		

F Critical @ 0.10	2.394832
F Critical @ 0.05	3.153123
F Critical @ 0.01	4.984078

Model Inputs:
VAR18; VAR118; VAR418

PU4, PU4, PU4

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	25.87	12.93	23.0453	0.0000
Within Groups	59	33.11	0.56		
Total	61	58.98	0.97		

F Critical @ 0.10	2.394832
F Critical @ 0.05	3.153123
F Critical @ 0.01	4.984078

Model Inputs:
VAR19; VAR119; VAR419
PEOU1, PEOU1, PEOU1

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	8.64	4.32	8.1240	0.0008
Within Groups	59	31.36	0.53		
Total	61	40.00	0.66		

F Critical @ 0.10	2.394832
F Critical @ 0.05	3.153123
F Critical @ 0.01	4.984078

Model Inputs:
VAR20; VAR120; VAR420
PEOU2, PEOU2, PEOU2

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	13.99	6.99	9.4014	0.0003
Within Groups	59	43.90	0.74		
Total	61	57.89	0.95		

F Critical @ 0.10	2.394832
F Critical @ 0.05	3.153123
F Critical @ 0.01	4.984078

Model Inputs:
VAR21; VAR121; VAR421
PEOU3, PEOU3, PEOU3

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	11.72	5.86	11.4387	0.0001
Within Groups	59	30.22	0.51		
Total	61	41.94	0.69		

F Critical @ 0.10	2.394832
F Critical @ 0.05	3.153123
F Critical @ 0.01	4.984078

Model Inputs:
VAR22; VAR122; VAR422
PEOU4, PEOU4, PEOU4

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	18.46	9.23	17.6191	0.0000
Within Groups	59	30.91	0.52		
Total	61	49.37	0.81		

F Critical @ 0.10	2.394832
F Critical @ 0.05	3.153123
F Critical @ 0.01	4.984078

Model Inputs:
VAR23; VAR123; VAR423
IU1, IU1, IU1

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	19.93	9.96	10.3737	0.0001
Within Groups	59	56.67	0.96		
Total	61	76.60	1.26		

F Critical @ 0.10	2.394832
F Critical @ 0.05	3.153123
F Critical @ 0.01	4.984078

Model Inputs:
VAR24; VAR124; VAR424
IU2, IU2, IU2

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	44.76	22.38	34.5999	0.0000
Within Groups	59	38.16	0.65		
Total	61	82.92	1.36		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078

Model Inputs:
VAR25; VAR125; VAR425
IU3, IU3, IU3

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.33	0.16	0.0983	0.9065
Within Groups	59	98.06	1.66		
Total	61	98.39	1.61		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR26; VAR126; VAR426
PU1, PU1, PU1

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	3.06	1.53	2.0498	0.1378
Within Groups	59	43.99	0.75		
Total	61	47.05	0.77		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR27; VAR127; VAR427
PU2, PU2, PU2

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.35	0.17	0.1839	0.8325
Within Groups	59	55.52	0.94		
Total	61	55.87	0.92		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR28; VAR128; VAR428
PU3, PU3, PU3

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	5.86	2.93	4.0139	0.0232
Within Groups	59	43.06	0.73		
Total	61	48.92	0.80		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078

Model Inputs:
VAR29; VAR129; VAR429
PU4, PU4, PU4

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	8.47	4.23	4.4596	0.0157
Within Groups	59	56.00	0.95		
Total	61	64.47	1.06		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078

Model Inputs:
VAR30; VAR130; VAR430
PEOU1, PEOU1, PEOU1

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.95	0.48	0.7468	0.4783
Within Groups	59	37.64	0.64		
Total	61	38.60	0.63		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR31; VAR131; VAR431
PEOU2, PEOU2, PEOU2

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	9.74	4.87	4.8263	0.0114
Within Groups	59	59.51	1.01		
Total	61	69.24	1.14		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078

Model Inputs:
VAR32; VAR132; VAR432
PEOU3, PEOU3, PEOU3

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	2.47	1.24	1.5273	0.2256
Within Groups	59	47.80	0.81		
Total	61	50.27	0.82		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR33; VAR133; VAR433
PEOU4, PEOU4, PEOU4

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	3.23	1.61	2.2898	0.1102
Within Groups	59	41.61	0.71		
Total	61	44.84	0.74		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR34; VAR134; VAR434
IU1, IU1, IU1

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	2.95	1.48	1.1182	0.3337
Within Groups	59	77.89	1.32		
Total	61	80.84	1.33		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR35; VAR135; VAR435
IU2, IU2, IU2

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	9.34	4.67	5.1146	0.0089
Within Groups	59	53.90	0.91		
Total	61	63.24	1.04		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078

Model Inputs:
VAR36; VAR136; VAR436
IU3, IU3, IU3

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.41	0.21	0.1085	0.8973
Within Groups	59	111.59	1.89		
Total	61	112.00	1.84		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR37; VAR137; VAR437
PU1, PU1, PU1

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	1.82	0.91	1.0111	0.3700
Within Groups	59	53.10	0.90		
Total	61	54.92	0.90		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR38; VAR138; VAR438
PU2, PU2, PU2
One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	5.39	2.70	3.2166	0.0472
Within Groups	59	49.45	0.84		
Total	61	54.84	0.90		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078

Model Inputs:
VAR39; VAR139; VAR439
PU3, PU3, PU3

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	5.56	2.78	2.5806	0.0843
Within Groups	59	63.54	1.08		
Total	61	69.10	1.13		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078

Model Inputs:
VAR40; VAR140; VAR440
PU4, PU4, PU4

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.27	0.14	0.1224	0.8850
Within Groups	59	65.17	1.10		
Total	61	65.44	1.07		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR41; VAR141; VAR441
PEOU1, PEOU1, PEOU1

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.48	0.24	0.3589	0.6999
Within Groups	59	39.73	0.67		
Total	61	40.21	0.66		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR42; VAR142; VAR442
PEOU2, PEOU2, PEOU2

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.30	0.15	0.1766	0.8385
Within Groups	59	50.66	0.86		
Total	61	50.97	0.84		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR43; VAR143; VAR443
PEOU3, PEOU3, PEOU3

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	7.38	3.69	3.6377	0.0324
Within Groups	59	59.86	1.01		
Total	61	67.24	1.10		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078

Model Inputs:
VAR44; VAR144; VAR444
PEOU4, PEOU4, PEOU4

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	1.75	0.88	0.8551	0.4305
Within Groups	59	60.44	1.02		
Total	61	62.19	1.02		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR45; VAR145; VAR445
IU1, IU1, IU1

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	2.03	1.02	0.7044	0.4985
Within Groups	59	85.07	1.44		
Total	61	87.10	1.43		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR46; VAR146; VAR446
IU2, IU2, IU2

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	1.84	0.92	0.7795	0.4633
Within Groups	59	69.58	1.18		
Total	61	71.42	1.17		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078
The treatment has NO significant effects on at any of its levels

---

Model Inputs:
VAR47; VAR147; VAR447
IU3, IU3, IU3

One Way ANOVA with Randomized Multiple Treatments

	DF	Sums of Squares	Mean Square	F Stat	p-Value
Between Groups	2	0.29	0.15	0.0985	0.9063
Within Groups	59	88.09	1.49		
Total	61	88.39	1.45		

F Critical @ 0.10 2.394832
F Critical @ 0.05 3.153123
F Critical @ 0.01 4.984078
The treatment has NO significant effects on at any of its levels

I. ANOVA RANDOMIZED BLOCK MULTIPLE SYSTEM PRESENTATION

```
Model Inputs:
VAR296; VAR297; VAR298
SUSA, SUSB, SUSC

ANOVA Randomized Blocks Multiple Treatments

                DF  Sums of Squares  Mean Square   F Stat  p-Value
Block Factor (Row)       18      4384.65     243.59   1.5282   0.1367
Treatment Factor (Column)    2      11369.96    5684.98   35.6650   0.0000
Error             36      5738.38     159.40
Total             56      21492.98

F Critical (Treatment) @ 0.10        2.456346
F Critical (Treatment) @ 0.05        3.259446
F Critical (Treatment) @ 0.01        5.247893
F Critical (Blocking) @ 0.10        1.645252
F Critical (Blocking) @ 0.05        1.898622
F Critical (Blocking) @ 0.01        2.479730

The treatment variable has NO significant effects on at any of its levels
```

J. NONPARAMETRIC KRUSKAL–WALLIS I: COMPARING THREE LOA SYSTEMS WITHIN THE SAME SYSTEM PRESENTATION

```
Model Inputs:
VAR15; VAR26; VAR37
PU1, PU1, PU1


             Kruskal-Wallis Test
H Statistic : 4.966568
p-Value : 0.083469
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 1% and 5% significance,
but are not statistically equal at 10% significance.

------------------------------------------------------------

Model Inputs:
VAR16; VAR27; VAR38
PU2, PU2, PU2


             Kruskal-Wallis Test
H Statistic : 5.523521
p-Value : 0.063180
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 1% and 5% significance,
but are not statistically equal at 10% significance.

------------------------------------------------------------
```

Model Inputs:
VAR17; VAR28; VAR39
PU3, PU3, PU3

Kruskal-Wallis Test
H Statistic : 3.631002
p-Value : 0.162756
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 10% significance.

Model Inputs:
VAR18; VAR29; VAR40
PU4, PU4, PU4

Kruskal-Wallis Test
H Statistic : 3.953767
p-Value : 0.138500
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 10% significance.

Model Inputs:
VAR19; VAR30; VAR41
PEOU1, PEOU1, PEOU1

Kruskal-Wallis Test
H Statistic : 4.748366
p-Value : 0.093091
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 1% and 5% significance,
but are not statistically equal at 10% significance.

Model Inputs:
VAR20; VAR31; VAR42
PEOU2, PEOU2, PEOU2

Kruskal-Wallis Test
H Statistic : 14.251796
p-Value : 0.000804
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.

Model Inputs:
VAR21; VAR32; VAR43
PEOU3, PEOU3, PEOU3

Kruskal-Wallis Test
H Statistic : 8.919039
p-Value : 0.011568
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 1% significance,
but are not statistically equal at 5% and 10% significance.

Model Inputs:
VAR22; VAR33; VAR44
PEOU4, PEOU4, PEOU4

Kruskal-Wallis Test
H Statistic : 0.514826
p-Value : 0.773049
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 10% significance.

Model Inputs:
VAR23; VAR34; VAR45
IU1, IU1, IU1

Kruskal-Wallis Test
H Statistic : 1.246989
p-Value : 0.536068
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 10% significance.

Model Inputs:
VAR24; VAR35; VAR46
IU2, IU2, IU2

Kruskal-Wallis Test
H Statistic : 2.475182
p-Value : 0.290082
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 10% significance.

Model Inputs:
VAR25; VAR36; VAR47
IU3, IU3, IU3

Kruskal-Wallis Test
H Statistic : 3.651094
p-Value : 0.161130
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 10% significance.

Model Inputs:
VAR115; VAR126; VAR137
PU1, PU1, PU1

Kruskal-Wallis Test
H Statistic : 0.464590
p-Value : 0.792712
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 10% significance.

Model Inputs:
VAR116; VAR127; VAR138
PU2, PU2, PU2

Kruskal-Wallis Test
H Statistic : 4.369508
p-Value : 0.112505
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 10% significance.

Model Inputs:
VAR117; VAR128; VAR139
PU3, PU3, PU3

Kruskal-Wallis Test
H Statistic : 1.713770
p-Value : 0.424482
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 10% significance.

Model Inputs:
VAR118; VAR129; VAR140
PU4, PU4, PU4

Kruskal-Wallis Test
H Statistic : 0.578361
p-Value : 0.748877
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 10% significance.

Model Inputs:
VAR119; VAR130; VAR141
PEOU1, PEOU1, PEOU1

Kruskal-Wallis Test
H Statistic : 0.251803
p-Value : 0.881702
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 10% significance.

Model Inputs:
VAR120; VAR131; VAR142
PEOU2, PEOU2, PEOU2

Kruskal-Wallis Test
H Statistic : 10.334754
p-Value : 0.005699
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.

Model Inputs:
VAR121; VAR132; VAR143
PEOU3, PEOU3, PEOU3

Kruskal-Wallis Test
H Statistic : 2.031475
p-Value : 0.362135
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 10% significance.

Model Inputs:
VAR122; VAR133; VAR144
PEOU4, PEOU4, PEOU4

Kruskal-Wallis Test
H Statistic : 2.382623
p-Value : 0.303823
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 10% significance.

Model Inputs:
VAR123; VAR134; VAR145
IU1, IU1, IU1

Kruskal-Wallis Test
H Statistic : 2.522295
p-Value : 0.283329
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 10% significance.

Model Inputs:
VAR124; VAR135; VAR146
IU2, IU2, IU2

Kruskal-Wallis Test
H Statistic : 6.905246
p-Value : 0.031662
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 1% significance,
but are not statistically equal at 5% and 10% significance.

Model Inputs:
VAR125; VAR136; VAR147
IU3, IU3, IU3

Kruskal-Wallis Test
H Statistic : 3.323607
p-Value : 0.189796
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 10% significance.

Model Inputs:
VAR229; VAR240; VAR251
PU1, PU1, PU1

Kruskal-Wallis Test
H Statistic : 20.303372
p-Value : 0.000039
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.

Model Inputs:
VAR230; VAR241; VAR252
PU2, PU2, PU2

Kruskal-Wallis Test
H Statistic : 28.644952
p-Value : 0.000001
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.

Model Inputs:
VAR231; VAR242; VAR253
PU3, PU3, PU3

Kruskal-Wallis Test
H Statistic : 25.724329
p-Value : 0.000003
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.

Model Inputs:
VAR232; VAR243; VAR254
PU4, PU4, PU4

Kruskal-Wallis Test
H Statistic : 22.564142
p-Value : 0.000013
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.

Model Inputs:
VAR233; VAR244; VAR255
PEOU1, PEOU1, PEOU1

Kruskal-Wallis Test
H Statistic : 4.928838
p-Value : 0.085058
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 1% and 5% significance,
but are not statistically equal at 10% significance.

Model Inputs:
VAR234; VAR245; VAR256
PEOU2, PEOU2, PEOU2

Kruskal-Wallis Test
H Statistic : 2.219505
p-Value : 0.329641
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 10% significance.

Model Inputs:
VAR235; VAR246; VAR257
PEOU3, PEOU3, PEOU3

Kruskal-Wallis Test
H Statistic : 2.989779
p-Value : 0.224273
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 10% significance.

Model Inputs:
VAR236; VAR247; VAR258
PEOU4, PEOU4, PEOU4

Kruskal-Wallis Test
H Statistic : 4.048906
p-Value : 0.132066
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 10% significance.

Model Inputs:
VAR237; VAR248; VAR259
IU1, IU1, IU1

Kruskal-Wallis Test
H Statistic : 20.463081
p-Value : 0.000036
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.

Model Inputs:
VAR238; VAR249; VAR260
IU2, IU2, IU2

Kruskal-Wallis Test
H Statistic : 22.724233
p-Value : 0.000012
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.

Model Inputs:
VAR239; VAR250; VAR261
IU3, IU3, IU3

Kruskal-Wallis Test
H Statistic : 7.390964
p-Value : 0.024835
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 1% significance,
but are not statistically equal at 5% and 10% significance.

Model Inputs:
VAR266; VAR276; VAR286
Q1, Q1, Q1

Kruskal-Wallis Test
H Statistic : 30.812112
p-Value : 0.000000
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.

Model Inputs:
VAR267; VAR277; VAR287
Q2, Q2, Q2

Kruskal-Wallis Test
H Statistic : 7.470054
p-Value : 0.023873
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 1% significance,
but are not statistically equal at 5% and 10% significance.

Model Inputs:
VAR268; VAR278; VAR288
Q3, Q3, Q3

Kruskal-Wallis Test
H Statistic : 12.270895
p-Value : 0.002165
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.

Model Inputs:
VAR269; VAR279; VAR289
Q4, Q4, Q4

Kruskal-Wallis Test
H Statistic : 8.240329
p-Value : 0.016242
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 1% significance,
but are not statistically equal at 5% and 10% significance.

Model Inputs:
VAR270; VAR280; VAR290
Q5, Q5, Q5

Kruskal-Wallis Test
H Statistic : 21.706753
p-Value : 0.000019
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.

Model Inputs:
VAR271; VAR281; VAR291
Q6, Q6, Q6

Kruskal-Wallis Test
H Statistic : 33.910784
p-Value : 0.000000
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.

Model Inputs:
VAR272; VAR282; VAR292
Q7, Q7, Q7

Kruskal-Wallis Test
H Statistic : 7.744388
p-Value : 0.020813
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 1% significance,
but are not statistically equal at 5% and 10% significance.

Model Inputs:
VAR273; VAR283; VAR293
Q8, Q8, Q8

Kruskal-Wallis Test
H Statistic : 14.636737
p-Value : 0.000663
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.

Model Inputs:
VAR274; VAR284; VAR294
Q9, Q9, Q9

Kruskal-Wallis Test
H Statistic : 22.744102
p-Value : 0.000012
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.

Model Inputs:
VAR275; VAR285; VAR295
Q10, Q10, Q10

Kruskal-Wallis Test
H Statistic : 0.196007
p-Value : 0.906646
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 10% significance.

K. NONPARAMETRIC KRUSKAL–WALLIS II: COMPARING THREE LOA SYSTEMS AMONG ALL THREE SYSTEM PRESENTATIONS

```
Model Inputs:
VAR15; VAR115; VAR415
PU1, PU1, PU1

             Kruskal-Wallis Test
H Statistic : 26.604924
p-Value : 0.000002
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.
-----------------------------------------------------------

Model Inputs:
VAR16; VAR116; VAR416
PU2, PU2, PU2
             Kruskal-Wallis Test
H Statistic : 30.483336
p-Value : 0.000000
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.
-----------------------------------------------------------

Model Inputs:
VAR17; VAR117; VAR417
PU3, PU3, PU3
             Kruskal-Wallis Test
H Statistic : 31.533757
p-Value : 0.000000
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.

-----------------------------------------------------------

Model Inputs:
VAR18; VAR118; VAR418
PU4, PU4, PU4

             Kruskal-Wallis Test
H Statistic : 34.777462
p-Value : 0.000000
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.
-----------------------------------------------------------
```

```
Model Inputs:
VAR19; VAR119; VAR419
PEOU1, PEOU1, PEOU1
              Kruskal-Wallis Test
H Statistic : 12.975671
p-Value : 0.001522
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.
-----------------------------------------------------------

Model Inputs:
VAR20; VAR120; VAR420
PEOU2, PEOU2, PEOU2

              Kruskal-Wallis Test
H Statistic : 19.074989
p-Value : 0.000072
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.
-----------------------------------------------------------

Model Inputs:
VAR21; VAR121; VAR421
PEOU3, PEOU3, PEOU3

              Kruskal-Wallis Test
H Statistic : 15.704835
p-Value : 0.000389
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.
-----------------------------------------------------------

Model Inputs:
VAR22; VAR122; VAR422
PEOU4, PEOU4, PEOU4

              Kruskal-Wallis Test
H Statistic : 22.806660
p-Value : 0.000011
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.
-----------------------------------------------------------

Model Inputs:
VAR23; VAR123; VAR423
IU1, IU1, IU1

              Kruskal-Wallis Test
H Statistic : 21.936274
p-Value : 0.000017
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.
-----------------------------------------------------------
```

```
Model Inputs:
VAR24; VAR124; VAR424
IU2, IU2, IU2
             Kruskal-Wallis Test
H Statistic : 33.478648
p-Value : 0.000000
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.
------------------------------------------------------------

Model Inputs:
VAR28; VAR128; VAR428
PU3, PU3, PU3
             Kruskal-Wallis Test
H Statistic : 8.709532
p-Value : 0.012845
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 1% significance,
but are not statistically equal at 5% and 10% significance.
------------------------------------------------------------

Model Inputs:
VAR29; VAR129; VAR429
PU4, PU4, PU4
             Kruskal-Wallis Test
H Statistic : 8.730167
p-Value : 0.012714
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 1% significance,
but are not statistically equal at 5% and 10% significance.
------------------------------------------------------------


Model Inputs:
VAR31; VAR131; VAR431
PEOU2, PEOU2, PEOU2
             Kruskal-Wallis Test
H Statistic : 9.517117
p-Value : 0.008578
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.
------------------------------------------------------------

Model Inputs:
VAR35; VAR135; VAR435
IU2, IU2, IU2
             Kruskal-Wallis Test
H Statistic : 14.278968
p-Value : 0.000793
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically not equal at 1%, 5%, or 10% significance.
------------------------------------------------------------
```

```
Model Inputs:
VAR38; VAR138; VAR438
PU2, PU2, PU2
             Kruskal-Wallis Test
H Statistic : 5.525735
p-Value : 0.063111
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 1% and 5% significance,
but are not statistically equal at 10% significance.
-----------------------------------------------------------


Model Inputs:
VAR43; VAR143; VAR443
PEOU3, PEOU3, PEOU3
             Kruskal-Wallis Test
H Statistic : 5.580003
p-Value : 0.061421
H Critical at 1% : 9.210340
H Critical at 5% : 5.991465
H Critical at 10% : 4.605170
The population medians are statistically equal at 1% and 5% significance,
but are not statistically equal at 10% significance.
```

L. T-TESTS, MANN–WHITNEY TESTS, AND WILCOXON SIGNED RANK TESTS I: COMPARING THREE LOA SYSTEMS WITHIN THE SAME SYSTEM PRESENTATION

```
TWO VARIABLE T-TEST WITH SIMILAR VARIANCE

Model Inputs:
VAR20; VAR31
PEOU2, PEOU2
Column 1 Observations : 23
Column 1 Sample Mean : 3.000000
Column 1 Sample Standard Deviation : 0.852803
Column 2 Observations : 23
Column 2 Sample Mean : 3.043478
Column 2 Sample Standard Deviation : 0.824525
Sample Mean Difference : -0.043478
t-Statistic : -0.175781
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.430636
p-Value Right Tailed : 0.569364
p-Value Two Tailed : 0.861273
-----------------------------------------------------------
Model Inputs:
VAR20; VAR42
PEOU2, PU4
Column 1 Observations : 23
Column 1 Sample Mean : 3.000000
Column 1 Sample Standard Deviation : 0.852803
Column 2 Observations : 23
Column 2 Sample Mean : 3.956522
Column 2 Sample Standard Deviation : 1.065076
Sample Mean Difference : -0.956522
t-Statistic : -3.362084
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000805
p-Value Right Tailed : 0.999195
p-Value Two Tailed : 0.001609
-----------------------------------------------------------
Model Inputs:
VAR31; VAR42
PEOU2, PEOU2
Column 1 Observations : 23
Column 1 Sample Mean : 3.043478
Column 1 Sample Standard Deviation : 0.824525
Column 2 Observations : 23
Column 2 Sample Mean : 3.956522
Column 2 Sample Standard Deviation : 1.065076
Sample Mean Difference : -0.913043
t-Statistic : -3.250943
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.001105
p-Value Right Tailed : 0.998895
p-Value Two Tailed : 0.002210
-----------------------------------------------------------
```

```
Model Inputs:
VAR21; VAR32
PEOU3, PEOU3
Column 1 Observations : 23
Column 1 Sample Mean : 3.782609
Column 1 Sample Standard Deviation : 0.671262
Column 2 Observations : 23
Column 2 Sample Mean : 3.565217
Column 2 Sample Standard Deviation : 0.895752
Sample Mean Difference : 0.217391
t-Statistic : 0.931401
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.821636
p-Value Right Tailed : 0.178364
p-Value Two Tailed : 0.356729
------------------------------------------------------------
Model Inputs:
VAR21; VAR43
PEOU3, PEOU3
Column 1 Observations : 23
Column 1 Sample Mean : 3.782609
Column 1 Sample Standard Deviation : 0.671262
Column 2 Observations : 23
Column 2 Sample Mean : 3.217391
Column 2 Sample Standard Deviation : 0.998022
Sample Mean Difference : 0.565217
t-Statistic : 2.253716
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.985377
p-Value Right Tailed : 0.014623
p-Value Two Tailed : 0.029247
------------------------------------------------------------
Model Inputs:
VAR32; VAR43
PEOU3, PEOU3
Column 1 Observations : 23
Column 1 Sample Mean : 3.565217
Column 1 Sample Standard Deviation : 0.895752
Column 2 Observations : 23
Column 2 Sample Mean : 3.217391
Column 2 Sample Standard Deviation : 0.998022
Sample Mean Difference : 0.347826
t-Statistic : 1.243886
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.889936
p-Value Right Tailed : 0.110064
p-Value Two Tailed : 0.220128
------------------------------------------------------------
Model Inputs:
VAR120; VAR131
PEOU2, PEOU2
Column 1 Observations : 20
Column 1 Sample Mean : 3.050000
Column 1 Sample Standard Deviation : 0.944513
Column 2 Observations : 20
Column 2 Sample Mean : 3.350000
Column 2 Sample Standard Deviation : 1.039990
Sample Mean Difference : -0.300000
t-Statistic : -0.954987
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.172810
p-Value Right Tailed : 0.827190
```

p-Value Two Tailed : 0.345620
Model Inputs:
VAR120; VAR142
PEOU2, PEOU2
Column 1 Observations : 20
Column 1 Sample Mean : 3.050000
Column 1 Sample Standard Deviation : 0.944513
Column 2 Observations : 20
Column 2 Sample Mean : 3.850000
Column 2 Sample Standard Deviation : 0.745160
Sample Mean Difference : -0.800000
t-Statistic : -2.973825
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.002543
p-Value Right Tailed : 0.997457
p-Value Two Tailed : 0.005086

Model Inputs:
VAR131; VAR142
PEOU2, PEOU2
Column 1 Observations : 20
Column 1 Sample Mean : 3.350000
Column 1 Sample Standard Deviation : 1.039990
Column 2 Observations : 20
Column 2 Sample Mean : 3.850000
Column 2 Sample Standard Deviation : 0.745160
Sample Mean Difference : -0.500000
t-Statistic : -1.747759
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.044291
p-Value Right Tailed : 0.955709
p-Value Two Tailed : 0.088583

Model Inputs:
VAR124; VAR135
IU2, IU2
Column 1 Observations : 20
Column 1 Sample Mean : 2.800000
Column 1 Sample Standard Deviation : 0.894427
Column 2 Observations : 20
Column 2 Sample Mean : 3.450000
Column 2 Sample Standard Deviation : 0.686333
Sample Mean Difference : -0.650000
t-Statistic : -2.578378
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.006963
p-Value Right Tailed : 0.993037
p-Value Two Tailed : 0.013926

Model Inputs:
VAR124; VAR146
IU2, IU2
Column 1 Observations : 20
Column 1 Sample Mean : 2.800000
Column 1 Sample Standard Deviation : 0.894427
Column 2 Observations : 20
Column 2 Sample Mean : 3.250000
Column 2 Sample Standard Deviation : 0.786398
Sample Mean Difference : -0.450000
t-Statistic : -1.689760
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.049632

p-Value Right Tailed : 0.950368
p-Value Two Tailed : 0.099263
Model Inputs:
VAR135; VAR146
IU2, IU2
Column 1 Observations : 20
Column 1 Sample Mean : 3.450000
Column 1 Sample Standard Deviation : 0.686333
Column 2 Observations : 20
Column 2 Sample Mean : 3.250000
Column 2 Sample Standard Deviation : 0.786398
Sample Mean Difference : 0.200000
t-Statistic : 0.856913
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.801567
p-Value Right Tailed : 0.198433
p-Value Two Tailed : 0.396865

Model Inputs:
VAR229; VAR240
PU1, PU1
Column 1 Observations : 19
Column 1 Sample Mean : 96.315789
Column 1 Sample Standard Deviation : 8.306976
Column 2 Observations : 19
Column 2 Sample Mean : 77.368421
Column 2 Sample Standard Deviation : 22.874563
Sample Mean Difference : 18.947368
t-Statistic : 3.393694
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.999155
p-Value Right Tailed : 0.000845
p-Value Two Tailed : 0.001691

Model Inputs:
VAR229; VAR251
PU1, PU1
Column 1 Observations : 19
Column 1 Sample Mean : 96.315789
Column 1 Sample Standard Deviation : 8.306976
Column 2 Observations : 19
Column 2 Sample Mean : 63.947368
Column 2 Sample Standard Deviation : 25.142867
Sample Mean Difference : 32.368421
t-Statistic : 5.328277
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.999997
p-Value Right Tailed : 0.000003
p-Value Two Tailed : 0.000005

```
Model Inputs:
VAR240; VAR251
PU1, PU1
Column 1 Observations : 19
Column 1 Sample Mean : 77.368421
Column 1 Sample Standard Deviation : 22.874563
Column 2 Observations : 19
Column 2 Sample Mean : 63.947368
Column 2 Sample Standard Deviation : 25.142867
Sample Mean Difference : 13.421053
t-Statistic : 1.721058
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.953087
p-Value Right Tailed : 0.046913
p-Value Two Tailed : 0.093825
Model Inputs:
VAR230; VAR241
PU2, PU2
Column 1 Observations : 19
Column 1 Sample Mean : 98.157895
Column 1 Sample Standard Deviation : 5.058141
Column 2 Observations : 19
Column 2 Sample Mean : 68.157895
Column 2 Sample Standard Deviation : 26.468562
Sample Mean Difference : 30.000000
t-Statistic : 4.852651
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.999988
p-Value Right Tailed : 0.000012
p-Value Two Tailed : 0.000024
------------------------------------------------------------
Model Inputs:
VAR230; VAR252
PU2, PU2
Column 1 Observations : 19
Column 1 Sample Mean : 98.157895
Column 1 Sample Standard Deviation : 5.058141
Column 2 Observations : 19
Column 2 Sample Mean : 64.210526
Column 2 Sample Standard Deviation : 25.180634
Sample Mean Difference : 33.947368
t-Statistic : 5.761379
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.999999
p-Value Right Tailed : 0.000001
p-Value Two Tailed : 0.000001
------------------------------------------------------------
Model Inputs:
VAR241; VAR252
PU2, PU2
Column 1 Observations : 19
Column 1 Sample Mean : 68.157895
Column 1 Sample Standard Deviation : 26.468562
Column 2 Observations : 19
Column 2 Sample Mean : 64.210526
Column 2 Sample Standard Deviation : 25.180634
Sample Mean Difference : 3.947368
t-Statistic : 0.470978
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.679751
p-Value Right Tailed : 0.320249
p-Value Two Tailed : 0.640498
------------------------------------------------------------
```

```
Model Inputs:
VAR231; VAR242
PU3, PU3
Column 1 Observations : 19
Column 1 Sample Mean : 98.421053
Column 1 Sample Standard Deviation : 5.014599
Column 2 Observations : 19
Column 2 Sample Mean : 73.947368
Column 2 Sample Standard Deviation : 23.188775
Sample Mean Difference : 24.473684
t-Statistic : 4.496492
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.999965
p-Value Right Tailed : 0.000035
p-Value Two Tailed : 0.000069
Model Inputs:
VAR231; VAR253
PU3, PU3
Column 1 Observations : 19
Column 1 Sample Mean : 98.421053
Column 1 Sample Standard Deviation : 5.014599
Column 2 Observations : 19
Column 2 Sample Mean : 60.526316
Column 2 Sample Standard Deviation : 27.883425
Sample Mean Difference : 37.894737
t-Statistic : 5.830390
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.999999
p-Value Right Tailed : 0.000001
p-Value Two Tailed : 0.000001
-----------------------------------------------------------
Model Inputs:
VAR242; VAR253
PU3, PU3
Column 1 Observations : 19
Column 1 Sample Mean : 73.947368
Column 1 Sample Standard Deviation : 23.188775
Column 2 Observations : 19
Column 2 Sample Mean : 60.526316
Column 2 Sample Standard Deviation : 27.883425
Sample Mean Difference : 13.421053
t-Statistic : 1.613120
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.942274
p-Value Right Tailed : 0.057726
p-Value Two Tailed : 0.115452
-----------------------------------------------------------
Model Inputs:
VAR232; VAR243
PU4, PU4
Column 1 Observations : 19
Column 1 Sample Mean : 98.421053
Column 1 Sample Standard Deviation : 5.014599
Column 2 Observations : 19
Column 2 Sample Mean : 76.315789
Column 2 Sample Standard Deviation : 26.501683
Sample Mean Difference : 22.105263
t-Statistic : 3.572402
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.999486
p-Value Right Tailed : 0.000514
p-Value Two Tailed : 0.001028
-----------------------------------------------------------
```

Model Inputs:
VAR232; VAR254
PU4, PU4
Column 1 Observations : 19
Column 1 Sample Mean : 98.421053
Column 1 Sample Standard Deviation : 5.014599
Column 2 Observations : 19
Column 2 Sample Mean : 64.736842
Column 2 Sample Standard Deviation : 30.933337
Sample Mean Difference : 33.684211
t-Statistic : 4.685366
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.999980
p-Value Right Tailed : 0.000020
p-Value Two Tailed : 0.000039
Model Inputs:
VAR243; VAR254
PU4, PU4
Column 1 Observations : 19
Column 1 Sample Mean : 76.315789
Column 1 Sample Standard Deviation : 26.501683
Column 2 Observations : 19
Column 2 Sample Mean : 64.736842
Column 2 Sample Standard Deviation : 30.933337
Sample Mean Difference : 11.578947
t-Statistic : 1.239068
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.888331
p-Value Right Tailed : 0.111669
p-Value Two Tailed : 0.223338

Model Inputs:
VAR233; VAR244
PEOU1, PEOU1
Column 1 Observations : 19
Column 1 Sample Mean : 84.473684
Column 1 Sample Standard Deviation : 12.121461
Column 2 Observations : 19
Column 2 Sample Mean : 79.736842
Column 2 Sample Standard Deviation : 20.647416
Sample Mean Difference : 4.736842
t-Statistic : 0.862373
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.802905
p-Value Right Tailed : 0.197095
p-Value Two Tailed : 0.394191

Model Inputs:
VAR233; VAR255
PEOU1, PEOU1
Column 1 Observations : 19
Column 1 Sample Mean : 84.473684
Column 1 Sample Standard Deviation : 12.121461
Column 2 Observations : 19
Column 2 Sample Mean : 70.526316
Column 2 Sample Standard Deviation : 19.853263
Sample Mean Difference : 13.947368
t-Statistic : 2.613591
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.993502
p-Value Right Tailed : 0.006498
p-Value Two Tailed : 0.012996

```
Model Inputs:
VAR244; VAR255
PEOU1, PEOU1
Column 1 Observations : 19
Column 1 Sample Mean : 79.736842
Column 1 Sample Standard Deviation : 20.647416
Column 2 Observations : 19
Column 2 Sample Mean : 70.526316
Column 2 Sample Standard Deviation : 19.853263
Sample Mean Difference : 9.210526
t-Statistic : 1.401621
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.915204
p-Value Right Tailed : 0.084796
p-Value Two Tailed : 0.169592
Model Inputs:
VAR237; VAR248
IU1, IU1
Column 1 Observations : 19
Column 1 Sample Mean : 92.894737
Column 1 Sample Standard Deviation : 17.265556
Column 2 Observations : 19
Column 2 Sample Mean : 76.315789
Column 2 Sample Standard Deviation : 29.666765
Sample Mean Difference : 16.578947
t-Statistic : 2.105335
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.978848
p-Value Right Tailed : 0.021152
p-Value Two Tailed : 0.042304
------------------------------------------------------------
Model Inputs:
VAR237; VAR259
IU1, IU1
Column 1 Observations : 19
Column 1 Sample Mean : 92.894737
Column 1 Sample Standard Deviation : 17.265556
Column 2 Observations : 19
Column 2 Sample Mean : 54.736842
Column 2 Sample Standard Deviation : 33.144200
Sample Mean Difference : 38.157895
t-Statistic : 4.450608
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.999960
p-Value Right Tailed : 0.000040
p-Value Two Tailed : 0.000079
------------------------------------------------------------
Model Inputs:
VAR248; VAR259
IU1, IU1
Column 1 Observations : 19
Column 1 Sample Mean : 76.315789
Column 1 Sample Standard Deviation : 29.666765
Column 2 Observations : 19
Column 2 Sample Mean : 54.736842
Column 2 Sample Standard Deviation : 33.144200
Sample Mean Difference : 21.578947
t-Statistic : 2.114570
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.979271
p-Value Right Tailed : 0.020729
p-Value Two Tailed : 0.041458
------------------------------------------------------------
```

Model Inputs:
VAR238; VAR249
IU2, IU2
Column 1 Observations : 19
Column 1 Sample Mean : 95.684211
Column 1 Sample Standard Deviation : 10.000292
Column 2 Observations : 19
Column 2 Sample Mean : 74.210526
Column 2 Sample Standard Deviation : 26.523740
Sample Mean Difference : 21.473684
t-Statistic : 3.302071
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.998913
p-Value Right Tailed : 0.001087
p-Value Two Tailed : 0.002174
Model Inputs:
VAR238; VAR260
IU2, IU2
Column 1 Observations : 19
Column 1 Sample Mean : 95.684211
Column 1 Sample Standard Deviation : 10.000292
Column 2 Observations : 19
Column 2 Sample Mean : 51.736842
Column 2 Sample Standard Deviation : 32.507849
Sample Mean Difference : 43.947368
t-Statistic : 5.632315
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.999999
p-Value Right Tailed : 0.000001
p-Value Two Tailed : 0.000002

Model Inputs:
VAR249; VAR260
IU2, IU2
Column 1 Observations : 19
Column 1 Sample Mean : 74.210526
Column 1 Sample Standard Deviation : 26.523740
Column 2 Observations : 19
Column 2 Sample Mean : 51.736842
Column 2 Sample Standard Deviation : 32.507849
Sample Mean Difference : 22.473684
t-Statistic : 2.334864
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.987378
p-Value Right Tailed : 0.012622
p-Value Two Tailed : 0.025244

Model Inputs:
VAR239; VAR250
IU3, IU3
Column 1 Observations : 19
Column 1 Sample Mean : 18.947368
Column 1 Sample Standard Deviation : 37.843939
Column 2 Observations : 19
Column 2 Sample Mean : 23.947368
Column 2 Sample Standard Deviation : 35.141735
Sample Mean Difference : -5.000000
t-Statistic : -0.422014
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.337762
p-Value Right Tailed : 0.662238
p-Value Two Tailed : 0.675525

Model Inputs:
VAR239; VAR261
IU3, IU3
Column 1 Observations : 19
Column 1 Sample Mean : 18.947368
Column 1 Sample Standard Deviation : 37.843939
Column 2 Observations : 19
Column 2 Sample Mean : 20.263158
Column 2 Sample Standard Deviation : 33.102269
Sample Mean Difference : -1.315789
t-Statistic : -0.114073
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.454907
p-Value Right Tailed : 0.545093
p-Value Two Tailed : 0.909814
Model Inputs:
VAR250; VAR261
IU3, IU3
Column 1 Observations : 19
Column 1 Sample Mean : 23.947368
Column 1 Sample Standard Deviation : 35.141735
Column 2 Observations : 19
Column 2 Sample Mean : 20.263158
Column 2 Sample Standard Deviation : 33.102269
Sample Mean Difference : 3.684211
t-Statistic : 0.332643
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.629333
p-Value Right Tailed : 0.370667
p-Value Two Tailed : 0.741333

Model Inputs:
VAR266; VAR276
Q1, Q1
Column 1 Observations : 19
Column 1 Sample Mean : 4.789474
Column 1 Sample Standard Deviation : 0.418854
Column 2 Observations : 19
Column 2 Sample Mean : 3.789474
Column 2 Sample Standard Deviation : 1.272746
Sample Mean Difference : 1.000000
t-Statistic : 3.253162
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.998758
p-Value Right Tailed : 0.001242
p-Value Two Tailed : 0.002484

Model Inputs:
VAR266; VAR286
Q1, Q1
Column 1 Observations : 19
Column 1 Sample Mean : 4.789474
Column 1 Sample Standard Deviation : 0.418854
Column 2 Observations : 19
Column 2 Sample Mean : 2.421053
Column 2 Sample Standard Deviation : 1.169795
Sample Mean Difference : 2.368421
t-Statistic : 8.308676
Hypothesized Mean : 0.000000
p-Value Left Tailed : 1.000000
p-Value Right Tailed : 0.000000
p-Value Two Tailed : 0.000000

```
Model Inputs:
VAR276; VAR286
Q1, Q1
Column 1 Observations : 19
Column 1 Sample Mean : 3.789474
Column 1 Sample Standard Deviation : 1.272746
Column 2 Observations : 19
Column 2 Sample Mean : 2.421053
Column 2 Sample Standard Deviation : 1.169795
Sample Mean Difference : 1.368421
t-Statistic : 3.450517
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.999278
p-Value Right Tailed : 0.000722
p-Value Two Tailed : 0.001445
Model Inputs:
VAR267; VAR277
Q2, Q2
Column 1 Observations : 19
Column 1 Sample Mean : 1.947368
Column 1 Sample Standard Deviation : 0.621261
Column 2 Observations : 19
Column 2 Sample Mean : 2.473684
Column 2 Sample Standard Deviation : 1.172292
Sample Mean Difference : -0.526316
t-Statistic : -1.729171
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.046173
p-Value Right Tailed : 0.953827
p-Value Two Tailed : 0.092346
------------------------------------------------------------
Model Inputs:
VAR267; VAR287
Q2, Q2
Column 1 Observations : 19
Column 1 Sample Mean : 1.947368
Column 1 Sample Standard Deviation : 0.621261
Column 2 Observations : 19
Column 2 Sample Mean : 2.789474
Column 2 Sample Standard Deviation : 0.976328
Sample Mean Difference : -0.842105
t-Statistic : -3.171929
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.001546
p-Value Right Tailed : 0.998454
p-Value Two Tailed : 0.003092
------------------------------------------------------------
Model Inputs:
VAR277; VAR287
Q2, Q2
Column 1 Observations : 19
Column 1 Sample Mean : 2.473684
Column 1 Sample Standard Deviation : 1.172292
Column 2 Observations : 19
Column 2 Sample Mean : 2.789474
Column 2 Sample Standard Deviation : 0.976328
Sample Mean Difference : -0.315789
t-Statistic : -0.902258
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.186459
p-Value Right Tailed : 0.813541
p-Value Two Tailed : 0.372917
------------------------------------------------------------
```

```
Model Inputs:
VAR268; VAR278
Q3, Q3
Column 1 Observations : 19
Column 1 Sample Mean : 4.263158
Column 1 Sample Standard Deviation : 0.452414
Column 2 Observations : 19
Column 2 Sample Mean : 4.052632
Column 2 Sample Standard Deviation : 0.705036
Sample Mean Difference : 0.210526
t-Statistic : 1.095445
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.859702
p-Value Right Tailed : 0.140298
p-Value Two Tailed : 0.280596
Model Inputs:
VAR268; VAR288
Q3, Q3
Column 1 Observations : 19
Column 1 Sample Mean : 4.263158
Column 1 Sample Standard Deviation : 0.452414
Column 2 Observations : 19
Column 2 Sample Mean : 3.263158
Column 2 Sample Standard Deviation : 0.991189
Sample Mean Difference : 1.000000
t-Statistic : 4.000616
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.999850
p-Value Right Tailed : 0.000150
p-Value Two Tailed : 0.000301
-----------------------------------------------------------
Model Inputs:
VAR278; VAR288
Q3, Q3
Column 1 Observations : 19
Column 1 Sample Mean : 4.052632
Column 1 Sample Standard Deviation : 0.705036
Column 2 Observations : 19
Column 2 Sample Mean : 3.263158
Column 2 Sample Standard Deviation : 0.991189
Sample Mean Difference : 0.789474
t-Statistic : 2.829126
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.996208
p-Value Right Tailed : 0.003792
p-Value Two Tailed : 0.007583
-----------------------------------------------------------
Model Inputs:
VAR269; VAR279
Q4, Q4
Column 1 Observations : 19
Column 1 Sample Mean : 2.052632
Column 1 Sample Standard Deviation : 0.970320
Column 2 Observations : 19
Column 2 Sample Mean : 2.210526
Column 2 Sample Standard Deviation : 1.134262
Sample Mean Difference : -0.157895
t-Statistic : -0.461084
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.323756
p-Value Right Tailed : 0.676244
p-Value Two Tailed : 0.647512
-----------------------------------------------------------
```

```
Model Inputs:
VAR269; VAR289
Q4, Q4
Column 1 Observations : 19
Column 1 Sample Mean : 2.052632
Column 1 Sample Standard Deviation : 0.970320
Column 2 Observations : 19
Column 2 Sample Mean : 3.263158
Column 2 Sample Standard Deviation : 1.147079
Sample Mean Difference : -1.210526
t-Statistic : -3.512008
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000609
p-Value Right Tailed : 0.999391
p-Value Two Tailed : 0.001217
Model Inputs:
VAR279; VAR289
Q4, Q4
Column 1 Observations : 19
Column 1 Sample Mean : 2.210526
Column 1 Sample Standard Deviation : 1.134262
Column 2 Observations : 19
Column 2 Sample Mean : 3.263158
Column 2 Sample Standard Deviation : 1.147079
Sample Mean Difference : -1.052632
t-Statistic : -2.844273
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.003648
p-Value Right Tailed : 0.996352
p-Value Two Tailed : 0.007296
-----------------------------------------------------------
Model Inputs:
VAR270; VAR280
Q5, Q5
Column 1 Observations : 19
Column 1 Sample Mean : 4.263158
Column 1 Sample Standard Deviation : 0.561951
Column 2 Observations : 19
Column 2 Sample Mean : 3.105263
Column 2 Sample Standard Deviation : 1.242521
Sample Mean Difference : 1.157895
t-Statistic : 3.701096
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.999643
p-Value Right Tailed : 0.000357
p-Value Two Tailed : 0.000714
-----------------------------------------------------------
Model Inputs:
VAR270; VAR290
Q5, Q5
Column 1 Observations : 19
Column 1 Sample Mean : 4.263158
Column 1 Sample Standard Deviation : 0.561951
Column 2 Observations : 19
Column 2 Sample Mean : 2.736842
Column 2 Sample Standard Deviation : 1.045738
Sample Mean Difference : 1.526316
t-Statistic : 5.604163
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.999999
p-Value Right Tailed : 0.000001
p-Value Two Tailed : 0.000002
-----------------------------------------------------------
```

Model Inputs:
VAR280; VAR290
Q5, Q5
Column 1 Observations : 19
Column 1 Sample Mean : 3.105263
Column 1 Sample Standard Deviation : 1.242521
Column 2 Observations : 19
Column 2 Sample Mean : 2.736842
Column 2 Sample Standard Deviation : 1.045738
Sample Mean Difference : 0.368421
t-Statistic : 0.988851
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.835332
p-Value Right Tailed : 0.164668
p-Value Two Tailed : 0.329336
Model Inputs:
VAR271; VAR281
Q6, Q6
Column 1 Observations : 19
Column 1 Sample Mean : 1.947368
Column 1 Sample Standard Deviation : 0.524265
Column 2 Observations : 19
Column 2 Sample Mean : 3.263158
Column 2 Sample Standard Deviation : 1.097578
Sample Mean Difference : -1.315789
t-Statistic : -4.715210
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000018
p-Value Right Tailed : 0.999982
p-Value Two Tailed : 0.000036

Model Inputs:
VAR271; VAR291
Q6, Q6
Column 1 Observations : 19
Column 1 Sample Mean : 1.947368
Column 1 Sample Standard Deviation : 0.524265
Column 2 Observations : 19
Column 2 Sample Mean : 4.368421
Column 2 Sample Standard Deviation : 0.895081
Sample Mean Difference : -2.421053
t-Statistic : -10.173495
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000000
p-Value Right Tailed : 1.000000
p-Value Two Tailed : 0.000000

Model Inputs:
VAR281; VAR291
Q6, Q6
Column 1 Observations : 19
Column 1 Sample Mean : 3.263158
Column 1 Sample Standard Deviation : 1.097578
Column 2 Observations : 19
Column 2 Sample Mean : 4.368421
Column 2 Sample Standard Deviation : 0.895081
Sample Mean Difference : -1.105263
t-Statistic : -3.401680
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000827
p-Value Right Tailed : 0.999173
p-Value Two Tailed : 0.001654

Model Inputs:
VAR272; VAR282
Q7, Q7
Column 1 Observations : 19
Column 1 Sample Mean : 4.210526
Column 1 Sample Standard Deviation : 0.713283
Column 2 Observations : 19
Column 2 Sample Mean : 4.105263
Column 2 Sample Standard Deviation : 0.994135
Sample Mean Difference : 0.105263
t-Statistic : 0.375000
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.645070
p-Value Right Tailed : 0.354930
p-Value Two Tailed : 0.709861
Model Inputs:
VAR272; VAR292
Q7, Q7
Column 1 Observations : 19
Column 1 Sample Mean : 4.210526
Column 1 Sample Standard Deviation : 0.713283
Column 2 Observations : 19
Column 2 Sample Mean : 3.473684
Column 2 Sample Standard Deviation : 1.020263
Sample Mean Difference : 0.736842
t-Statistic : 2.580039
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.992947
p-Value Right Tailed : 0.007053
p-Value Two Tailed : 0.014106

Model Inputs:
VAR282; VAR292
Q7, Q7
Column 1 Observations : 19
Column 1 Sample Mean : 4.105263
Column 1 Sample Standard Deviation : 0.994135
Column 2 Observations : 19
Column 2 Sample Mean : 3.473684
Column 2 Sample Standard Deviation : 1.020263
Sample Mean Difference : 0.631579
t-Statistic : 1.932581
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.969407
p-Value Right Tailed : 0.030593
p-Value Two Tailed : 0.061185

Model Inputs:
VAR273; VAR283
Q8, Q8
Column 1 Observations : 19
Column 1 Sample Mean : 2.631579
Column 1 Sample Standard Deviation : 1.116071
Column 2 Observations : 19
Column 2 Sample Mean : 2.578947
Column 2 Sample Standard Deviation : 1.216360
Sample Mean Difference : 0.052632
t-Statistic : 0.138972
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.554877
p-Value Right Tailed : 0.445123
p-Value Two Tailed : 0.890247

Model Inputs:
VAR273; VAR293
Q8, Q8
Column 1 Observations : 19
Column 1 Sample Mean : 2.631579
Column 1 Sample Standard Deviation : 1.116071
Column 2 Observations : 19
Column 2 Sample Mean : 4.000000
Column 2 Sample Standard Deviation : 0.942809
Sample Mean Difference : -1.368421
t-Statistic : -4.082707
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000118
p-Value Right Tailed : 0.999882
p-Value Two Tailed : 0.000237
Model Inputs:
VAR283; VAR293
Q8, Q8
Column 1 Observations : 19
Column 1 Sample Mean : 2.578947
Column 1 Sample Standard Deviation : 1.216360
Column 2 Observations : 19
Column 2 Sample Mean : 4.000000
Column 2 Sample Standard Deviation : 0.942809
Sample Mean Difference : -1.421053
t-Statistic : -4.024922
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000140
p-Value Right Tailed : 0.999860
p-Value Two Tailed : 0.000280

Model Inputs:
VAR274; VAR284
Q9, Q9
Column 1 Observations : 19
Column 1 Sample Mean : 4.578947
Column 1 Sample Standard Deviation : 0.692483
Column 2 Observations : 19
Column 2 Sample Mean : 3.684211
Column 2 Sample Standard Deviation : 1.249561
Sample Mean Difference : 0.894737
t-Statistic : 2.729967
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.995129
p-Value Right Tailed : 0.004871
p-Value Two Tailed : 0.009741

Model Inputs:
VAR274; VAR294
Q9, Q9
Column 1 Observations : 19
Column 1 Sample Mean : 4.578947
Column 1 Sample Standard Deviation : 0.692483
Column 2 Observations : 19
Column 2 Sample Mean : 2.578947
Column 2 Sample Standard Deviation : 1.121298
Sample Mean Difference : 2.000000
t-Statistic : 6.614951
Hypothesized Mean : 0.000000
p-Value Left Tailed : 1.000000
p-Value Right Tailed : 0.000000
p-Value Two Tailed : 0.000000

Model Inputs:
VAR284; VAR294
Q9, Q9
Column 1 Observations : 19
Column 1 Sample Mean : 3.684211
Column 1 Sample Standard Deviation : 1.249561
Column 2 Observations : 19
Column 2 Sample Mean : 2.578947
Column 2 Sample Standard Deviation : 1.121298
Sample Mean Difference : 1.105263
t-Statistic : 2.869571
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.996581
p-Value Right Tailed : 0.003419
p-Value Two Tailed : 0.006838

MANN-WHITNEY TEST

Model Inputs:
VAR20
VAR31
PEOU2
PEOU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	23
Median	3.00	3.00
Rank Sum	533.00	548.00
U Values	272.00	257.00

Wilcoxon W 533.00
U-Stat 257.00
Mean 264.50
Std Dev 45.51831
Z-Score 0.15378
P-value (One Tail) 0.43889
P-value (Two Tail) 0.87778
* Adjusted for Ties
Null hypothesis: There is zero difference between the variables

---

Model Inputs:
VAR20
VAR42
PEOU2
PEOU2

Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	23
Median	3.00	4.00
Rank Sum	403.50	677.50
U Values	401.50	127.50

Wilcoxon W 403.50
U-Stat 127.50
Mean 264.50

```
Std Dev       45.51831
Z-Score       2.99879
P-value (One Tail) 0.00136
P-value (Two Tail) 0.00271
* Adjusted for Ties


Null hypothesis: There is zero difference between the two variables

------------------------------------------------------------

Model Inputs:
VAR31
VAR42
PEOU2
PEOU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)
         Sample 1      Sample 2
Count        23          23
Median       3.00         4.00
Rank Sum      406.00       675.00
U Values      399.00       130.00
Wilcoxon W     406.00
U-Stat       130.00
Mean        264.50
Std Dev       45.51831
Z-Score       2.94387
P-value (One Tail) 0.00162
P-value (Two Tail) 0.00324
* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
------------------------------------------------------------

Model Inputs:
VAR21
VAR32
PEOU3
PEOU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)
         Sample 1      Sample 2
Count        23          23
Median       4.00         4.00
Rank Sum      566.00       515.00
U Values      239.00       290.00
Wilcoxon W     566.00
U-Stat       239.00
Mean        264.50
Std Dev       45.51831
Z-Score       0.54923
P-value (One Tail) 0.29142
P-value (Two Tail) 0.58285
* Adjusted for Ties

Null hypothesis: There is zero difference between the variables

------------------------------------------------------------
```

Model Inputs:
VAR21
VAR43
PEOU3
PEOU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	23
Median	4.00	3.00
Rank Sum	634.50	446.50
U Values	170.50	358.50
Wilcoxon W	634.50	
U-Stat	170.50	
Mean	264.50	
Std Dev	45.51831	
Z-Score	2.05412	
P-value (One Tail)	0.01998	
P-value (Two Tail)	0.03996	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR32
VAR43
PEOU3
PEOU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	23
Median	4.00	3.00
Rank Sum	605.50	475.50
U Values	199.50	329.50
Wilcoxon W	605.50	
U-Stat	199.50	
Mean	264.50	
Std Dev	45.51831	
Z-Score	1.41701	
P-value (One Tail)	0.07824	
P-value (Two Tail)	0.15648	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR120
VAR131
PEOU2
PEOU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	20
Median	3.00	3.50
Rank Sum	372.50	447.50
U Values	237.50	162.50
Wilcoxon W	372.50	
U-Stat	162.50	
Mean	200.00	
Std Dev	36.96846	
Z-Score	1.00085	
P-value (One Tail)	0.15845	
P-value (Two Tail)	0.31690	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR120
VAR142
PEOU2
PEOU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	20
Median	3.00	4.00
Rank Sum	312.50	507.50
U Values	297.50	102.50
Wilcoxon W	312.50	
U-Stat	102.50	
Mean	200.00	
Std Dev	36.96846	
Z-Score	2.62386	
P-value (One Tail)	0.00435	
P-value (Two Tail)	0.00869	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR131
VAR142
PEOU2
PEOU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	20
Median	3.50	4.00
Rank Sum	354.50	465.50
U Values	255.50	144.50
Wilcoxon W	354.50	
U-Stat	144.50	
Mean	200.00	
Std Dev	36.96846	
Z-Score	1.48775	
P-value (One Tail)	0.06841	
P-value (Two Tail)	0.13682	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR124
VAR135
IU2
IU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	20
Median	3.00	3.00
Rank Sum	332.00	488.00
U Values	278.00	122.00
Wilcoxon W	332.00	
U-Stat	122.00	
Mean	200.00	
Std Dev	36.96846	
Z-Score	2.09638	
P-value (One Tail)	0.01802	
P-value (Two Tail)	0.03605	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR124
VAR146
IU2
IU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	20
Median	3.00	3.00
Rank Sum	360.00	460.00
U Values	250.00	150.00
Wilcoxon W	360.00	
U-Stat	150.00	
Mean	200.00	
Std Dev	36.96846	
Z-Score	1.33898	
P-value (One Tail)	0.09029	
P-value (Two Tail)	0.18058	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR135
VAR146
IU2
IU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	20
Median	3.00	3.00
Rank Sum	439.00	381.00
U Values	171.00	229.00
Wilcoxon W	439.00	
U-Stat	171.00	
Mean	200.00	
Std Dev	36.96846	
Z-Score	0.77093	
P-value (One Tail)	0.22037	
P-value (Two Tail)	0.44075	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR229
VAR240
PU1
PU1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	100.00	80.00
Rank Sum	475.50	265.50
U Values	75.50	285.50
Wilcoxon W	475.50	
U-Stat	75.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	3.05085	
P-value (One Tail)	0.00114	
P-value (Two Tail)	0.00228	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR229
VAR251
PU1
PU1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	100.00	70.00
Rank Sum	515.00	226.00
U Values	36.00	325.00
Wilcoxon W	515.00	
U-Stat	36.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	4.20404	
P-value (One Tail)	0.00001	
P-value (Two Tail)	0.00003	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR240
VAR251
PU1
PU1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	80.00	70.00
Rank Sum	432.50	308.50
U Values	118.50	242.50
Wilcoxon W	432.50	
U-Stat	118.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	1.79548	
P-value (One Tail)	0.03629	
P-value (Two Tail)	0.07258	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR230
VAR241
PU2
PU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	100.00	75.00
Rank Sum	513.00	228.00
U Values	38.00	323.00
Wilcoxon W	513.00	
U-Stat	38.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	4.14565	
P-value (One Tail)	0.00002	
P-value (Two Tail)	0.00003	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR230
VAR252
PU2
PU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	100.00	75.00
Rank Sum	524.00	217.00
U Values	27.00	334.00
Wilcoxon W	524.00	
U-Stat	27.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	4.46680	
P-value (One Tail)	0.00000	
P-value (Two Tail)	0.00001	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR241
VAR252
PU2
PU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	75.00	75.00
Rank Sum	385.00	356.00
U Values	166.00	195.00
Wilcoxon W	385.00	
U-Stat	166.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	0.40873	
P-value (One Tail)	0.34137	
P-value (Two Tail)	0.68274	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR231
VAR242
PU3
PU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	100.00	80.00
Rank Sum	503.50	237.50
U Values	47.50	313.50
Wilcoxon W	503.50	
U-Stat	47.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	3.86830	
P-value (One Tail)	0.00005	
P-value (Two Tail)	0.00011	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR231
VAR253
PU3
PU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	100.00	70.00
Rank Sum	526.50	214.50
U Values	24.50	336.50
Wilcoxon W	526.50	
U-Stat	24.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	4.53978	
P-value (One Tail)	0.00000	
P-value (Two Tail)	0.00001	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR242
VAR253
PU3
PU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	80.00	70.00
Rank Sum	423.50	317.50
U Values	127.50	233.50
Wilcoxon W	423.50	
U-Stat	127.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	1.53272	
P-value (One Tail)	0.06267	
P-value (Two Tail)	0.12534	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR232
VAR243
PU4
PU4
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	100.00	85.00
Rank Sum	490.50	250.50
U Values	60.50	300.50
Wilcoxon W	490.50	
U-Stat	60.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	3.48877	
P-value (One Tail)	0.00024	
P-value (Two Tail)	0.00049	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR232
VAR254
PU4
PU4
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	100.00	70.00
Rank Sum	496.50	244.50
U Values	54.50	306.50
Wilcoxon W	496.50	
U-Stat	54.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	3.66394	
P-value (One Tail)	0.00012	
P-value (Two Tail)	0.00025	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables

---

Model Inputs:
VAR243
VAR254
PU4
PU4
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	85.00	70.00
Rank Sum	409.00	332.00
U Values	142.00	219.00
Wilcoxon W	409.00	
U-Stat	142.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	1.10940	
P-value (One Tail)	0.13363	
P-value (Two Tail)	0.26726	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables

---

Model Inputs:
VAR233
VAR244
PEOU1
PEOU1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	90.00	80.00
Rank Sum	381.50	359.50
U Values	169.50	191.50
Wilcoxon W	381.50	
U-Stat	169.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	0.30654	
P-value (One Tail)	0.37959	
P-value (Two Tail)	0.75919	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR233
VAR255
PEOU1
PEOU1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	90.00	70.00
Rank Sum	445.50	295.50
U Values	105.50	255.50
Wilcoxon W	445.50	
U-Stat	105.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	2.17501	
P-value (One Tail)	0.01481	
P-value (Two Tail)	0.02963	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR244
VAR255
PEOU1
PEOU1
Nonparametric Mann-Whitney Test

(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	80.00	70.00
Rank Sum	421.00	320.00
U Values	130.00	231.00
Wilcoxon W	421.00	
U-Stat	130.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	1.45974	
P-value (One Tail)	0.07218	
P-value (Two Tail)	0.14436	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR237
VAR248
IU1
IU1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	100.00	90.00
Rank Sum	455.50	285.50
U Values	95.50	265.50
Wilcoxon W	455.50	
U-Stat	95.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	2.46696	
P-value (One Tail)	0.00681	
P-value (Two Tail)	0.01363	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR237
VAR259
IU1
IU1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	100.00	50.00
Rank Sum	496.00	245.00
U Values	55.00	306.00
Wilcoxon W	496.00	
U-Stat	55.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	3.64934	
P-value (One Tail)	0.00013	
P-value (Two Tail)	0.00026	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR248
VAR259
IU1
IU1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	90.00	50.00
Rank Sum	443.00	298.00
U Values	108.00	253.00
Wilcoxon W	443.00	
U-Stat	108.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	2.10202	
P-value (One Tail)	0.01778	
P-value (Two Tail)	0.03555	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR238
VAR249
IU2
IU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	100.00	80.00
Rank Sum	482.00	259.00
U Values	69.00	292.00
Wilcoxon W	482.00	
U-Stat	69.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	3.24062	
P-value (One Tail)	0.00060	
P-value (Two Tail)	0.00119	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR238
VAR260
IU2
IU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	100.00	40.00
Rank Sum	514.00	227.00
U Values	37.00	324.00
Wilcoxon W	514.00	
U-Stat	37.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	4.17485	
P-value (One Tail)	0.00001	
P-value (Two Tail)	0.00003	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR249
VAR260
IU2
IU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	80.00	40.00
Rank Sum	440.50	300.50
U Values	110.50	250.50
Wilcoxon W	440.50	
U-Stat	110.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	2.02903	
P-value (One Tail)	0.02123	
P-value (Two Tail)	0.04245	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables

---

Model Inputs:
VAR239
VAR250
IU3
IU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	0.00	0.00
Rank Sum	348.50	392.50
U Values	202.50	158.50
Wilcoxon W	348.50	
U-Stat	158.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	0.62769	
P-value (One Tail)	0.26510	
P-value (Two Tail)	0.53021	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables

---

Model Inputs:
VAR239
VAR261
IU3
IU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	0.00	0.00
Rank Sum	357.00	384.00
U Values	194.00	167.00
Wilcoxon W	357.00	
U-Stat	167.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	0.37953	
P-value (One Tail)	0.35215	
P-value (Two Tail)	0.70429	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR250
VAR261
IU3
IU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	0.00	0.00
Rank Sum	381.00	360.00
U Values	170.00	191.00
Wilcoxon W	381.00	
U-Stat	170.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	0.29195	
P-value (One Tail)	0.38516	
P-value (Two Tail)	0.77033	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR266
VAR276
Q1
Q1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	5.00	4.00
Rank Sum	466.00	275.00
U Values	85.00	276.00
Wilcoxon W	466.00	
U-Stat	85.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	2.77350	
P-value (One Tail)	0.00277	
P-value (Two Tail)	0.00555	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR266
VAR286
Q1
Q1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	5.00	2.00
Rank Sum	533.50	207.50
U Values	17.50	343.50
Wilcoxon W	533.50	
U-Stat	17.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	4.74415	
P-value (One Tail)	0.00000	
P-value (Two Tail)	0.00000	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR276
VAR286
Q1
Q1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	4.00	2.00
Rank Sum	472.00	269.00
U Values	79.00	282.00
Wilcoxon W	472.00	
U-Stat	79.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	2.94867	
P-value (One Tail)	0.00160	
P-value (Two Tail)	0.00319	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR267
VAR277
Q2
Q2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	2.00	2.00
Rank Sum	326.00	415.00
U Values	225.00	136.00
Wilcoxon W	326.00	
U-Stat	136.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	1.28457	
P-value (One Tail)	0.09947	
P-value (Two Tail)	0.19894	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR267
VAR287
Q2
Q2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	2.00	3.00
Rank Sum	280.50	460.50
U Values	270.50	90.50
Wilcoxon W	280.50	
U-Stat	90.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	2.61293	
P-value (One Tail)	0.00449	
P-value (Two Tail)	0.00898	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR277
VAR287
Q2
Q2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	2.00	3.00
Rank Sum	343.50	397.50
U Values	207.50	153.50
Wilcoxon W	343.50	
U-Stat	153.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	0.77366	
P-value (One Tail)	0.21957	
P-value (Two Tail)	0.43913	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR268
VAR278
Q3
Q3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	4.00	4.00
Rank Sum	398.50	342.50
U Values	152.50	208.50
Wilcoxon W	398.50	
U-Stat	152.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	0.80286	
P-value (One Tail)	0.21103	
P-value (Two Tail)	0.42206	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR268
VAR288
Q3
Q3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	4.00	3.00
Rank Sum	476.00	265.00
U Values	75.00	286.00
Wilcoxon W	476.00	
U-Stat	75.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	3.06545	
P-value (One Tail)	0.00109	
P-value (Two Tail)	0.00217	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR278
VAR288
Q3
Q3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	4.00	3.00
Rank Sum	452.00	289.00
U Values	99.00	262.00
Wilcoxon W	452.00	
U-Stat	99.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	2.36477	
P-value (One Tail)	0.00902	
P-value (Two Tail)	0.01804	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR269
VAR279
Q4
Q4
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	2.00	2.00
Rank Sum	360.00	381.00
U Values	191.00	170.00
Wilcoxon W	360.00	
U-Stat	170.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	0.29195	
P-value (One Tail)	0.38516	
P-value (Two Tail)	0.77033	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR269
VAR289
Q4
Q4
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	2.00	3.00
Rank Sum	268.00	473.00
U Values	283.00	78.00
Wilcoxon W	268.00	
U-Stat	78.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	2.97786	
P-value (One Tail)	0.00145	
P-value (Two Tail)	0.00290	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR279
VAR289
Q4
Q4
Nonparametric Mann-Whitney Test

(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	2.00	3.00
Rank Sum	280.00	461.00
U Values	271.00	90.00
Wilcoxon W	280.00	
U-Stat	90.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	2.62753	
P-value (One Tail)	0.00430	
P-value (Two Tail)	0.00860	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR270
VAR280
Q5
Q5
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	4.00	3.00
Rank Sum	466.50	274.50
U Values	84.50	276.50
Wilcoxon W	466.50	
U-Stat	84.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	2.78810	
P-value (One Tail)	0.00265	
P-value (Two Tail)	0.00530	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR270
VAR290
Q5
Q5
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	4.00	3.00
Rank Sum	507.00	234.00
U Values	44.00	317.00
Wilcoxon W	507.00	
U-Stat	44.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	3.97049	
P-value (One Tail)	0.00004	
P-value (Two Tail)	0.00007	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR280
VAR290
Q5
Q5
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	3.00	3.00
Rank Sum	399.50	341.50
U Values	151.50	209.50
Wilcoxon W	399.50	
U-Stat	151.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	0.83205	
P-value (One Tail)	0.20269	
P-value (Two Tail)	0.40538	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR271
VAR281
Q6
Q6
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	2.00	3.00
Rank Sum	249.00	492.00
U Values	302.00	59.00
Wilcoxon W	249.00	
U-Stat	59.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	3.53256	
P-value (One Tail)	0.00021	
P-value (Two Tail)	0.00041	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR271
VAR291
Q6
Q6
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	2.00	5.00
Rank Sum	201.00	540.00
U Values	350.00	11.00
Wilcoxon W	201.00	
U-Stat	11.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	4.93391	
P-value (One Tail)	0.00000	
P-value (Two Tail)	0.00000	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR281
VAR291
Q6
Q6
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	3.00	5.00
Rank Sum	271.00	470.00
U Values	280.00	81.00
Wilcoxon W	271.00	
U-Stat	81.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	2.89028	
P-value (One Tail)	0.00192	
P-value (Two Tail)	0.00385	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR272
VAR282
Q7
Q7
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	4.00	4.00
Rank Sum	372.00	369.00
U Values	179.00	182.00
Wilcoxon W	372.00	
U-Stat	179.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	0.02919	
P-value (One Tail)	0.48835	
P-value (Two Tail)	0.97671	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR272
VAR292
Q7
Q7
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	4.00	3.00
Rank Sum	447.50	293.50
U Values	103.50	257.50
Wilcoxon W	447.50	
U-Stat	103.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	2.23340	
P-value (One Tail)	0.01276	
P-value (Two Tail)	0.02552	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR282
VAR292
Q7
Q7
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	4.00	3.00
Rank Sum	442.00	299.00
U Values	109.00	252.00
Wilcoxon W	442.00	
U-Stat	109.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	2.07283	
P-value (One Tail)	0.01909	
P-value (Two Tail)	0.03819	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR273
VAR283
Q8
Q8
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	3.00	2.00
Rank Sum	376.50	364.50
U Values	174.50	186.50
Wilcoxon W	376.50	
U-Stat	174.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	0.16057	
P-value (One Tail)	0.43622	
P-value (Two Tail)	0.87243	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR273
VAR293
Q8
Q8
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	3.00	4.00
Rank Sum	256.50	484.50
U Values	294.50	66.50
Wilcoxon W	256.50	
U-Stat	66.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	3.31360	
P-value (One Tail)	0.00046	
P-value (Two Tail)	0.00092	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR283
VAR293
Q8
Q8
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	2.00	4.00
Rank Sum	258.50	482.50
U Values	292.50	68.50
Wilcoxon W	258.50	
U-Stat	68.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	3.25521	
P-value (One Tail)	0.00057	
P-value (Two Tail)	0.00113	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR274
VAR284
Q9
Q9
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	5.00	4.00
Rank Sum	453.50	287.50
U Values	97.50	263.50
Wilcoxon W	453.50	
U-Stat	97.50	
Mean	180.50	
Std Dev	34.25274	
Z-Score	2.40857	
P-value (One Tail)	0.00801	
P-value (Two Tail)	0.01602	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR274
VAR294
Q9
Q9

Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	5.00	3.00
Rank Sum	526.00	215.00
U Values	25.00	336.00
Wilcoxon W	526.00	
U-Stat	25.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	4.52519	
P-value (One Tail)	0.00000	
P-value (Two Tail)	0.00001	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR284
VAR294
Q9
Q9
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	19	19
Median	4.00	3.00
Rank Sum	462.00	279.00
U Values	89.00	272.00
Wilcoxon W	462.00	
U-Stat	89.00	
Mean	180.50	
Std Dev	34.25274	
Z-Score	2.65672	
P-value (One Tail)	0.00395	
P-value (Two Tail)	0.00789	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables

M. T-TESTS, MANN–WHITNEY TESTS, AND WILCOXON SIGNED RANK TESTS II: COMPARING THREE LOA SYSTEMS AMONG ALL THREE SYSTEM PRESENTATIONS

```
Two Variable (T) Independent Equal Variance

Model Inputs:
VAR15; VAR115
PU1, PU1
Column 1 Observations : 23
Column 1 Sample Mean : 3.826087
Column 1 Sample Standard Deviation : 0.984063
Column 2 Observations : 20
Column 2 Sample Mean : 3.650000
Column 2 Sample Standard Deviation : 1.039990
Sample Mean Difference : 0.176087
t-Statistic : 0.570024
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.714114
p-Value Right Tailed : 0.285886
p-Value Two Tailed : 0.571772
-----------------------------------------------------------


Model Inputs:
VAR15; VAR415
PU1, PU1
Column 1 Observations : 23
Column 1 Sample Mean : 3.826087
Column 1 Sample Standard Deviation : 0.984063
Column 2 Observations : 19
Column 2 Sample Mean : 4.894737
Column 2 Sample Standard Deviation : 0.315302
Sample Mean Difference : -1.068650
t-Statistic : -4.536633
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000026
p-Value Right Tailed : 0.999974
p-Value Two Tailed : 0.000051
-----------------------------------------------------------


Model Inputs:
VAR115; VAR415
PU1, PU1
Column 1 Observations : 20
Column 1 Sample Mean : 3.650000
Column 1 Sample Standard Deviation : 1.039990
Column 2 Observations : 19
Column 2 Sample Mean : 4.894737
Column 2 Sample Standard Deviation : 0.315302
Sample Mean Difference : -1.244737
t-Statistic : -5.000362
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000007
p-Value Right Tailed : 0.999993
p-Value Two Tailed : 0.000014
-----------------------------------------------------------
```

```
Model Inputs:
VAR16; VAR116
PU2, PU2
Column 1 Observations : 23
Column 1 Sample Mean : 3.956522
Column 1 Sample Standard Deviation : 0.877924
Column 2 Observations : 20
Column 2 Sample Mean : 4.050000
Column 2 Sample Standard Deviation : 0.759155
Sample Mean Difference : -0.093478
t-Statistic : -0.370591
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.356425
p-Value Right Tailed : 0.643575
p-Value Two Tailed : 0.712850
-----------------------------------------------------------


Model Inputs:
VAR16; VAR416
PU2, PU2
Column 1 Observations : 23
Column 1 Sample Mean : 3.956522
Column 1 Sample Standard Deviation : 0.877924
Column 2 Observations : 19
Column 2 Sample Mean : 4.947368
Column 2 Sample Standard Deviation : 0.229416
Sample Mean Difference : -0.990847
t-Statistic : -4.777259
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000012
p-Value Right Tailed : 0.999988
p-Value Two Tailed : 0.000024
-----------------------------------------------------------


Model Inputs:
VAR116; VAR416
PU2, PU2
Column 1 Observations : 20
Column 1 Sample Mean : 4.050000
Column 1 Sample Standard Deviation : 0.759155
Column 2 Observations : 19
Column 2 Sample Mean : 4.947368
Column 2 Sample Standard Deviation : 0.229416
Sample Mean Difference : -0.897368
t-Statistic : -4.939758
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000008
p-Value Right Tailed : 0.999992
p-Value Two Tailed : 0.000017
-----------------------------------------------------------
```

Model Inputs:
VAR17; VAR117
PU3, PU3
Column 1 Observations : 23
Column 1 Sample Mean : 3.608696
Column 1 Sample Standard Deviation : 0.940944
Column 2 Observations : 20
Column 2 Sample Mean : 3.400000
Column 2 Sample Standard Deviation : 0.994723
Sample Mean Difference : 0.208696
t-Statistic : 0.706438
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.758044
p-Value Right Tailed : 0.241956
p-Value Two Tailed : 0.483911

Model Inputs:
VAR17; VAR417
PU3, PU3
Column 1 Observations : 23
Column 1 Sample Mean : 3.608696
Column 1 Sample Standard Deviation : 0.940944
Column 2 Observations : 19
Column 2 Sample Mean : 4.947368
Column 2 Sample Standard Deviation : 0.229416
Sample Mean Difference : -1.338673
t-Statistic : -6.042724
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000000
p-Value Right Tailed : 1.000000
p-Value Two Tailed : 0.000000

Model Inputs:
VAR117; VAR417
PU3, PU3
Column 1 Observations : 20
Column 1 Sample Mean : 3.400000
Column 1 Sample Standard Deviation : 0.994723
Column 2 Observations : 19
Column 2 Sample Mean : 4.947368
Column 2 Sample Standard Deviation : 0.229416
Sample Mean Difference : -1.547368
t-Statistic : -6.611492
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000000
p-Value Right Tailed : 1.000000
p-Value Two Tailed : 0.000000

```
Model Inputs:
VAR18; VAR118
PU4, PU4
Column 1 Observations : 23
Column 1 Sample Mean : 3.652174
Column 1 Sample Standard Deviation : 0.775107
Column 2 Observations : 20
Column 2 Sample Mean : 3.450000
Column 2 Sample Standard Deviation : 0.998683
Sample Mean Difference : 0.202174
t-Statistic : 0.746541
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.770200
p-Value Right Tailed : 0.229800
p-Value Two Tailed : 0.459600
------------------------------------------------------------

Model Inputs:
VAR18; VAR418
PU4, PU4
Column 1 Observations : 23
Column 1 Sample Mean : 3.652174
Column 1 Sample Standard Deviation : 0.775107
Column 2 Observations : 19
Column 2 Sample Mean : 4.947368
Column 2 Sample Standard Deviation : 0.229416
Sample Mean Difference : -1.295195
t-Statistic : -7.020636
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000000
p-Value Right Tailed : 1.000000
p-Value Two Tailed : 0.000000
------------------------------------------------------------

Model Inputs:
VAR118; VAR418
PU4, PU4
Column 1 Observations : 20
Column 1 Sample Mean : 3.450000
Column 1 Sample Standard Deviation : 0.998683
Column 2 Observations : 19
Column 2 Sample Mean : 4.947368
Column 2 Sample Standard Deviation : 0.229416
Sample Mean Difference : -1.497368
t-Statistic : -6.373694
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000000
p-Value Right Tailed : 1.000000
p-Value Two Tailed : 0.000000
------------------------------------------------------------
```

```
Model Inputs:
VAR19; VAR119
PEOU1, PEOU1
Column 1 Observations : 23
Column 1 Sample Mean : 3.913043
Column 1 Sample Standard Deviation : 0.668312
Column 2 Observations : 20
Column 2 Sample Mean : 3.600000
Column 2 Sample Standard Deviation : 0.882580
Sample Mean Difference : 0.313043
t-Statistic : 1.321124
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.903107
p-Value Right Tailed : 0.096893
significant at 10%
significantly greater than the hypothesized mean difference.
p-Value Two Tailed : 0.193786
-----------------------------------------------------------

Model Inputs:
VAR19; VAR419
PEOU1, PEOU1
Column 1 Observations : 23
Column 1 Sample Mean : 3.913043
Column 1 Sample Standard Deviation : 0.668312
Column 2 Observations : 19
Column 2 Sample Mean : 4.526316
Column 2 Sample Standard Deviation : 0.611775
Sample Mean Difference : -0.613272
t-Statistic : -3.074191
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.001897
p-Value Right Tailed : 0.998103
p-Value Two Tailed : 0.003793
-----------------------------------------------------------

Model Inputs:
VAR119; VAR419
PEOU1, PEOU1
Column 1 Observations : 20
Column 1 Sample Mean : 3.600000
Column 1 Sample Standard Deviation : 0.882580
Column 2 Observations : 19
Column 2 Sample Mean : 4.526316
Column 2 Sample Standard Deviation : 0.611775
Sample Mean Difference : -0.926316
t-Statistic : -3.789906
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000269
p-Value Right Tailed : 0.999731
p-Value Two Tailed : 0.000538
-----------------------------------------------------------
```

```
Model Inputs:
VAR20; VAR120
PEOU2, PEOU2
Column 1 Observations : 23
Column 1 Sample Mean : 3.000000
Column 1 Sample Standard Deviation : 0.852803
Column 2 Observations : 20
Column 2 Sample Mean : 3.050000
Column 2 Sample Standard Deviation : 0.944513
Sample Mean Difference : -0.050000
t-Statistic : -0.182423
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.428075
p-Value Right Tailed : 0.571925
p-Value Two Tailed : 0.856150
------------------------------------------------------------

Model Inputs:
VAR20; VAR420
PEOU2, PEOU2
Column 1 Observations : 23
Column 1 Sample Mean : 3.000000
Column 1 Sample Standard Deviation : 0.852803
Column 2 Observations : 19
Column 2 Sample Mean : 4.052632
Column 2 Sample Standard Deviation : 0.779864
Sample Mean Difference : -1.052632
t-Statistic : -4.136798
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000088
p-Value Right Tailed : 0.999912
p-Value Two Tailed : 0.000176
------------------------------------------------------------

Model Inputs:
VAR120; VAR420
PEOU2, PEOU2
Column 1 Observations : 20
Column 1 Sample Mean : 3.050000
Column 1 Sample Standard Deviation : 0.944513
Column 2 Observations : 19
Column 2 Sample Mean : 4.052632
Column 2 Sample Standard Deviation : 0.779864
Sample Mean Difference : -1.002632
t-Statistic : -3.604293
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000458
p-Value Right Tailed : 0.999542
p-Value Two Tailed : 0.000917
------------------------------------------------------------
```

```
Model Inputs:
VAR21; VAR121
PEOU3, PEOU3
Column 1 Observations : 23
Column 1 Sample Mean : 3.782609
Column 1 Sample Standard Deviation : 0.671262
Column 2 Observations : 20
Column 2 Sample Mean : 3.700000
Column 2 Sample Standard Deviation : 0.864505
Sample Mean Difference : 0.082609
t-Statistic : 0.352319
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.636798
p-Value Right Tailed : 0.363202
p-Value Two Tailed : 0.726404
-----------------------------------------------------------

Model Inputs:
VAR21; VAR421
PEOU3, PEOU3
Column 1 Observations : 23
Column 1 Sample Mean : 3.782609
Column 1 Sample Standard Deviation : 0.671262
Column 2 Observations : 19
Column 2 Sample Mean : 4.684211
Column 2 Sample Standard Deviation : 0.582393
Sample Mean Difference : -0.901602
t-Statistic : -4.595709
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000021
p-Value Right Tailed : 0.999979
p-Value Two Tailed : 0.000043
-----------------------------------------------------------

Model Inputs:
VAR121; VAR421
PEOU3, PEOU3
Column 1 Observations : 20
Column 1 Sample Mean : 3.700000
Column 1 Sample Standard Deviation : 0.864505
Column 2 Observations : 19
Column 2 Sample Mean : 4.684211
Column 2 Sample Standard Deviation : 0.582393
Sample Mean Difference : -0.984211
t-Statistic : -4.147096
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000094
p-Value Right Tailed : 0.999906
p-Value Two Tailed : 0.000189
-----------------------------------------------------------
```

```
Model Inputs:
VAR22; VAR122
PEOU4, PEOU4
Column 1 Observations : 23
Column 1 Sample Mean : 3.391304
Column 1 Sample Standard Deviation : 0.782718
Column 2 Observations : 20
Column 2 Sample Mean : 3.400000
Column 2 Sample Standard Deviation : 0.753937
Sample Mean Difference : -0.008696
t-Statistic : -0.036960
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.485348
p-Value Right Tailed : 0.514652
p-Value Two Tailed : 0.970696
------------------------------------------------------------

Model Inputs:
VAR22; VAR422
PEOU4, PEOU4
Column 1 Observations : 23
Column 1 Sample Mean : 3.391304
Column 1 Sample Standard Deviation : 0.782718
Column 2 Observations : 19
Column 2 Sample Mean : 4.578947
Column 2 Sample Standard Deviation : 0.606977
Sample Mean Difference : -1.187643
t-Statistic : -5.402909
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000002
p-Value Right Tailed : 0.999998
p-Value Two Tailed : 0.000003
------------------------------------------------------------

Model Inputs:
VAR122; VAR422
PEOU4, PEOU4
Column 1 Observations : 20
Column 1 Sample Mean : 3.400000
Column 1 Sample Standard Deviation : 0.753937
Column 2 Observations : 19
Column 2 Sample Mean : 4.578947
Column 2 Sample Standard Deviation : 0.606977
Sample Mean Difference : -1.178947
t-Statistic : -5.361501
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000002
p-Value Right Tailed : 0.999998
p-Value Two Tailed : 0.000005
------------------------------------------------------------
```

```
Model Inputs:
VAR23; VAR123
IU1, IU1
Column 1 Observations : 23
Column 1 Sample Mean : 3.739130
Column 1 Sample Standard Deviation : 1.136877
Column 2 Observations : 20
Column 2 Sample Mean : 3.350000
Column 2 Sample Standard Deviation : 0.933302
Sample Mean Difference : 0.389130
t-Statistic : 1.215064
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.884354
p-Value Right Tailed : 0.115646
p-Value Two Tailed : 0.231293
-----------------------------------------------------------

Model Inputs:
VAR23; VAR423
IU1, IU1
Column 1 Observations : 23
Column 1 Sample Mean : 3.739130
Column 1 Sample Standard Deviation : 1.136877
Column 2 Observations : 19
Column 2 Sample Mean : 4.736842
Column 2 Sample Standard Deviation : 0.805682
Sample Mean Difference : -0.997712
t-Statistic : -3.213484
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.001296
p-Value Right Tailed : 0.998704
p-Value Two Tailed : 0.002592
-----------------------------------------------------------

Model Inputs:
VAR123; VAR423
IU1, IU1
Column 1 Observations : 20
Column 1 Sample Mean : 3.350000
Column 1 Sample Standard Deviation : 0.933302
Column 2 Observations : 19
Column 2 Sample Mean : 4.736842
Column 2 Sample Standard Deviation : 0.805682
Sample Mean Difference : -1.386842
t-Statistic : -4.955638
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000008
p-Value Right Tailed : 0.999992
p-Value Two Tailed : 0.000016
-----------------------------------------------------------
```

```
Model Inputs:
VAR24; VAR124
IU2, IU2
Column 1 Observations : 23
Column 1 Sample Mean : 3.260870
Column 1 Sample Standard Deviation : 0.915393
Column 2 Observations : 20
Column 2 Sample Mean : 2.800000
Column 2 Sample Standard Deviation : 0.894427
Sample Mean Difference : 0.460870
t-Statistic : 1.664257
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.948157
p-Value Right Tailed : 0.051843
significant at 10%
significantly greater than the hypothesized mean difference.
p-Value Two Tailed : 0.103687
-----------------------------------------------------------

Model Inputs:
VAR24; VAR424
IU2, IU2
Column 1 Observations : 23
Column 1 Sample Mean : 3.260870
Column 1 Sample Standard Deviation : 0.915393
Column 2 Observations : 19
Column 2 Sample Mean : 4.842105
Column 2 Sample Standard Deviation : 0.501460
Sample Mean Difference : -1.581236
t-Statistic : -6.732035
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000000
p-Value Right Tailed : 1.000000
p-Value Two Tailed : 0.000000
-----------------------------------------------------------

Model Inputs:
VAR124; VAR424
IU2, IU2
Column 1 Observations : 20
Column 1 Sample Mean : 2.800000
Column 1 Sample Standard Deviation : 0.894427
Column 2 Observations : 19
Column 2 Sample Mean : 4.842105
Column 2 Sample Standard Deviation : 0.501460
Sample Mean Difference : -2.042105
t-Statistic : -8.730025
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.000000
p-Value Right Tailed : 1.000000
p-Value Two Tailed : 0.000000
-----------------------------------------------------------
```

```
Model Inputs:
VAR28; VAR128
PU3, PU3
Column 1 Observations : 23
Column 1 Sample Mean : 3.217391
Column 1 Sample Standard Deviation : 0.735868
Column 2 Observations : 20
Column 2 Sample Mean : 3.700000
Column 2 Sample Standard Deviation : 0.656947
Sample Mean Difference : -0.482609
t-Statistic : -2.253683
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.014813
significant at 10% and 5%
p-Value Right Tailed : 0.985187
p-Value Two Tailed : 0.029627
significant at 10% and 5%
-----------------------------------------------------------

Model Inputs:
VAR28; VAR428
PU3, PU3
Column 1 Observations : 23
Column 1 Sample Mean : 3.217391
Column 1 Sample Standard Deviation : 0.735868
Column 2 Observations : 19
Column 2 Sample Mean : 3.947368
Column 2 Sample Standard Deviation : 1.129094
Sample Mean Difference : -0.729977
t-Statistic : -2.522255
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.007871
p-Value Right Tailed : 0.992129
p-Value Two Tailed : 0.015743
significant at 10% and 5%
-----------------------------------------------------------

Model Inputs:
VAR128; VAR428
PU3, PU3
Column 1 Observations : 20
Column 1 Sample Mean : 3.700000
Column 1 Sample Standard Deviation : 0.656947
Column 2 Observations : 19
Column 2 Sample Mean : 3.947368
Column 2 Sample Standard Deviation : 1.129094
Sample Mean Difference : -0.247368
t-Statistic : -0.841577
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.202716
p-Value Right Tailed : 0.797284
p-Value Two Tailed : 0.405431
-----------------------------------------------------------
```

```
Model Inputs:
VAR29; VAR129
PU4, PU4
Column 1 Observations : 23
Column 1 Sample Mean : 3.173913
Column 1 Sample Standard Deviation : 0.834058
Column 2 Observations : 20
Column 2 Sample Mean : 3.750000
Column 2 Sample Standard Deviation : 0.716350
Sample Mean Difference : -0.576087
t-Statistic : -2.410367
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.010253
significant at 10% and 5%
p-Value Right Tailed : 0.989747
p-Value Two Tailed : 0.020506
significant at 10% and 5%
------------------------------------------------------------

Model Inputs:
VAR29; VAR429
PU4, PU4
Column 1 Observations : 23
Column 1 Sample Mean : 3.173913
Column 1 Sample Standard Deviation : 0.834058
Column 2 Observations : 19
Column 2 Sample Mean : 4.052632
Column 2 Sample Standard Deviation : 1.311220
Sample Mean Difference : -0.878719
t-Statistic : -2.635918
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.005942
p-Value Right Tailed : 0.994058
p-Value Two Tailed : 0.011885
significant at 10% and 5%
------------------------------------------------------------

Model Inputs:
VAR129; VAR429
PU4, PU4
Column 1 Observations : 20
Column 1 Sample Mean : 3.750000
Column 1 Sample Standard Deviation : 0.716350
Column 2 Observations : 19
Column 2 Sample Mean : 4.052632
Column 2 Sample Standard Deviation : 1.311220
Sample Mean Difference : -0.302632
t-Statistic : -0.900723
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.186781
p-Value Right Tailed : 0.813219
p-Value Two Tailed : 0.373561
------------------------------------------------------------
```

```
Model Inputs:
VAR31; VAR131
PEOU2, PEOU2
Column 1 Observations : 23
Column 1 Sample Mean : 3.043478
Column 1 Sample Standard Deviation : 0.824525
Column 2 Observations : 20
Column 2 Sample Mean : 3.350000
Column 2 Sample Standard Deviation : 1.039990
Sample Mean Difference : -0.306522
t-Statistic : -1.077318
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.143818
p-Value Right Tailed : 0.856182
p-Value Two Tailed : 0.287636
------------------------------------------------------------

Model Inputs:
VAR31; VAR431
PEOU2, PEOU2
Column 1 Observations : 23
Column 1 Sample Mean : 3.043478
Column 1 Sample Standard Deviation : 0.824525
Column 2 Observations : 19
Column 2 Sample Mean : 4.000000
Column 2 Sample Standard Deviation : 1.154701
Sample Mean Difference : -0.956522
t-Statistic : -3.126445
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.001646
p-Value Right Tailed : 0.998354
p-Value Two Tailed : 0.003291
------------------------------------------------------------


Model Inputs:
VAR131; VAR431
PEOU2, PEOU2
Column 1 Observations : 20
Column 1 Sample Mean : 3.350000
Column 1 Sample Standard Deviation : 1.039990
Column 2 Observations : 19
Column 2 Sample Mean : 4.000000
Column 2 Sample Standard Deviation : 1.154701
Sample Mean Difference : -0.650000
t-Statistic : -1.849055
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.036226
significant at 10% and 5%
p-Value Right Tailed : 0.963774
p-Value Two Tailed : 0.072452
significant at 10%
------------------------------------------------------------
```

```
Model Inputs:
VAR35; VAR135
IU2, IU2
Column 1 Observations : 23
Column 1 Sample Mean : 3.000000
Column 1 Sample Standard Deviation : 0.904534
Column 2 Observations : 20
Column 2 Sample Mean : 3.450000
Column 2 Sample Standard Deviation : 0.686333
Sample Mean Difference : -0.450000
t-Statistic : -1.815389
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.038392
significant at 10% and 5%
p-Value Right Tailed : 0.961608
p-Value Two Tailed : 0.076783
significant at 10%
------------------------------------------------------------



Model Inputs:
VAR35; VAR435
IU2, IU2
Column 1 Observations : 23
Column 1 Sample Mean : 3.000000
Column 1 Sample Standard Deviation : 0.904534
Column 2 Observations : 19
Column 2 Sample Mean : 3.947368
Column 2 Sample Standard Deviation : 1.223551
Sample Mean Difference : -0.947368
t-Statistic : -2.882789
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.003157
p-Value Right Tailed : 0.996843
p-Value Two Tailed : 0.006314
------------------------------------------------------------

Model Inputs:
VAR135; VAR435
IU2, IU2
Column 1 Observations : 20
Column 1 Sample Mean : 3.450000
Column 1 Sample Standard Deviation : 0.686333
Column 2 Observations : 19
Column 2 Sample Mean : 3.947368
Column 2 Sample Standard Deviation : 1.223551
Sample Mean Difference : -0.497368
t-Statistic : -1.576185
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.061748
significant at 10%
p-Value Right Tailed : 0.938252
p-Value Two Tailed : 0.123496
------------------------------------------------------------
```

```
Model Inputs:
VAR38; VAR138
PU2, PU2
Column 1 Observations : 23
Column 1 Sample Mean : 4.086957
Column 1 Sample Standard Deviation : 0.733178
Column 2 Observations : 20
Column 2 Sample Mean : 3.800000
Column 2 Sample Standard Deviation : 0.695852
Sample Mean Difference : 0.286957
t-Statistic : 1.310610
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.901358
p-Value Right Tailed : 0.098642
significant at 10%
significantly greater than the hypothesized mean difference.
p-Value Two Tailed : 0.197284
------------------------------------------------------------

Model Inputs:
VAR38; VAR438
PU2, PU2
Column 1 Observations : 23
Column 1 Sample Mean : 4.086957
Column 1 Sample Standard Deviation : 0.733178
Column 2 Observations : 19
Column 2 Sample Mean : 3.368421
Column 2 Sample Standard Deviation : 1.256562
Sample Mean Difference : 0.718535
t-Statistic : 2.310611
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.986954
p-Value Right Tailed : 0.013046
significant at 10% and 5%
significantly greater than the hypothesized mean difference.
p-Value Two Tailed : 0.026093
significant at 10% and 5%
------------------------------------------------------------

Model Inputs:
VAR138; VAR438
PU2, PU2
Column 1 Observations : 20
Column 1 Sample Mean : 3.800000
Column 1 Sample Standard Deviation : 0.695852
Column 2 Observations : 19
Column 2 Sample Mean : 3.368421
Column 2 Sample Standard Deviation : 1.256562
Sample Mean Difference : 0.431579
t-Statistic : 1.335996
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.905145
p-Value Right Tailed : 0.094855
significant at 10%
significantly greater than the hypothesized mean difference.
p-Value Two Tailed : 0.189710
------------------------------------------------------------
```

Model Inputs:
VAR43; VAR143
PEOU3, PEOU3
Column 1 Observations : 23
Column 1 Sample Mean : 3.217391
Column 1 Sample Standard Deviation : 0.998022
Column 2 Observations : 20
Column 2 Sample Mean : 3.500000
Column 2 Sample Standard Deviation : 0.827170
Sample Mean Difference : -0.282609
t-Statistic : -1.001678
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.161187
p-Value Right Tailed : 0.838813
p-Value Two Tailed : 0.322374

Model Inputs:
VAR43; VAR443
PEOU3, PEOU3
Column 1 Observations : 23
Column 1 Sample Mean : 3.217391
Column 1 Sample Standard Deviation : 0.998022
Column 2 Observations : 19
Column 2 Sample Mean : 4.052632
Column 2 Sample Standard Deviation : 1.177270
Sample Mean Difference : -0.835240
t-Statistic : -2.489169
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.008532
p-Value Right Tailed : 0.991468
p-Value Two Tailed : 0.017063
significant at 10% and 5%

Model Inputs:
VAR143; VAR443
PEOU3, PEOU3
Column 1 Observations : 20
Column 1 Sample Mean : 3.500000
Column 1 Sample Standard Deviation : 0.827170
Column 2 Observations : 19
Column 2 Sample Mean : 4.052632
Column 2 Sample Standard Deviation : 1.177270
Sample Mean Difference : -0.552632
t-Statistic : -1.703355
Hypothesized Mean : 0.000000
p-Value Left Tailed : 0.048444
significant at 10% and 5%
p-Value Right Tailed : 0.951556
p-Value Two Tailed : 0.096889
significant at 10%

MANN-WHITNEY TEST

Model Inputs:
VAR15
VAR115
PU1
PU1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	20
Median	4.00	4.00
Rank Sum	533.00	413.00
U Values	203.00	257.00
Wilcoxon W	413.00	
U-Stat	203.00	
Mean	230.00	
Std Dev	41.06905	
Z-Score	0.64525	
P-value (One Tail)	0.25938	
P-value (Two Tail)	0.51876	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR15
VAR415
PU1
PU1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	19
Median	4.00	5.00
Rank Sum	340.50	562.50
U Values	372.50	64.50
Wilcoxon W	562.50	
U-Stat	64.50	
Mean	218.50	
Std Dev	39.57166	
Z-Score	3.87904	
P-value (One Tail)	0.00005	
P-value (Two Tail)	0.00010	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR115
VAR415
PU1
PU1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	19
Median	4.00	5.00
Rank Sum	268.50	511.50
U Values	321.50	58.50
Wilcoxon W	511.50	
U-Stat	58.50	
Mean	190.00	
Std Dev	35.59026	
Z-Score	3.68078	
P-value (One Tail)	0.00012	
P-value (Two Tail)	0.00023	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR16
VAR116
PU2
PU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	20
Median	4.00	4.00
Rank Sum	495.50	450.50
U Values	240.50	219.50
Wilcoxon W	450.50	
U-Stat	219.50	
Mean	230.00	
Std Dev	41.06905	
Z-Score	0.24349	
P-value (One Tail)	0.40381	
P-value (Two Tail)	0.80762	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR16
VAR416
PU2
PU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	19
Median	4.00	5.00
Rank Sum	333.00	570.00
U Values	380.00	57.00
Wilcoxon W	570.00	
U-Stat	57.00	
Mean	218.50	
Std Dev	39.57166	
Z-Score	4.06857	
P-value (One Tail)	0.00002	
P-value (Two Tail)	0.00005	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR116
VAR416
PU2
PU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	19
Median	4.00	5.00
Rank Sum	266.00	514.00
U Values	324.00	56.00
Wilcoxon W	514.00	
U-Stat	56.00	
Mean	190.00	
Std Dev	35.59026	
Z-Score	3.75103	
P-value (One Tail)	0.00009	
P-value (Two Tail)	0.00018	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR17
VAR117
PU3
PU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	20
Median	4.00	3.50
Rank Sum	535.00	411.00
U Values	201.00	259.00
Wilcoxon W	411.00	
U-Stat	201.00	
Mean	230.00	
Std Dev	41.06905	
Z-Score	0.69395	
P-value (One Tail)	0.24386	
P-value (Two Tail)	0.48771	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR17
VAR417
PU3
PU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	19
Median	4.00	5.00
Rank Sum	311.50	591.50
U Values	401.50	35.50
Wilcoxon W	591.50	
U-Stat	35.50	
Mean	218.50	
Std Dev	39.57166	
Z-Score	4.61189	
P-value (One Tail)	0.00000	
P-value (Two Tail)	0.00000	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR117
VAR417
PU3
PU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	19
Median	3.50	5.00
Rank Sum	234.00	546.00
U Values	356.00	24.00
Wilcoxon W	546.00	
U-Stat	24.00	
Mean	190.00	
Std Dev	35.59026	
Z-Score	4.65015	
P-value (One Tail)	0.00000	
P-value (Two Tail)	0.00000	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR18
VAR118
PU4
PU4
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	20
Median	4.00	4.00
Rank Sum	516.50	429.50
U Values	219.50	240.50
Wilcoxon W	429.50	
U-Stat	219.50	
Mean	230.00	
Std Dev	41.06905	
Z-Score	0.24349	
P-value (One Tail)	0.40381	
P-value (Two Tail)	0.80762	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR18
VAR418
PU4
PU4
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	19
Median	4.00	5.00
Rank Sum	311.00	592.00
U Values	402.00	35.00
Wilcoxon W	592.00	
U-Stat	35.00	
Mean	218.50	
Std Dev	39.57166	
Z-Score	4.62452	
P-value (One Tail)	0.00000	
P-value (Two Tail)	0.00000	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR118
VAR418
PU4
PU4
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	19
Median	4.00	5.00
Rank Sum	226.00	554.00
U Values	364.00	16.00
Wilcoxon W	554.00	
U-Stat	16.00	
Mean	190.00	
Std Dev	35.59026	
Z-Score	4.87493	
P-value (One Tail)	0.00000	
P-value (Two Tail)	0.00000	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR19
VAR119
PEOU1
PEOU1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	20
Median	4.00	4.00
Rank Sum	557.00	389.00
U Values	179.00	281.00
Wilcoxon W	389.00	
U-Stat	179.00	
Mean	230.00	
Std Dev	41.06905	
Z-Score	1.22964	
P-value (One Tail)	0.10942	
P-value (Two Tail)	0.21883	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR19
VAR419
PEOU1
PEOU1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	19
Median	4.00	5.00
Rank Sum	390.00	513.00
U Values	323.00	114.00
Wilcoxon W	513.00	
U-Stat	114.00	
Mean	218.50	
Std Dev	39.57166	
Z-Score	2.62814	
P-value (One Tail)	0.00429	
P-value (Two Tail)	0.00859	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR119
VAR419
PEOU1
PEOU1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	19
Median	4.00	5.00
Rank Sum	290.00	490.00
U Values	300.00	80.00
Wilcoxon W	490.00	
U-Stat	80.00	
Mean	190.00	
Std Dev	35.59026	
Z-Score	3.07668	
P-value (One Tail)	0.00105	
P-value (Two Tail)	0.00209	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR20
VAR120
PEOU2
PEOU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	20
Median	3.00	3.00
Rank Sum	498.50	447.50
U Values	237.50	222.50
Wilcoxon W	447.50	
U-Stat	222.50	
Mean	230.00	
Std Dev	41.06905	
Z-Score	0.17044	
P-value (One Tail)	0.43233	
P-value (Two Tail)	0.86466	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR20
VAR420
PEOU2
PEOU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	19
Median	3.00	4.00
Rank Sum	362.00	541.00
U Values	351.00	86.00
Wilcoxon W	541.00	
U-Stat	86.00	
Mean	218.50	
Std Dev	39.57166	
Z-Score	3.33572	
P-value (One Tail)	0.00043	
P-value (Two Tail)	0.00085	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR120
VAR420
PEOU2
PEOU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	19
Median	3.00	4.00
Rank Sum	289.00	491.00
U Values	301.00	79.00
Wilcoxon W	491.00	
U-Stat	79.00	
Mean	190.00	
Std Dev	35.59026	
Z-Score	3.10478	
P-value (One Tail)	0.00095	
P-value (Two Tail)	0.00190	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR21
VAR121
PEOU3
PEOU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	20
Median	4.00	4.00
Rank Sum	520.00	426.00
U Values	216.00	244.00
Wilcoxon W	426.00	
U-Stat	216.00	
Mean	230.00	
Std Dev	41.06905	
Z-Score	0.32871	
P-value (One Tail)	0.37119	
P-value (Two Tail)	0.74237	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR21
VAR421
PEOU3
PEOU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	19
Median	4.00	5.00
Rank Sum	352.00	551.00
U Values	361.00	76.00
Wilcoxon W	551.00	
U-Stat	76.00	
Mean	218.50	
Std Dev	39.57166	
Z-Score	3.58843	
P-value (One Tail)	0.00017	
P-value (Two Tail)	0.00033	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR121
VAR421
PEOU3
PEOU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	19
Median	4.00	5.00
Rank Sum	283.00	497.00
U Values	307.00	73.00
Wilcoxon W	497.00	
U-Stat	73.00	
Mean	190.00	
Std Dev	35.59026	
Z-Score	3.27337	
P-value (One Tail)	0.00053	
P-value (Two Tail)	0.00106	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR22
VAR122
PEOU4
PEOU4
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	20
Median	3.00	3.00
Rank Sum	514.50	431.50
U Values	221.50	238.50
Wilcoxon W	431.50	
U-Stat	221.50	
Mean	230.00	
Std Dev	41.06905	
Z-Score	0.19479	
P-value (One Tail)	0.42278	
P-value (Two Tail)	0.84555	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR22
VAR422
PEOU4
PEOU4

Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	19
Median	3.00	5.00
Rank Sum	333.50	569.50
U Values	379.50	57.50
Wilcoxon W	569.50	
U-Stat	57.50	
Mean	218.50	
Std Dev	39.57166	
Z-Score	4.05593	
P-value (One Tail)	0.00002	
P-value (Two Tail)	0.00005	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR122
VAR422
PEOU4
PEOU4
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	19
Median	3.00	5.00
Rank Sum	262.00	518.00
U Values	328.00	52.00
Wilcoxon W	518.00	
U-Stat	52.00	
Mean	190.00	
Std Dev	35.59026	
Z-Score	3.86342	
P-value (One Tail)	0.00006	
P-value (Two Tail)	0.00011	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR23
VAR123
IU1
IU1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	20
Median	4.00	3.00
Rank Sum	574.50	371.50
U Values	161.50	298.50
Wilcoxon W	371.50	
U-Stat	161.50	
Mean	230.00	
Std Dev	41.06905	
Z-Score	1.65575	
P-value (One Tail)	0.04889	
P-value (Two Tail)	0.09777	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR23
VAR423
IU1
IU1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	19
Median	4.00	5.00
Rank Sum	357.50	545.50
U Values	355.50	81.50
Wilcoxon W	545.50	
U-Stat	81.50	
Mean	218.50	
Std Dev	39.57166	
Z-Score	3.44944	
P-value (One Tail)	0.00028	
P-value (Two Tail)	0.00056	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR123
VAR423
IU1
IU1
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	19
Median	3.00	5.00
Rank Sum	258.50	521.50
U Values	331.50	48.50
Wilcoxon W	521.50	
U-Stat	48.50	
Mean	190.00	
Std Dev	35.59026	
Z-Score	3.96176	
P-value (One Tail)	0.00004	
P-value (Two Tail)	0.00007	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR24
VAR124
IU2
IU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	20
Median	3.00	3.00
Rank Sum	570.00	376.00
U Values	166.00	294.00
Wilcoxon W	376.00	
U-Stat	166.00	
Mean	230.00	
Std Dev	41.06905	
Z-Score	1.54618	
P-value (One Tail)	0.06103	
P-value (Two Tail)	0.12206	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR24
VAR424
IU2
IU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	19
Median	3.00	5.00
Rank Sum	304.50	598.50
U Values	408.50	28.50
Wilcoxon W	598.50	
U-Stat	28.50	
Mean	218.50	
Std Dev	39.57166	
Z-Score	4.78878	
P-value (One Tail)	0.00000	
P-value (Two Tail)	0.00000	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables

---

Model Inputs:
VAR124
VAR424
IU2
IU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	19
Median	3.00	5.00
Rank Sum	221.00	559.00
U Values	369.00	11.00
Wilcoxon W	559.00	
U-Stat	11.00	
Mean	190.00	
Std Dev	35.59026	
Z-Score	5.01542	
P-value (One Tail)	0.00000	
P-value (Two Tail)	0.00000	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables

---

Model Inputs:
VAR28
VAR128
PU3
PU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	20
Median	3.00	4.00
Rank Sum	433.00	513.00
U Values	303.00	157.00
Wilcoxon W	513.00	
U-Stat	157.00	
Mean	230.00	
Std Dev	41.06905	
Z-Score	1.76532	
P-value (One Tail)	0.03876	
P-value (Two Tail)	0.07751	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR28
VAR428
PU3
PU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	19
Median	3.00	4.00
Rank Sum	393.50	509.50
U Values	319.50	117.50
Wilcoxon W	509.50	
U-Stat	117.50	
Mean	218.50	
Std Dev	39.57166	
Z-Score	2.53970	
P-value (One Tail)	0.00555	
P-value (Two Tail)	0.01109	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR128
VAR428
PU3
PU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	19
Median	4.00	4.00
Rank Sum	354.00	426.00
U Values	236.00	144.00
Wilcoxon W	426.00	
U-Stat	144.00	
Mean	190.00	
Std Dev	35.59026	
Z-Score	1.27844	
P-value (One Tail)	0.10055	
P-value (Two Tail)	0.20109	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR29
VAR129
PU4
PU4
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	20
Median	3.00	4.00
Rank Sum	420.50	525.50
U Values	315.50	144.50
Wilcoxon W	525.50	
U-Stat	144.50	
Mean	230.00	
Std Dev	41.06905	
Z-Score	2.06969	
P-value (One Tail)	0.01924	
P-value (Two Tail)	0.03848	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR29
VAR429
PU4
PU4
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	19
Median	3.00	5.00
Rank Sum	381.00	522.00
U Values	332.00	105.00
Wilcoxon W	522.00	
U-Stat	105.00	
Mean	218.50	
Std Dev	39.57166	
Z-Score	2.85558	
P-value (One Tail)	0.00215	
P-value (Two Tail)	0.00430	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR129
VAR429
PU4
PU4
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	19
Median	4.00	5.00
Rank Sum	341.50	438.50
U Values	248.50	131.50
Wilcoxon W	438.50	
U-Stat	131.50	
Mean	190.00	
Std Dev	35.59026	
Z-Score	1.62966	
P-value (One Tail)	0.05159	
P-value (Two Tail)	0.10317	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR31
VAR131
PEOU2
PEOU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	20
Median	3.00	3.50
Rank Sum	461.50	484.50
U Values	274.50	185.50
Wilcoxon W	484.50	
U-Stat	185.50	
Mean	230.00	
Std Dev	41.06905	
Z-Score	1.07137	
P-value (One Tail)	0.14200	
P-value (Two Tail)	0.28400	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR31
VAR431
PEOU2
PEOU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	19
Median	3.00	4.00
Rank Sum	378.50	524.50
U Values	334.50	102.50
Wilcoxon W	524.50	
U-Stat	102.50	
Mean	218.50	
Std Dev	39.57166	
Z-Score	2.91876	
P-value (One Tail)	0.00176	
P-value (Two Tail)	0.00351	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR131
VAR431
PEOU2
PEOU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	19
Median	3.50	4.00
Rank Sum	330.00	450.00
U Values	260.00	120.00
Wilcoxon W	450.00	
U-Stat	120.00	
Mean	190.00	
Std Dev	35.59026	
Z-Score	1.95278	
P-value (One Tail)	0.02542	
P-value (Two Tail)	0.05085	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR35
VAR135
IU2
IU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	20
Median	3.00	3.00
Rank Sum	447.00	499.00
U Values	289.00	171.00
Wilcoxon W	499.00	
U-Stat	171.00	
Mean	230.00	
Std Dev	41.06905	
Z-Score	1.42443	
P-value (One Tail)	0.07716	
P-value (Two Tail)	0.15432	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR35
VAR435
IU2
IU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	19
Median	3.00	4.00
Rank Sum	377.00	526.00
U Values	336.00	101.00
Wilcoxon W	526.00	
U-Stat	101.00	
Mean	218.50	
Std Dev	39.57166	
Z-Score	2.95666	
P-value (One Tail)	0.00155	
P-value (Two Tail)	0.00311	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR135
VAR435
IU2
IU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	19
Median	3.00	4.00
Rank Sum	321.50	458.50
U Values	268.50	111.50
Wilcoxon W	458.50	
U-Stat	111.50	
Mean	190.00	
Std Dev	35.59026	
Z-Score	2.19161	
P-value (One Tail)	0.01420	
P-value (Two Tail)	0.02841	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR38
VAR138
PU2
PU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	20
Median	4.00	4.00
Rank Sum	562.00	384.00
U Values	174.00	286.00
Wilcoxon W	384.00	
U-Stat	174.00	
Mean	230.00	
Std Dev	41.06905	
Z-Score	1.35138	
P-value (One Tail)	0.08829	
P-value (Two Tail)	0.17657	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR38
VAR438
PU2
PU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	19
Median	4.00	4.00
Rank Sum	564.50	338.50
U Values	148.50	288.50
Wilcoxon W	338.50	
U-Stat	148.50	
Mean	218.50	
Std Dev	39.57166	
Z-Score	1.75631	
P-value (One Tail)	0.03952	
P-value (Two Tail)	0.07904	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR138
VAR438
PU2
PU2
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	19
Median	4.00	4.00
Rank Sum	433.50	346.50
U Values	156.50	223.50
Wilcoxon W	346.50	
U-Stat	156.50	
Mean	190.00	
Std Dev	35.59026	
Z-Score	0.92722	
P-value (One Tail)	0.17691	
P-value (Two Tail)	0.35381	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR43
VAR143
PEOU3
PEOU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	20
Median	3.00	3.00
Rank Sum	465.50	480.50
U Values	270.50	189.50
Wilcoxon W	480.50	
U-Stat	189.50	
Mean	230.00	
Std Dev	41.06905	
Z-Score	0.97397	
P-value (One Tail)	0.16504	
P-value (Two Tail)	0.33007	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables
---

Model Inputs:
VAR43
VAR443
PEOU3
PEOU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	23	19
Median	3.00	5.00
Rank Sum	405.00	498.00
U Values	308.00	129.00
Wilcoxon W	498.00	
U-Stat	129.00	
Mean	218.50	
Std Dev	39.57166	
Z-Score	2.24908	
P-value (One Tail)	0.01225	
P-value (Two Tail)	0.02451	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables

---

Model Inputs:
VAR143
VAR443
PEOU3
PEOU3
Nonparametric Mann-Whitney Test
(Two Independent Samples)

	Sample 1	Sample 2
Count	20	19
Median	3.00	5.00
Rank Sum	340.50	439.50
U Values	249.50	130.50
Wilcoxon W	439.50	
U-Stat	130.50	
Mean	190.00	
Std Dev	35.59026	
Z-Score	1.65776	
P-value (One Tail)	0.04868	
P-value (Two Tail)	0.09737	

* Adjusted for Ties
Null hypothesis: There is zero difference between the variables

N. T-TESTS, MANN–WHITNEY TESTS III: COMPARING THREE RISK AMONG ALL THREE SYSTEM PRESENTATIONS

```
Model Inputs:
VAR3; VAR2
Column 1 Observations : 19
Column 1 Sample Mean : 2.815789
Column 1 Sample Standard Deviation : 0.772092
Column 2 Observations : 20
Column 2 Sample Mean : 3.175000
Column 2 Sample Standard Deviation : 0.507185
Sample Mean Difference : -0.359211
t-Statistic : -1.725838
Hypothesized Mean : 0.000000

p-Value Left Tailed : 0.046360*
significant at 10% and 5%
rejected
significantly less than the hypothesized mean difference.

p-Value Right Tailed : 0.953640
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly greater than the hypothesized mean difference.

p-Value Two Tailed : 0.092720
significant at 10%
rejected
significantly different than the hypothesized mean difference.

--------------------------------------------------------------------------------

Model Inputs:
VAR3; VAR1
Column 1 Observations : 19
Column 1 Sample Mean : 2.815789
Column 1 Sample Standard Deviation : 0.772092
Column 2 Observations : 23
Column 2 Sample Mean : 3.206522
Column 2 Sample Standard Deviation : 0.531145
Sample Mean Difference : -0.390732
t-Statistic : -1.936912
Hypothesized Mean : 0.000000

p-Value Left Tailed : 0.029921*
significant at 10% and 5%
rejected
significantly less than the hypothesized mean difference.

p-Value Right Tailed : 0.970079
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly greater than the hypothesized mean difference.

p-Value Two Tailed : 0.059842
significant at 10%
rejected
significantly different than the hypothesized mean difference.

--------------------------------------------------------------------------------
```

```
Model Inputs:
VAR2; VAR1
Column 1 Observations : 20
Column 1 Sample Mean : 3.175000
Column 1 Sample Standard Deviation : 0.507185
Column 2 Observations : 23
Column 2 Sample Mean : 3.206522
Column 2 Sample Standard Deviation : 0.531145
Sample Mean Difference : -0.031522
t-Statistic : -0.198199
Hypothesized Mean : 0.000000

p-Value Left Tailed : 0.421934
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly less than the hypothesized mean difference.

p-Value Right Tailed : 0.578066
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly greater than the hypothesized mean difference.

p-Value Two Tailed : 0.843869
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly different than the hypothesized mean difference.

--------------------------------------------------------------------------------

Model Inputs:
VAR6; VAR5
Column 1 Observations : 19
Column 1 Sample Mean : 3.105263
Column 1 Sample Standard Deviation : 0.597656
Column 2 Observations : 20
Column 2 Sample Mean : 3.160000
Column 2 Sample Standard Deviation : 0.560451
Sample Mean Difference : -0.054737
t-Statistic : -0.295171
Hypothesized Mean : 0.000000

p-Value Left Tailed : 0.384757
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly less than the hypothesized mean difference.

p-Value Right Tailed : 0.615243
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly greater than the hypothesized mean difference.

p-Value Two Tailed : 0.769513
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly different than the hypothesized mean difference.

--------------------------------------------------------------------------------
```

```
Model Inputs:
VAR6; VAR4
Column 1 Observations : 19
Column 1 Sample Mean : 3.105263
Column 1 Sample Standard Deviation : 0.597656
Column 2 Observations : 23
Column 2 Sample Mean : 3.226087
Column 2 Sample Standard Deviation : 0.569862
Sample Mean Difference : -0.120824
t-Statistic : -0.669033
Hypothesized Mean : 0.000000

p-Value Left Tailed : 0.253659
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly less than the hypothesized mean difference.

p-Value Right Tailed : 0.746341
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly greater than the hypothesized mean difference.

p-Value Two Tailed : 0.507318
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly different than the hypothesized mean difference.

--------------------------------------------------------------------------------

Model Inputs:
VAR5; VAR4
Column 1 Observations : 20
Column 1 Sample Mean : 3.160000
Column 1 Sample Standard Deviation : 0.560451
Column 2 Observations : 23
Column 2 Sample Mean : 3.226087
Column 2 Sample Standard Deviation : 0.569862
Sample Mean Difference : -0.066087
t-Statistic : -0.382219
Hypothesized Mean : 0.000000

p-Value Left Tailed : 0.352137
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly less than the hypothesized mean difference.

p-Value Right Tailed : 0.647863
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly greater than the hypothesized mean difference.

p-Value Two Tailed : 0.704273
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly different than the hypothesized mean difference.

--------------------------------------------------------------------------------
```

```
Model Inputs:
VAR9; VAR8
Column 1 Observations : 19
Column 1 Sample Mean : 4.000000
Column 1 Sample Standard Deviation : 0.545690
Column 2 Observations : 20
Column 2 Sample Mean : 4.180000
Column 2 Sample Standard Deviation : 0.449093
Sample Mean Difference : -0.180000
t-Statistic : -1.127270
Hypothesized Mean : 0.000000

p-Value Left Tailed : 0.133443
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly less than the hypothesized mean difference.

p-Value Right Tailed : 0.866557
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly greater than the hypothesized mean difference.

p-Value Two Tailed : 0.266886
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly different than the hypothesized mean difference.

-------------------------------------------------------------------------------

Model Inputs:
VAR9; VAR7
Column 1 Observations : 19
Column 1 Sample Mean : 4.000000
Column 1 Sample Standard Deviation : 0.545690
Column 2 Observations : 23
Column 2 Sample Mean : 3.982609
Column 2 Sample Standard Deviation : 0.525402
Sample Mean Difference : 0.017391
t-Statistic : 0.104929
Hypothesized Mean : 0.000000

p-Value Left Tailed : 0.541522
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly less than the hypothesized mean difference.

p-Value Right Tailed : 0.458478
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly greater than the hypothesized mean difference.

p-Value Two Tailed : 0.916956
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly different than the hypothesized mean difference.

-------------------------------------------------------------------------------
```

Model Inputs:
VAR8; VAR7
Column 1 Observations : 20
Column 1 Sample Mean : 4.180000
Column 1 Sample Standard Deviation : 0.449093
Column 2 Observations : 23
Column 2 Sample Mean : 3.982609
Column 2 Sample Standard Deviation : 0.525402
Sample Mean Difference : 0.197391
t-Statistic : 1.313519
Hypothesized Mean : 0.000000

p-Value Left Tailed : 0.901844
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly less than the hypothesized mean difference.

p-Value Right Tailed : 0.098156
significant at 10%
rejected
significantly greater than the hypothesized mean difference.

p-Value Two Tailed : 0.196311
not significant at any of the following significance levels: 1%, 5%, and 10%
not rejected
not significantly different than the hypothesized mean difference.

Nonparametric Mann-Whitney Test
(Two Independent Samples)

Model Inputs:
VAR3
VAR2

	Sample 1	Sample 2
Count	19	20
Median	2.75	3.25
Rank Sum	320.50	459.50
U Values	249.50	130.50

Wilcoxon W 320.50
U-Stat 130.50
Mean 190.00
Std Dev 35.59026
Z-Score 1.65776
P-value (One Tail) 0.04868**
P-value (Two Tail) 0.09737
* Adjusted for Ties

Null hypothesis: There is zero difference between the two variables

---

Model Inputs:
VAR3
VAR1

	Sample 1	Sample 2
Count	19	23
Median	2.75	3.25
Rank Sum	334.00	569.00
U Values	293.00	144.00

Wilcoxon W	334.00
U-Stat	144.00
Mean	218.50
Std Dev	39.57166
Z-Score	1.87002
P-value (One Tail)	0.03074**
P-value (Two Tail)	0.06148

* Adjusted for Ties

Null hypothesis: There is zero difference between the two variables

---

Model Inputs:
VAR2
VAR1

	Sample 1	Sample 2
Count	20	23
Median	3.25	3.25
Rank Sum	432.50	513.50
U Values	237.50	222.50

Wilcoxon W	432.50
U-Stat	222.50
Mean	230.00
Std Dev	41.06905
Z-Score	0.17044
P-value (One Tail)	0.43233
P-value (Two Tail)	0.86466

* Adjusted for Ties

Null hypothesis: There is zero difference between the two variables

---

Model Inputs:
VAR6
VAR5

	Sample 1	Sample 2
Count	19	20
Median	2.80	3.30
Rank Sum	354.00	426.00
U Values	216.00	164.00

Wilcoxon W	354.00
U-Stat	164.00
Mean	190.00
Std Dev	35.59026
Z-Score	0.71649
P-value (One Tail)	0.23684
P-value (Two Tail)	0.47369

* Adjusted for Ties

Null hypothesis: There is zero difference between the two variables

---

Model Inputs:
VAR6
VAR4

	Sample 1	Sample 2
Count	19	23
Median	2.80	3.20
Rank Sum	372.50	530.50
U Values	254.50	182.50

Wilcoxon W	372.50
U-Stat	182.50
Mean	218.50
Std Dev	39.57166
Z-Score	0.89711
P-value (One Tail)	0.18483
P-value (Two Tail)	0.36966

* Adjusted for Ties

Null hypothesis: There is zero difference between the two variables

---

Model Inputs:
VAR5
VAR4

	Sample 1	Sample 2
Count	20	23
Median	3.30	3.20
Rank Sum	431.50	514.50
U Values	238.50	221.50

Wilcoxon W	431.50
U-Stat	221.50
Mean	230.00
Std Dev	41.06905
Z-Score	0.19479
P-value (One Tail)	0.42278
P-value (Two Tail)	0.84555

* Adjusted for Ties

Null hypothesis: There is zero difference between the two variables

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Model Inputs:
VAR9
VAR8

	Sample 1	Sample 2
Count	19	20
Median	4.20	4.20
Rank Sum	343.50	436.50
U Values	226.50	153.50

Wilcoxon W	343.50
U-Stat	153.50
Mean	190.00
Std Dev	35.59026
Z-Score	1.01151
P-value (One Tail)	0.15589
P-value (Two Tail)	0.31177

* Adjusted for Ties

Null hypothesis: There is zero difference between the two variables

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Model Inputs:
VAR9
VAR7

	Sample 1	Sample 2
Count	19	23
Median	4.20	4.00
Rank Sum	418.50	484.50
U Values	208.50	228.50

Wilcoxon W	418.50
U-Stat	208.50
Mean	218.50
Std Dev	39.57166
Z-Score	0.24007
P-value (One Tail)	0.40514
P-value (Two Tail)	0.81028

* Adjusted for Ties

Null hypothesis: There is zero difference between the two variables

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Model Inputs:
VAR8
VAR7

	Sample 1	Sample 2
Count	20	23
Median	4.20	4.00
Rank Sum	492.00	454.00
U Values	178.00	282.00

Wilcoxon W	492.00
U-Stat	178.00
Mean	230.00
Std Dev	41.06905
Z-Score	1.25399
P-value (One Tail)	0.10492
P-value (Two Tail)	0.20985

* Adjusted for Ties

Null hypothesis: There is zero difference between the two variables

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O. CUSTOM ECONOMETRIC MODEL

Model Inputs:
VAR296
VAR15; VAR16; VAR17; VAR18; VAR19; VAR20; VAR21; VAR22; VAR23; VAR24; VAR25
SUSA
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Regression Results

OVERALL FIT

Multiple R	0.85341	Maximum Log Likelihood	-52.79311
R-Square	0.72830	Akaike Info Criterion (AIC)	6.82033
Adjusted R-Square	0.30135	Bayes Schwarz Criterion (BSC)	7.41682
Standard Error	7.28268	Hannan-Quinn Criterion (HQC)	6.92128
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	135.82272	26.21155	5.18179	0.00128	73.84226	197.80319
VAR X1	-1.78874	5.52795	-0.32358	0.75571	-14.86027	11.28279
VAR X2	0.02206	4.87473	0.00452	0.99652	-11.50484	11.54895
VAR X3	-13.67128	6.12796	-2.23097	0.06088	-28.16161	0.81904
VAR X4	-9.34621	6.28587	-1.48686	0.18065	-24.20993	5.51752
VAR X5	-1.40361	5.80732	-0.24170	0.81594	-15.13574	12.32853
VAR X6	-5.81092	3.63238	-1.59976	0.15369	-14.40012	2.77829
VAR X7	-2.34249	4.29174	-0.54581	0.60215	-12.49084	7.80587
VAR X8	1.71980	3.64092	0.47235	0.65105	-6.88960	10.32921
VAR X9	17.00398	5.38884	3.15541	0.01603	4.26140	29.74656
VAR X10	2.09003	3.88437	0.53806	0.60721	-7.09505	11.27512
VAR X11	-5.90165	2.22358	-2.65412	0.03275	-11.15957	-0.64372

ANOVA

	DF	SS	MS	F	p-Value
Regression	11	995.19	90.47	1.70580	0.24525
Residual	7	371.26	53.04		
Total	18	1366.45			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.538166
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.603037
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.683924

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	95.0000	88.3590	6.6410
2	72.5000	74.1628	-1.6628
3	70.0000	75.6522	-5.6522
4	75.0000	75.8116	-0.8116
5	75.0000	80.3578	-5.3578
6	82.5000	80.8513	1.6487
7	67.5000	69.9100	-2.4100
8	80.0000	79.2775	0.7225
9	75.0000	72.0685	2.9315
10	72.5000	69.3965	3.1035
11	80.0000	74.7454	5.2546
12	85.0000	94.8167	-9.8167
13	72.5000	70.6797	1.8203
14	85.0000	82.1545	2.8455
15	87.5000	82.2271	5.2729
16	57.5000	62.7255	-5.2255
17	67.5000	71.9936	-4.4936
18	70.0000	69.8192	0.1808
19	82.5000	77.4913	5.0087

Model Inputs:
VAR296
VAR115; VAR116; VAR117; VAR118; VAR119; VAR120; VAR121; VAR122; VAR123; VAR124; VAR125
SUSA
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Regression Results

OVERALL FIT

Multiple R	0.88343	Maximum Log Likelihood	-50.87483
R-Square	0.78046	Akaike Info Criterion (AIC)	6.61840
Adjusted R-Square	0.43546	Bayes Schwarz Criterion (BSC)	7.21489
Standard Error	6.54648	Hannan-Quinn Criterion (HQC)	6.71935
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	84.41065	14.02099	6.02031	0.00053	51.25627	117.56502
VAR X1	4.29701	3.22930	1.33063	0.22502	-3.33909	11.93310
VAR X2	-4.74808	3.47455	-1.36653	0.21404	-12.96409	3.46793
VAR X3	-1.55878	2.71996	-0.57309	0.58452	-7.99047	4.87292
VAR X4	0.19499	3.52861	0.05526	0.95748	-8.14886	8.53883
VAR X5	2.34834	3.46511	0.67771	0.51972	-5.84534	10.54203
VAR X6	0.12822	3.12654	0.04101	0.96843	-7.26488	7.52133
VAR X7	-9.63957	3.51108	-2.74547	0.02869	-17.94195	-1.33719
VAR X8	1.30092	3.68058	0.35346	0.73415	-7.40226	10.00410
VAR X9	7.71859	3.86191	1.99864	0.08579	-1.41339	16.85056
VAR X10	-4.08750	3.76275	-1.08631	0.31333	-12.98498	4.80998
VAR X11	3.88113	1.65218	2.34910	0.05116	-0.02565	7.78791

ANOVA

	DF	SS	MS	F	p-Value
Regression	11	1066.45	96.95	2.26221	0.14394
Residual	7	299.99	42.86		
Total	18	1366.45			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.538166
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.603037
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.683924

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	95.0000	88.9821	6.0179
2	72.5000	78.9031	-6.4031
3	70.0000	68.8483	1.1517
4	75.0000	75.4205	-0.4205
5	75.0000	75.8613	-0.8613
6	82.5000	80.4929	2.0071
7	67.5000	72.1619	-4.6619
8	80.0000	76.8574	3.1426
9	75.0000	69.6283	5.3717
10	72.5000	63.1904	9.3096
11	80.0000	83.7127	-3.7127
12	85.0000	84.9268	0.0732
13	72.5000	74.1235	-1.6235
14	85.0000	83.3330	1.6670
15	87.5000	87.1051	0.3949
16	57.5000	63.6923	-6.1923
17	67.5000	68.3553	-0.8553
18	70.0000	72.9885	-2.9885
19	82.5000	83.9165	-1.4165

Model Inputs:
VAR297
VAR26; VAR27; VAR28; VAR29; VAR30; VAR31; VAR32; VAR33; VAR34; VAR35; VAR36
SUSB
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Regression Results

OVERALL FIT

Multiple R	0.41400	Maximum Log Likelihood	-75.07586
R-Square	0.17140	Akaike Info Criterion (AIC)	9.16588
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	9.76237
Standard Error	25.11410	Hannan-Quinn Criterion (HQC)	9.26683
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	73.60663	59.01666	1.24722	0.25243	-65.94561	213.15886
VAR X1	-9.85115	29.10503	-0.33847	0.74494	-78.67361	58.97131
VAR X2	2.22424	17.00323	0.13081	0.89960	-37.98202	42.43049
VAR X3	17.32394	42.26699	0.40987	0.69415	-82.62161	117.26949
VAR X4	9.05908	46.05609	0.19670	0.84965	-99.84626	117.96442
VAR X5	5.83809	32.83013	0.17783	0.86390	-71.79284	83.46902
VAR X6	-4.67918	12.56492	-0.37240	0.72061	-34.39050	25.03215
VAR X7	-5.22580	37.30754	-0.14007	0.89255	-93.44412	82.99252
VAR X8	-2.55167	19.13462	-0.13335	0.89767	-47.79785	42.69452
VAR X9	6.08891	17.19362	0.35414	0.73366	-34.56755	46.74536
VAR X10	-23.39301	55.19399	-0.42383	0.68441	-153.90607	107.12005
VAR X11	1.13779	10.08145	0.11286	0.91331	-22.70105	24.97663

ANOVA

	DF	SS	MS	F	p-Value	
Regression	11	913.26	83.02	0.13163	0.99825	
Residual	7	4415.03	630.72			
Total	18	5328.29				

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.538166
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.603037
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.683924

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	70.0000	69.3266	0.6734
2	17.5000	61.0329	-43.5329
3	62.5000	61.8052	0.6948
4	52.5000	61.6853	-9.1853
5	40.0000	52.7767	-12.7767
6	77.5000	71.7678	5.7322
7	65.0000	55.8199	9.1801
8	47.5000	64.5702	-17.0702
9	82.5000	79.0521	3.4479
10	50.0000	59.1853	-9.1853
11	80.0000	61.7282	18.2718
12	72.5000	74.1624	-1.6624
13	50.0000	57.4916	-7.4916
14	65.0000	66.5137	-1.5137
15	80.0000	59.3342	20.6658
16	57.5000	64.0322	-6.5322
17	87.5000	64.5955	22.9045
18	72.5000	59.8952	12.6048
19	65.0000	50.2251	14.7749

Model Inputs:
VAR297
VAR126; VAR127; VAR128; VAR129; VAR130; VAR131; VAR132; VAR133; VAR134; VAR135; VAR136
SUSB
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Regression Results
OVERALL FIT

Multiple R	0.71362	Maximum Log Likelihood	-70.36150
R-Square	0.50926	Akaike Info Criterion (AIC)	8.66963
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	9.26612
Standard Error	19.32733	Hannan-Quinn Criterion (HQC)	8.77058
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	144.15681	68.43138	2.10659	0.07316	-17.65769	305.97131
VAR X1	-19.85530	14.77429	-1.34391	0.22090	-54.79094	15.08034
VAR X2	9.77247	13.47704	0.72512	0.49190	-22.09566	41.64059
VAR X3	-18.03786	27.35753	-0.65934	0.53076	-82.72814	46.65241
VAR X4	4.35736	19.03998	0.22885	0.82553	-40.66504	49.37976
VAR X5	23.41367	15.12588	1.54792	0.16557	-12.35336	59.18070
VAR X6	-6.98935	6.99968	-0.99852	0.35128	-23.54096	9.56227
VAR X7	-23.35786	12.56216	-1.85938	0.10531	-53.06264	6.34692
VAR X8	-1.18514	20.97284	-0.05651	0.95652	-50.77802	48.40774
VAR X9	9.73763	13.78441	0.70642	0.50275	-22.85733	42.33259
VAR X10	1.09762	18.07236	0.06073	0.95327	-41.63673	43.83197
VAR X11	-3.22113	4.87714	-0.66046	0.53009	-14.75373	8.31146

ANOVA

	DF	SS	MS	F	p-Value
Regression	11	2713.47	246.68	0.66037	0.74162
Residual	7	2614.82	373.55		
Total	18	5328.29			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.538166
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.603037
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.683924

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	70.0000	60.8043	9.1957
2	17.5000	28.6807	-11.1807
3	62.5000	62.8903	-0.3903
4	52.5000	67.5379	-15.0379
5	40.0000	67.5062	-27.5062
6	77.5000	67.8865	9.6135
7	65.0000	54.3905	10.6095
8	47.5000	66.6995	-19.1995
9	82.5000	77.8860	4.6140
10	50.0000	43.8826	6.1174
11	80.0000	82.5926	-2.5926
12	72.5000	61.7825	10.7175
13	50.0000	56.7486	-6.7486
14	65.0000	70.3898	-5.3898
15	80.0000	66.4862	13.5138
16	57.5000	50.3621	7.1379
17	87.5000	70.6651	16.8349
18	72.5000	66.4555	6.0445
19	65.0000	71.3531	-6.3531

Model Inputs:
VAR298
VAR37; VAR38; VAR39; VAR40; VAR41; VAR42; VAR43; VAR44; VAR45; VAR46; VAR47
SUSC
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Regression Results
OVERALL FIT

Multiple R	0.89265	Maximum Log Likelihood	-58.45594
R-Square	0.79683	Akaike Info Criterion (AIC)	7.41641
Adjusted R-Square	0.47756	Bayes Schwarz Criterion (BSC)	8.01290
Standard Error	9.97518	Hannan-Quinn Criterion (HQC)	7.51736
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	124.03364	47.11869	2.63237	0.03380	12.61564	235.45164
VAR X1	0.68233	6.42648	0.10617	0.91842	-14.51389	15.87854
VAR X2	-5.33325	6.05009	-0.88151	0.40729	-19.63944	8.97295
VAR X3	-14.79477	12.09981	-1.22273	0.26100	-43.40627	13.81673
VAR X4	-3.88013	8.19348	-0.47356	0.65023	-23.25463	15.49437
VAR X5	-5.32504	5.18321	-1.02736	0.33844	-17.58139	6.93131
VAR X6	-18.70452	5.38859	-3.47113	0.01039	-31.44652	-5.96252
VAR X7	5.37888	4.56624	1.17797	0.27730	-5.41856	16.17632
VAR X8	11.61093	6.83245	1.69938	0.13305	-4.54524	27.76711
VAR X9	5.63244	4.01871	1.40155	0.20380	-3.87030	15.13517
VAR X10	7.98640	6.32898	1.26188	0.24741	-6.97925	22.95205
VAR X11	-6.74464	2.74341	-2.45849	0.04356	-13.23178	-0.25751

ANOVA

	DF	SS	MS	F	p-Value
Regression	11	2731.76	248.34	2.49579	0.11717
Residual	7	696.53	99.50		
Total	18	3428.29			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.538166
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.603037
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.683924

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	72.5000	62.4626	10.0374
2	42.5000	34.8846	7.6154
3	47.5000	53.0272	-5.5272
4	55.0000	59.0813	-4.0813
5	42.5000	38.3684	4.1316
6	45.0000	40.0761	4.9239
7	60.0000	61.3668	-1.3668
8	20.0000	21.1984	-1.1984
9	50.0000	43.1607	6.8393
10	37.5000	35.4381	2.0619
11	30.0000	33.4265	-3.4265
12	47.5000	47.9480	-0.4480
13	40.0000	32.9212	7.0788
14	52.5000	55.3537	-2.8537
15	47.5000	50.9017	-3.4017
16	35.0000	31.9282	3.0718
17	32.5000	32.1283	0.3717
18	27.5000	42.5523	-15.0523
19	15.0000	23.7761	-8.7761

Model Inputs:
VAR298
VAR137; VAR138; VAR139; VAR140; VAR141; VAR142; VAR143; VAR144; VAR145; VAR146; VAR147
SUSC
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Regression Results
OVERALL FIT

Multiple R	0.48672	Maximum Log Likelihood	-70.36610
R-Square	0.23689	Akaike Info Criterion (AIC)	8.67012
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	9.26660
Standard Error	19.33227	Hannan-Quinn Criterion (HQC)	8.77106
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	37.14345	45.07098	0.82411	0.43705	-69.43248	143.71939
VAR X1	3.50715	11.52996	0.30418	0.76984	-23.75687	30.77117
VAR X2	-2.85355	14.32993	-0.19913	0.84782	-36.73845	31.03134
VAR X3	-1.51031	10.12789	-0.14912	0.88566	-25.45898	22.43835
VAR X4	12.65144	13.58893	0.93101	0.38283	-19.48128	44.78416
VAR X5	-3.15128	7.07835	-0.44520	0.66962	-19.88892	13.58635
VAR X6	8.10490	9.89760	0.81888	0.43984	-15.29920	31.50900
VAR X7	-2.58199	8.16909	-0.31607	0.76117	-21.89881	16.73483
VAR X8	-0.22895	7.62375	-0.03003	0.97688	-18.25626	17.79835
VAR X9	-0.37588	7.80832	-0.04814	0.96295	-18.83963	18.08787
VAR X10	-15.40196	12.23706	-1.25863	0.24851	-44.33800	13.53409
VAR X11	2.75434	5.73420	0.48034	0.64564	-10.80488	16.31356

ANOVA

	DF	SS	MS	F	p-Value	
Regression	11	812.13	73.83	0.19755	0.99123	
Residual	7	2616.16	373.74			
Total	18	3428.29				

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.538166
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.603037
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.683924

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	72.5000	44.4629	28.0371
2	42.5000	47.0747	-4.5747
3	47.5000	35.4939	12.0061
4	55.0000	56.6545	-1.6545
5	42.5000	43.8346	-1.3346
6	45.0000	40.6760	4.3240
7	60.0000	53.0923	6.9077
8	20.0000	34.6542	-14.6542
9	50.0000	47.6549	2.3451
10	37.5000	41.2946	-3.7946
11	30.0000	36.5464	-6.5464
12	47.5000	44.3071	3.1929
13	40.0000	32.5360	7.4640
14	52.5000	46.7927	5.7073
15	47.5000	32.1601	15.3399
16	35.0000	35.9813	-0.9813
17	32.5000	46.5735	-14.0735
18	27.5000	40.3251	-12.8251
19	15.0000	39.8851	-24.8851

Model Inputs:
VAR215
VAR1; VAR101
HA1
HA1, HA1

Regression Results

OVERALL FIT

Multiple R	0.26892	Maximum Log Likelihood	-78.29596
R-Square	0.07232	Akaike Info Criterion (AIC)	8.55747
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	8.70659
Standard Error	19.86549	Hannan-Quinn Criterion (HQC)	8.58271
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	27.82386	30.63905	0.90812	0.37729	-37.12802	92.77574
VAR X1	3.30455	4.87668	0.67762	0.50769	-7.03355	13.64265
VAR X2	6.01658	5.52138	1.08969	0.29199	-5.68823	17.72139

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	492.22	246.11	0.62363	0.54853
Residual	16	6314.21	394.64		
Total	18	6806.42			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	75.0000	65.1084	9.8916
2	40.0000	55.7873	-15.7873
3	60.0000	61.8038	-1.8038
4	63.0000	58.4993	4.5007
5	90.0000	71.1250	18.8750
6	80.0000	62.3964	17.6036
7	80.0000	55.7873	24.2127
8	30.0000	62.3964	-32.3964
9	70.0000	56.3798	13.6202
10	65.0000	55.7873	9.2127
11	50.0000	58.4993	-8.4993
12	60.0000	58.4993	1.5007
13	25.0000	53.0752	-28.0752
14	50.0000	53.0752	-3.0752
15	40.0000	55.7873	-15.7873
16	75.0000	56.3798	18.6202
17	90.0000	59.0918	30.9082
18	50.0000	71.1250	-21.1250
19	40.0000	62.3964	-22.3964

Model Inputs:
VAR216
VAR2; VAR102
HA2
HA2, HA2

Regression Results

OVERALL FIT

Multiple R	0.64923	Maximum Log Likelihood	-77.74652
R-Square	0.42150	Akaike Info Criterion (AIC)	8.49963
Adjusted R-Square	0.34919	Bayes Schwarz Criterion (BSC)	8.64876
Standard Error	19.26827	Hannan-Quinn Criterion (HQC)	8.52487
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	134.92912	29.22769	4.61648	0.00029	72.96918	196.88906
VAR X1	-18.46902	5.53856	-3.33462	0.00420	-30.21025	-6.72778
VAR X2	-4.04212	5.88093	-0.68733	0.50172	-16.50914	8.42489

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	4328.16	2164.08	5.82892	0.01254
Residual	16	5940.26	371.27		
Total	18	10268.42			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	35.0000	30.4577	4.5423
2	30.0000	44.8846	-14.8846
3	40.0000	44.8846	-4.8846
4	70.0000	59.3115	10.6885
5	80.0000	48.9267	31.0733
6	80.0000	63.3536	16.6464
7	15.0000	48.9267	-33.9267
8	20.0000	44.8846	-24.8846
9	40.0000	30.4577	9.5423
10	50.0000	63.3536	-13.3536
11	40.0000	67.3957	-27.3957
12	60.0000	40.8424	19.1576
13	75.0000	67.3957	7.6043
14	50.0000	48.9267	1.0733
15	20.0000	26.4156	-6.4156
16	100.0000	85.8647	14.1353
17	70.0000	71.4378	-1.4378
18	50.0000	63.3536	-13.3536
19	75.0000	48.9267	26.0733

Model Inputs:
VAR217
VAR3; VAR103
HA3
HA3, HA3

Regression Results

OVERALL FIT

Multiple R	0.62212	Maximum Log Likelihood	-74.32877
R-Square	0.38703	Akaike Info Criterion (AIC)	8.13987
Adjusted R-Square	0.31041	Bayes Schwarz Criterion (BSC)	8.28899
Standard Error	15.93607	Hannan-Quinn Criterion (HQC)	8.16511
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	-52.66667	32.20044	-1.63559	0.12144	-120.92855	15.59521
VAR X1	20.66667	7.01801	2.94480	0.00951	5.78914	35.54419
VAR X2	12.00000	4.75122	2.52567	0.02248	1.92787	22.07213

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	2565.61	1282.81	5.05125	0.01993
Residual	16	4063.33	253.96		
Total	18	6628.95			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	40.0000	42.0000	-2.0000
2	30.0000	36.6667	-6.6667
3	50.0000	45.3333	4.6667
4	65.0000	57.3333	7.6667
5	70.0000	45.3333	24.6667
6	40.0000	36.6667	3.3333
7	45.0000	45.3333	-0.3333
8	20.0000	33.3333	-13.3333
9	50.0000	66.0000	-16.0000
10	65.0000	45.3333	19.6667
11	80.0000	57.3333	22.6667
12	60.0000	57.3333	2.6667
13	25.0000	57.3333	-32.3333
14	30.0000	45.3333	-15.3333
15	75.0000	78.0000	-3.0000
16	75.0000	54.0000	21.0000
17	50.0000	57.3333	-7.3333
18	40.0000	36.6667	3.3333
19	20.0000	33.3333	-13.3333

Model Inputs:
VAR218
VAR4; VAR104
HA4
HA4, HA4

Regression Results

OVERALL FIT

Multiple R	0.44274	Maximum Log Likelihood	-79.41627
R-Square	0.19602	Akaike Info Criterion (AIC)	8.67540
Adjusted R-Square	0.09552	Bayes Schwarz Criterion (BSC)	8.82452
Standard Error	21.14121	Hannan-Quinn Criterion (HQC)	8.70063
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	77.96049	26.42207	2.95058	0.00940	21.94821	133.97278
VAR X1	-13.05185	6.61074	-1.97434	0.06586	-27.06599	0.96228
VAR X2	-2.21728	6.67718	-0.33207	0.74415	-16.37227	11.93770

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	1743.53	871.76	1.95047	0.17457
Residual	16	7151.21	446.95		
Total	18	8894.74			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	50.0000	29.9358	20.0642
2	10.0000	45.2049	-35.2049
3	10.0000	32.1531	-22.1531
4	60.0000	60.4741	-0.4741
5	20.0000	34.3704	-14.3704
6	60.0000	45.2049	14.7951
7	50.0000	34.3704	15.6296
8	20.0000	32.1531	-12.1531
9	40.0000	34.3704	5.6296
10	60.0000	47.4222	12.5778
11	50.0000	47.4222	2.5778
12	40.0000	56.0395	-16.0395
13	50.0000	42.9877	7.0123
14	0.0000	34.3704	-34.3704
15	50.0000	47.4222	2.5778
16	90.0000	45.2049	44.7951
17	50.0000	47.4222	2.5778
18	20.0000	32.1531	-12.1531
19	40.0000	21.3185	18.6815

Model Inputs:
VAR219
VAR5; VAR105
AL1
AL1, AL1

Regression Results

OVERALL FIT

Multiple R	0.32140	Maximum Log Likelihood	-79.59255
R-Square	0.10330	Akaike Info Criterion (AIC)	8.69395
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	8.84307
Standard Error	21.34926	Hannan-Quinn Criterion (HQC)	8.71919
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	-1.28749	29.42632	-0.04375	0.96564	-63.66850	61.09352
VAR X1	7.22092	6.06208	1.19116	0.25096	-5.63013	20.07196
VAR X2	3.46694	4.97787	0.69647	0.49613	-7.08568	14.01957

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	840.08	420.04	0.92157	0.41801
Residual	16	7292.65	455.79		
Total	18	8132.74			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	65.0000	34.2430	30.7570
2	50.0000	30.7761	19.2239
3	50.0000	41.4639	8.5361
4	20.0000	41.4639	-21.4639
5	30.0000	52.1518	-22.1518
6	70.0000	45.2179	24.7821
7	25.0000	34.2430	-9.2430
8	50.0000	44.9309	5.0691
9	20.0000	27.3091	-7.3091
10	65.0000	44.9309	20.0691
11	10.0000	30.7761	-20.7761
12	10.0000	34.2430	-24.2430
13	10.0000	27.0221	-17.0221
14	50.0000	41.4639	8.5361
15	33.0000	37.9970	-4.9970
16	75.0000	30.7761	44.2239
17	30.0000	41.7510	-11.7510
18	30.0000	37.7100	-7.7100
19	20.0000	34.5301	-14.5301

Model Inputs:
VAR220
VAR6; VAR106
AL2
AL2, AL2

Regression Results

OVERALL FIT

Multiple R	0.21153	Maximum Log Likelihood	-81.51096
R-Square	0.04475	Akaike Info Criterion (AIC)	8.89589
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	9.04501
Standard Error	23.75030	Hannan-Quinn Criterion (HQC)	8.92113
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	71.79930	38.05167	1.88689	0.07746	-8.86665	152.46524
VAR X1	-6.63850	10.85574	-0.61152	0.54945	-29.65164	16.37464
VAR X2	-5.97300	6.95202	-0.85918	0.40293	-20.71062	8.76461

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	422.77	211.38	0.37474	0.69334
Residual	16	9025.23	564.08		
Total	18	9448.00			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	60.0000	52.5493	7.4507
2	50.0000	47.2418	2.7582
3	50.0000	39.9378	10.0622
4	80.0000	40.6033	39.3967
5	50.0000	45.9108	4.0892
6	0.0000	34.6303	-34.6303
7	10.0000	39.9378	-29.9378
8	50.0000	46.5763	3.4237
9	20.0000	46.5763	-26.5763
10	65.0000	40.6033	24.3967
11	10.0000	46.5763	-36.5763
12	30.0000	33.9648	-3.9648
13	25.0000	40.6033	-15.6033
14	50.0000	45.9108	4.0892
15	33.0000	39.9378	-6.9378
16	75.0000	40.6033	34.3967
17	70.0000	39.9378	30.0622
18	30.0000	40.6033	-10.6033
19	40.0000	35.2958	4.7042

Model Inputs:
VAR221
VAR7; VAR107
AL3
AL3, AL3

Regression Results

OVERALL FIT

Multiple R	0.03526	Maximum Log Likelihood	-77.81701
R-Square	0.00124	Akaike Info Criterion (AIC)	8.50705
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	8.65618
Standard Error	19.34388	Hannan-Quinn Criterion (HQC)	8.53229
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	59.43057	24.00835	2.47541	0.02487	8.53514	110.32600
VAR X1	-0.43368	5.42859	-0.07989	0.93732	-11.94177	11.07441
VAR X2	0.50829	4.88335	0.10409	0.91839	-9.84394	10.86052

ANOVA

	DF	SS	MS	F	p-Value	
Regression	2	7.45	3.73	0.00996	0.99010	
Residual	16	5986.97	374.19			
Total	18	5994.42				

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	55.0000	61.1047	-6.1047
2	60.0000	60.0881	-0.0881
3	50.0000	59.1461	-9.1461
4	68.0000	59.1461	8.8539
5	90.0000	59.2207	30.7793
6	60.0000	60.0135	-0.0135
7	35.0000	59.6544	-24.6544
8	50.0000	58.7124	-8.7124
9	60.0000	60.5964	-0.5964
10	90.0000	59.6544	30.3456
11	70.0000	59.2207	10.7793
12	70.0000	59.1461	10.8539
13	75.0000	59.6544	15.3456
14	62.0000	59.6544	2.3456
15	33.0000	58.7124	-25.7124
16	75.0000	59.2207	15.7793
17	30.0000	59.7290	-29.7290
18	30.0000	59.6544	-29.6544
19	70.0000	60.6710	9.3290

Model Inputs:
VAR222
VAR8; VAR108
AL4
AL4, AL4

Regression Results

OVERALL FIT

Multiple R	0.40601	Maximum Log Likelihood	-75.66603
R-Square	0.16484	Akaike Info Criterion (AIC)	8.28063
Adjusted R-Square	0.06045	Bayes Schwarz Criterion (BSC)	8.42976
Standard Error	17.16508	Hannan-Quinn Criterion (HQC)	8.30587
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	54.50550	16.06234	3.39337	0.00371	20.45485	88.55615
VAR X1	5.65578	3.18312	1.77681	0.09461	-1.09213	12.40369
VAR X2	0.93469	3.34553	0.27938	0.78353	-6.15752	8.02690

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	930.50	465.25	1.57904	0.23667
Residual	16	4714.24	294.64		
Total	18	5644.74			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	100.0000	69.5558	30.4442
2	70.0000	75.2116	-5.2116
3	70.0000	79.9327	-9.9327
4	55.0000	63.9000	-8.9000
5	90.0000	76.1463	13.8537
6	60.0000	64.8347	-4.8347
7	85.0000	74.2769	10.7231
8	50.0000	67.6864	-17.6864
9	100.0000	78.9980	21.0020
10	65.0000	69.5558	-4.5558
11	90.0000	84.6538	5.3462
12	70.0000	80.8674	-10.8674
13	50.0000	80.8674	-30.8674
14	75.0000	74.2769	0.7231
15	40.0000	66.7517	-26.7517
16	90.0000	86.5232	3.4768
17	90.0000	66.7517	23.2483
18	80.0000	69.5558	10.4442
19	85.0000	84.6538	0.3462

Model Inputs:
VAR223
VAR9; VAR109
AL5
AL5, AL5

Regression Results

OVERALL FIT

Multiple R	0.03359	Maximum Log Likelihood	-77.61473
R-Square	0.00113	Akaike Info Criterion (AIC)	8.48576
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	8.63488
Standard Error	19.12772	Hannan-Quinn Criterion (HQC)	8.51100
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	55.64730	30.62745	1.81691	0.08801	-9.28000	120.57459
VAR X1	0.61565	4.58816	0.13418	0.89493	-9.11081	10.34211
VAR X2	0.05466	5.94693	0.00919	0.99278	-12.55227	12.66159

ANOVA

	DF	SS	MS	F	p-Value	
Regression	2	6.61	3.31	0.00904	0.99101	
Residual	16	5853.91	365.87			
Total	18	5860.53				

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	70.0000	58.2739	11.7261
2	40.0000	57.0426	-17.0426
3	60.0000	58.8895	1.1105
4	90.0000	57.0972	32.9028
5	80.0000	57.7129	22.2871
6	60.0000	57.1519	2.8481
7	50.0000	58.2739	-8.2739
8	30.0000	58.2739	-28.2739
9	80.0000	58.8895	21.1105
10	70.0000	57.7129	12.2871
11	60.0000	58.3285	1.6715
12	50.0000	58.3285	-8.3285
13	50.0000	58.3285	-8.3285
14	55.0000	58.3832	-3.3832
15	50.0000	58.2739	-8.2739
16	90.0000	58.9442	31.0558
17	50.0000	58.9988	-8.9988
18	40.0000	58.3832	-18.3832
19	30.0000	57.7129	-27.7129

Model Inputs:
VAR224
VAR10; VAR110
LN1
LN1, LN1

Regression Results

OVERALL FIT

Multiple R	0.33961	Maximum Log Likelihood	-73.50668
R-Square	0.11533	Akaike Info Criterion (AIC)	8.05333
Adjusted R-Square	0.00475	Bayes Schwarz Criterion (BSC)	8.20246
Standard Error	15.22461	Hannan-Quinn Criterion (HQC)	8.07857
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	132.65517	44.61151	2.97356	0.00896	38.08300	227.22734
VAR X1	2.89655	4.37979	0.66135	0.51780	-6.38818	12.18128
VAR X2	-11.24138	8.57514	-1.31093	0.20839	-29.41986	6.93710

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	483.48	241.74	1.04294	0.37518
Residual	16	3708.62	231.79		
Total	18	4192.11			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	90.0000	90.9310	-0.9310
2	60.0000	85.1379	-25.1379
3	100.0000	90.9310	9.0690
4	100.0000	99.2759	0.7241
5	90.0000	88.0345	1.9655
6	100.0000	85.1379	14.8621
7	100.0000	96.3793	3.6207
8	100.0000	90.9310	9.0690
9	100.0000	90.9310	9.0690
10	100.0000	88.0345	11.9655
11	100.0000	85.1379	14.8621
12	80.0000	90.9310	-10.9310
13	100.0000	90.9310	9.0690
14	100.0000	102.1724	-2.1724
15	100.0000	90.9310	9.0690
16	100.0000	102.1724	-2.1724
17	50.0000	88.0345	-38.0345
18	70.0000	90.9310	-20.9310
19	95.0000	88.0345	6.9655

Model Inputs:
VAR225
VAR11; VAR111
LN2
LN2, LN2

Regression Results

OVERALL FIT

Multiple R	0.25282	Maximum Log Likelihood	-84.03348
R-Square	0.06392	Akaike Info Criterion (AIC)	9.16142
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	9.31054
Standard Error	27.32318	Hannan-Quinn Criterion (HQC)	9.18666
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	27.52014	24.72949	1.11285	0.28221	-24.90404	79.94432
VAR X1	5.62369	5.40918	1.03966	0.31396	-5.84326	17.09065
VAR X2	-1.88899	6.11785	-0.30877	0.76148	-14.85825	11.08027

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	815.63	407.81	0.54626	0.58954
Residual	16	11944.90	746.56		
Total	18	12760.53			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	20.0000	38.7243	-18.7243
2	30.0000	36.8353	-6.8353
3	90.0000	44.3480	45.6520
4	50.0000	31.2116	18.7884
5	20.0000	48.0827	-28.0827
6	20.0000	23.6989	-3.6989
7	90.0000	36.8353	53.1647
8	5.0000	36.8353	-31.8353
9	10.0000	34.9896	-24.9896
10	50.0000	44.3480	5.6520
11	10.0000	36.8785	-26.8785
12	60.0000	44.3480	15.6520
13	25.0000	46.1937	-21.1937
14	50.0000	34.9463	15.0537
15	10.0000	31.2116	-21.2116
16	20.0000	36.8353	-16.8353
17	50.0000	29.3659	20.6341
18	70.0000	38.7243	31.2757
19	20.0000	25.5879	-5.5879

Model Inputs:
VAR226
VAR12; VAR112
LN3
LN3, LN3

Regression Results

OVERALL FIT

Multiple R	0.17537	Maximum Log Likelihood	-70.38605
R-Square	0.03075	Akaike Info Criterion (AIC)	7.72485
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	7.87397
Standard Error	12.80127	Hannan-Quinn Criterion (HQC)	7.75008
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	87.01027	18.79359	4.62978	0.00028	47.16963	126.85091
VAR X1	1.76444	2.98125	0.59185	0.56222	-4.55552	8.08440
VAR X2	-0.84917	3.09379	-0.27447	0.78723	-7.40770	5.70937

ANOVA

	DF	SS	MS	F	p-Value	
Regression	2	83.20	41.60	0.25384	0.77888	
Residual	16	2621.96	163.87			
Total	18	2705.16				

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	95.0000	89.8222	5.1778
2	50.0000	86.2933	-36.2933
3	90.0000	92.3697	-2.3697
4	99.0000	88.0578	10.9422
5	100.0000	89.8222	10.1778
6	100.0000	84.5289	15.4711
7	95.0000	90.6714	4.3286
8	90.0000	88.9069	1.0931
9	90.0000	92.3697	-2.3697
10	95.0000	91.5866	3.4134
11	90.0000	91.5205	-1.5205
12	70.0000	91.5866	-21.5866
13	100.0000	90.6714	9.3286
14	90.0000	89.8222	0.1778
15	95.0000	88.9069	6.0931
16	100.0000	92.4358	7.5642
17	90.0000	91.5205	-1.5205
18	80.0000	90.6714	-10.6714
19	95.0000	92.4358	2.5642

Model Inputs:
VAR227
VAR13; VAR113
LN4
LN4, LN4

Regression Results

OVERALL FIT

Multiple R	0.44336	Maximum Log Likelihood	-78.01303
R-Square	0.19656	Akaike Info Criterion (AIC)	8.52769
Adjusted R-Square	0.09613	Bayes Schwarz Criterion (BSC)	8.67681
Standard Error	19.55569	Hannan-Quinn Criterion (HQC)	8.55293
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	17.31903	31.52366	0.54940	0.59032	-49.50814	84.14621
VAR X1	8.04960	5.33397	1.50912	0.15076	-3.25790	19.35710
VAR X2	6.15952	5.77245	1.06705	0.30178	-6.07754	18.39657

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	1496.99	748.49	1.95723	0.17362
Residual	16	6118.80	382.43		
Total	18	7615.79			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	85.0000	88.3646	-3.3646
2	40.0000	74.1555	-34.1555
3	80.0000	74.1555	5.8445
4	95.0000	58.0563	36.9437
5	100.0000	80.3150	19.6850
6	70.0000	76.0456	-6.0456
7	55.0000	74.1555	-19.1555
8	70.0000	80.3150	-10.3150
9	100.0000	88.3646	11.6354
10	90.0000	74.1555	15.8445
11	65.0000	82.2051	-17.2051
12	80.0000	88.3646	-8.3646
13	100.0000	82.2051	17.7949
14	70.0000	61.8365	8.1635
15	100.0000	88.3646	11.6354
16	40.0000	66.1059	-26.1059
17	50.0000	72.2654	-22.2654
18	90.0000	82.2051	7.7949
19	100.0000	88.3646	11.6354

Model Inputs:
VAR228
VAR14; VAR114
LN5
LN5, LN5

Regression Results

OVERALL FIT

Multiple R	0.29292	Maximum Log Likelihood	-78.16975
R-Square	0.08580	Akaike Info Criterion (AIC)	8.54418
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	8.69331
Standard Error	19.72670	Hannan-Quinn Criterion (HQC)	8.56942
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	52.22936	37.12229	1.40695	0.17857	-26.46639	130.92510
VAR X1	-2.72171	7.02756	-0.38729	0.70364	-17.61947	12.17605
VAR X2	8.61162	7.02756	1.22541	0.23816	-6.28614	23.50938

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	584.35	292.18	0.75082	0.48790
Residual	16	6226.28	389.14		
Total	18	6810.63			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	80.0000	81.6789	-1.6789
2	40.0000	78.5107	-38.5107
3	80.0000	67.1774	12.8226
4	98.0000	78.5107	19.4893
5	100.0000	84.4006	15.5994
6	70.0000	81.6789	-11.6789
7	60.0000	73.0673	-13.0673
8	70.0000	84.4006	-14.4006
9	100.0000	84.4006	15.5994
10	90.0000	75.7890	14.2110
11	65.0000	81.6789	-16.6789
12	80.0000	81.6789	-1.6789
13	100.0000	73.0673	26.9327
14	70.0000	75.7890	-5.7890
15	100.0000	81.6789	18.3211
16	50.0000	64.4557	-14.4557
17	50.0000	81.6789	-31.6789
18	90.0000	81.6789	8.3211
19	100.0000	81.6789	18.3211

Model Inputs:
VAR229
VAR15; VAR115
PU1
PU1, PU1

Regression Results

OVERALL FIT

Multiple R	0.10538	Maximum Log Likelihood	-63.56150
R-Square	0.01111	Akaike Info Criterion (AIC)	7.00647
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	7.15560
Standard Error	8.76182	Hannan-Quinn Criterion (HQC)	7.03171
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	91.66835	13.01140	7.04523	0.00000	64.08542	119.25128
VAR X1	1.07685	2.55350	0.42171	0.67885	-4.33633	6.49002
VAR X2	0.12133	2.08492	0.05820	0.95431	-4.29851	4.54118

ANOVA

	DF	SS	MS	F	p-Value	
Regression	2	13.79	6.90	0.08984	0.91454	
Residual	16	1228.31	76.77			
Total	18	1242.11				

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	100.0000	95.2629	4.7371
2	70.0000	96.5824	-26.5824
3	100.0000	96.2184	3.7816
4	100.0000	96.3397	3.6603
5	100.0000	96.4611	3.5389
6	100.0000	94.4287	5.5713
7	100.0000	96.4611	3.5389
8	100.0000	95.2629	4.7371
9	100.0000	97.5379	2.4621
10	100.0000	96.5824	3.4176
11	100.0000	96.5824	3.4176
12	90.0000	96.3397	-6.3397
13	100.0000	95.3842	4.6158
14	100.0000	96.5824	3.4176
15	100.0000	97.5379	2.4621
16	100.0000	97.5379	2.4621
17	80.0000	95.2629	-15.2629
18	90.0000	96.2184	-6.2184
19	100.0000	97.4166	2.5834

Model Inputs:
VAR230
VAR16; VAR116
PU2
PU2, PU2

Regression Results

OVERALL FIT

Multiple R	0.48177	Maximum Log Likelihood	-52.35537
R-Square	0.23210	Akaike Info Criterion (AIC)	5.82688
Adjusted R-Square	0.13612	Bayes Schwarz Criterion (BSC)	5.97600
Standard Error	4.70131	Hannan-Quinn Criterion (HQC)	5.85212
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	85.36364	10.04324	8.49961	0.00000	64.07291	106.65436
VAR X1	4.09091	1.95388	2.09373	0.05257	-0.05114	8.23296
VAR X2	-1.00000	1.48668	-0.67264	0.51078	-4.15163	2.15163

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	106.89	53.44	2.41808	0.12090
Residual	16	353.64	22.10		
Total	18	460.53			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	100.0000	97.7273	2.2727
2	90.0000	96.7273	-6.7273
3	100.0000	101.8182	-1.8182
4	100.0000	97.7273	2.2727
5	100.0000	97.7273	2.2727
6	100.0000	97.7273	2.2727
7	100.0000	97.7273	2.2727
8	100.0000	97.7273	2.2727
9	100.0000	101.8182	-1.8182
10	100.0000	96.7273	3.2727
11	100.0000	96.7273	3.2727
12	95.0000	97.7273	-2.7273
13	100.0000	93.6364	6.3636
14	100.0000	97.7273	2.2727
15	100.0000	102.8182	-2.8182
16	100.0000	100.8182	-0.8182
17	80.0000	93.6364	-13.6364
18	100.0000	99.7273	0.2727
19	100.0000	98.7273	1.2727

Model Inputs:
VAR231
VAR17; VAR117
PU3
PU3, PU3

Regression Results

OVERALL FIT

Multiple R	0.10118	Maximum Log Likelihood	-54.48404
R-Square	0.01024	Akaike Info Criterion (AIC)	6.05095
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	6.20007
Standard Error	5.29149	Hannan-Quinn Criterion (HQC)	6.07619
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	101.23918	7.34948	13.77501	0.00000	85.65897	116.81938
VAR X1	-0.40584	1.63762	-0.24783	0.80742	-3.87745	3.06576
VAR X2	-0.36797	1.23091	-0.29894	0.76884	-2.97738	2.24145

ANOVA

	DF	SS	MS	F	p-Value	
Regression	2	4.63	2.32	0.08275	0.92098	
Residual	16	448.00	28.00			
Total	18	452.63				

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	100.0000	98.9177	1.0823
2	80.0000	98.1439	-18.1439
3	100.0000	98.5119	1.4881
4	100.0000	98.5119	1.4881
5	100.0000	98.5498	1.4502
6	100.0000	98.9556	1.0444
7	100.0000	98.1439	1.8561
8	100.0000	99.2857	0.7143
9	100.0000	97.7381	2.2619
10	100.0000	97.7381	2.2619
11	100.0000	99.2478	0.7522
12	90.0000	98.5119	-8.5119
13	100.0000	98.5119	1.4881
14	100.0000	98.1439	1.8561
15	100.0000	98.1439	1.8561
16	100.0000	97.3701	2.6299
17	100.0000	98.1818	1.8182
18	100.0000	98.8799	1.1201
19	100.0000	98.5119	1.4881

Model Inputs:
VAR232
VAR18; VAR118
PU4
PU4, PU4

Regression Results

OVERALL FIT

Multiple R	0.12369	Maximum Log Likelihood	-54.43789
R-Square	0.01530	Akaike Info Criterion (AIC)	6.04609
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	6.19522
Standard Error	5.27794	Hannan-Quinn Criterion (HQC)	6.07133
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	102.17391	7.82071	13.06453	0.00000	85.59475	118.75308
VAR X1	-0.71196	1.55151	-0.45888	0.65249	-4.00101	2.57709
VAR X2	-0.30978	1.29633	-0.23897	0.81416	-3.05789	2.43832

ANOVA

	DF	SS	MS	F	p-Value	
Regression	2	6.93	3.46	0.12430	0.88396	
Residual	16	445.71	27.86			
Total	18	452.63				

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	100.0000	97.3750	2.6250
2	80.0000	98.0870	-18.0870
3	100.0000	98.3967	1.6033
4	100.0000	98.7065	1.2935
5	100.0000	98.7989	1.2011
6	100.0000	99.5109	0.4891
7	100.0000	98.0870	1.9130
8	100.0000	99.4185	0.5815
9	100.0000	97.3750	2.6250
10	100.0000	98.7989	1.2011
11	100.0000	98.4891	1.5109
12	90.0000	98.3967	-8.3967
13	100.0000	98.7989	1.2011
14	100.0000	98.0870	1.9130
15	100.0000	98.0870	1.9130
16	100.0000	97.3750	2.6250
17	100.0000	98.7989	1.2011
18	100.0000	99.0163	0.9837
19	100.0000	98.3967	1.6033

Model Inputs:
VAR233
VAR19; VAR119
PEOU1
PEOU1, PEOU1

Regression Results

OVERALL FIT

Multiple R	0.26323	Maximum Log Likelihood	-69.81760
R-Square	0.06929	Akaike Info Criterion (AIC)	7.66501
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	7.81413
Standard Error	12.40332	Hannan-Quinn Criterion (HQC)	7.69025
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	68.68558	19.00266	3.61452	0.00233	28.40174	108.96943
VAR X1	0.48933	4.29179	0.11402	0.91064	-8.60886	9.58751
VAR X2	3.76106	3.68977	1.01932	0.32322	-4.06089	11.58302

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	183.26	91.63	0.59560	0.56300
Residual	16	2461.48	153.84		
Total	18	2644.74			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	85.0000	85.6871	-0.6871
2	60.0000	81.9261	-21.9261
3	70.0000	78.1650	-8.1650
4	90.0000	81.9261	8.0739
5	70.0000	85.6871	-15.6871
6	90.0000	84.7085	5.2915
7	90.0000	81.9261	8.0739
8	80.0000	81.4368	-1.4368
9	70.0000	86.1765	-16.1765
10	90.0000	85.6871	4.3129
11	90.0000	89.4482	0.5518
12	100.0000	81.9261	18.0739
13	100.0000	86.1765	13.8235
14	80.0000	89.4482	-9.4482
15	100.0000	85.6871	14.3129
16	100.0000	89.9375	10.0625
17	80.0000	81.4368	-1.4368
18	70.0000	85.6871	-15.6871
19	90.0000	81.9261	8.0739

Model Inputs:
VAR234
VAR20; VAR120
PEOU2
PEOU2, PEOU2

Regression Results

OVERALL FIT

Multiple R	0.39948	Maximum Log Likelihood	-75.61699
R-Square	0.15959	Akaike Info Criterion (AIC)	8.27547
Adjusted R-Square	0.05453	Bayes Schwarz Criterion (BSC)	8.42459
Standard Error	17.11838	Hannan-Quinn Criterion (HQC)	8.30071
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	48.94184	20.64902	2.37018	0.03068	5.16787	92.71582
VAR X1	8.70213	4.99395	1.74254	0.10060	-1.88456	19.28882
VAR X2	0.61844	4.31526	0.14331	0.88783	-8.52951	9.76639

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	890.32	445.16	1.51912	0.24885
Residual	16	4688.62	293.04		
Total	18	5578.95			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	80.0000	77.5220	2.4780
2	70.0000	68.2014	1.7986
3	80.0000	68.2014	11.7986
4	90.0000	84.9872	5.0128
5	80.0000	85.6057	-5.6057
6	80.0000	68.8199	11.1801
7	100.0000	84.3688	15.6312
8	30.0000	76.9035	-46.9035
9	70.0000	76.9035	-6.9035
10	80.0000	85.6057	-5.6057
11	100.0000	86.8426	13.1574
12	90.0000	76.9035	13.0965
13	75.0000	68.8199	6.1801
14	75.0000	68.2014	6.7986
15	50.0000	67.5830	-17.5830
16	80.0000	77.5220	2.4780
17	70.0000	67.5830	2.4170
18	50.0000	77.5220	-27.5220
19	95.0000	76.9035	18.0965

Model Inputs:
VAR235
VAR21; VAR121
PEOU3
PEOU3, PEOU3

Regression Results

OVERALL FIT

Multiple R	0.36988	Maximum Log Likelihood	-70.09875
R-Square	0.13681	Akaike Info Criterion (AIC)	7.69460
Adjusted R-Square	0.02892	Bayes Schwarz Criterion (BSC)	7.84373
Standard Error	12.59857	Hannan-Quinn Criterion (HQC)	7.71984
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	62.12216	26.70351	2.32637	0.03346	5.51325	118.73107
VAR X1	7.76429	5.41604	1.43357	0.17095	-3.71720	19.24579
VAR X2	-1.32733	3.66385	-0.36228	0.72189	-9.09435	6.43969

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	402.52	201.26	1.26799	0.30820
Residual	16	2539.58	158.72		
Total	18	2942.11			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	90.0000	80.1057	9.8943
2	70.0000	78.7784	-8.7784
3	90.0000	89.1973	0.8027
4	80.0000	89.1973	-9.1973
5	50.0000	80.1057	-30.1057
6	90.0000	87.8700	2.1300
7	95.0000	87.8700	7.1300
8	100.0000	81.4330	18.5670
9	90.0000	87.8700	2.1300
10	85.0000	86.5427	-1.5427
11	100.0000	89.1973	10.8027
12	85.0000	90.5247	-5.5247
13	75.0000	80.1057	-5.1057
14	90.0000	81.4330	8.5670
15	90.0000	87.8700	2.1300
16	100.0000	86.5427	13.4573
17	100.0000	89.1973	10.8027
18	70.0000	89.1973	-19.1973
19	90.0000	96.9616	-6.9616

Model Inputs:
VAR236
VAR22; VAR122
PEOU4
PEOU4, PEOU4

Regression Results

OVERALL FIT

Multiple R	0.15351	Maximum Log Likelihood	-72.71669
R-Square	0.02356	Akaike Info Criterion (AIC)	7.97018
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	8.11930
Standard Error	14.57088	Hannan-Quinn Criterion (HQC)	7.99542
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	92.27273	23.40224	3.94290	0.00116	42.66219	141.88326
VAR X1	0.75758	4.50624	0.16812	0.86860	-8.79523	10.31038
VAR X2	-2.57576	4.50624	-0.57160	0.57554	-12.12857	6.97705

ANOVA

	DF	SS	MS	F	p-Value	
Regression	2	81.98	40.99	0.19306	0.82632	
Residual	16	3396.97	212.31			
Total	18	3478.95				

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	100.0000	84.2424	15.7576
2	70.0000	84.2424	-14.2424
3	80.0000	87.5758	-7.5758
4	90.0000	87.5758	2.4242
5	50.0000	84.2424	-34.2424
6	85.0000	84.2424	0.7576
7	95.0000	87.5758	7.4242
8	80.0000	87.5758	-7.5758
9	100.0000	90.9091	9.0909
10	90.0000	82.4242	7.5758
11	100.0000	86.8182	13.1818
12	85.0000	86.8182	-1.8182
13	75.0000	84.2424	-9.2424
14	80.0000	86.8182	-6.8182
15	95.0000	86.0606	8.9394
16	100.0000	82.4242	17.5758
17	100.0000	86.0606	13.9394
18	65.0000	87.5758	-22.5758
19	95.0000	87.5758	7.4242

Model Inputs:
VAR237
VAR23; VAR123
IU1
IU1, IU1

Regression Results

OVERALL FIT

Multiple R	0.26026	Maximum Log Likelihood	-76.19988
R-Square	0.06774	Akaike Info Criterion (AIC)	8.33683
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	8.48595
Standard Error	17.68180	Hannan-Quinn Criterion (HQC)	8.36207
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	87.64453	22.56551	3.88400	0.00132	39.80778	135.48128
VAR X1	3.54290	4.05477	0.87376	0.39517	-5.05284	12.13863
VAR X2	-2.42710	4.37965	-0.55418	0.58712	-11.71156	6.85735

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	363.46	181.73	0.58126	0.57057
Residual	16	5002.33	312.65		
Total	18	5365.79			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	100.0000	92.1077	7.8923
2	40.0000	89.6806	-49.6806
3	100.0000	94.5348	5.4652
4	90.0000	96.9619	-6.9619
5	100.0000	88.5648	11.4352
6	100.0000	81.4790	18.5210
7	95.0000	92.1077	2.8923
8	100.0000	90.9919	9.0081
9	100.0000	98.0777	1.9223
10	100.0000	92.1077	7.8923
11	100.0000	98.0777	1.9223
12	100.0000	98.0777	1.9223
13	100.0000	90.9919	9.0081
14	100.0000	94.5348	5.4652
15	100.0000	89.6806	10.3194
16	100.0000	95.6506	4.3494
17	50.0000	87.4490	-37.4490
18	90.0000	99.3890	-9.3890
19	100.0000	94.5348	5.4652

Model Inputs:
VAR238
VAR24; VAR124
IU2
IU2, IU2

Regression Results

OVERALL FIT

Multiple R	0.00889	Maximum Log Likelihood	-67.00063
R-Square	0.00008	Akaike Info Criterion (AIC)	7.36849
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	7.51761
Standard Error	10.60649	Hannan-Quinn Criterion (HQC)	7.39373
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	95.70434	12.47090	7.67421	0.00000	69.26720	122.14148
VAR X1	-0.06420	2.64922	-0.02423	0.98097	-5.68030	5.55191
VAR X2	0.06781	2.78949	0.02431	0.98091	-5.84564	5.98127

ANOVA

	DF	SS	MS	F	p-Value	
Regression	2	0.14	0.07	0.00063	0.99937	
Residual	16	1799.96	112.50			
Total	18	1800.11				

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	100.0000	95.6510	4.3490
2	60.0000	95.7830	-35.7830
3	100.0000	95.5832	4.4168
4	98.0000	95.5154	2.4846
5	100.0000	95.7830	4.2170
6	100.0000	95.8436	4.1564
7	95.0000	95.6510	-0.6510
8	90.0000	95.6474	-5.6474
9	100.0000	95.7152	4.2848
10	100.0000	95.7830	4.2170
11	100.0000	95.7152	4.2848
12	95.0000	95.7152	-0.7152
13	100.0000	95.7116	4.2884
14	100.0000	95.6510	4.3490
15	100.0000	95.6510	4.3490
16	100.0000	95.6546	4.3454
17	100.0000	95.7794	4.2206
18	80.0000	95.5154	-15.5154
19	100.0000	95.6510	4.3490

Model Inputs:
VAR239
VAR25; VAR125
IU3
IU3, IU3

Regression Results

OVERALL FIT

Multiple R	0.44599	Maximum Log Likelihood	-88.96074
R-Square	0.19891	Akaike Info Criterion (AIC)	9.68008
Adjusted R-Square	0.09877	Bayes Schwarz Criterion (BSC)	9.82920
Standard Error	35.92640	Hannan-Quinn Criterion (HQC)	9.70532
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	11.63242	22.61588	0.51435	0.61404	-36.31111	59.57594
VAR X1	11.03335	7.50351	1.47043	0.16084	-4.87338	26.94007
VAR X2	-7.82474	7.52016	-1.04050	0.31358	-23.76677	8.11729

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	5127.65	2563.82	1.98637	0.16961
Residual	16	20651.30	1290.71		
Total	18	25778.95			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	0.0000	-16.4579	16.4579
2	10.0000	13.4335	-3.4335
3	0.0000	36.9077	-36.9077
4	0.0000	7.0163	-7.0163
5	0.0000	7.0163	-7.0163
6	0.0000	14.8410	-14.8410
7	0.0000	25.8744	-25.8744
8	0.0000	36.9077	-36.9077
9	0.0000	7.0163	-7.0163
10	0.0000	14.8410	-14.8410
11	100.0000	58.9744	41.0256
12	0.0000	7.0163	-7.0163
13	100.0000	25.8744	74.1256
14	0.0000	25.8744	-25.8744
15	100.0000	14.8410	85.1590
16	0.0000	29.0830	-29.0830
17	0.0000	14.8410	-14.8410
18	50.0000	36.9077	13.0923
19	0.0000	-0.8085	0.8085

Model Inputs:
VAR240
VAR26; VAR126
PU1
PU1, PU1

Regression Results

OVERALL FIT

Multiple R	0.37867	Maximum Log Likelihood	-80.50178
R-Square	0.14339	Akaike Info Criterion (AIC)	8.78966
Adjusted R-Square	0.03632	Bayes Schwarz Criterion (BSC)	8.93878
Standard Error	22.45537	Hannan-Quinn Criterion (HQC)	8.81490
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	13.64198	39.99856	0.34106	0.73749	-71.15118	98.43513
VAR X1	5.33333	6.35134	0.83972	0.41344	-8.13090	18.79757
VAR X2	11.69136	7.76275	1.50609	0.15153	-4.76493	28.14765

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	1350.52	675.26	1.33915	0.28991
Residual	16	8067.90	504.24		
Total	18	9418.42			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	50.0000	71.0741	-21.0741
2	30.0000	81.7407	-51.7407
3	30.0000	53.0247	-23.0247
4	50.0000	76.4074	-26.4074
5	60.0000	81.7407	-21.7407
6	100.0000	71.0741	28.9259
7	85.0000	76.4074	8.5926
8	100.0000	81.7407	18.2593
9	80.0000	70.0494	9.9506
10	100.0000	82.7654	17.2346
11	80.0000	93.4321	-13.4321
12	80.0000	76.4074	3.5926
13	75.0000	81.7407	-6.7407
14	80.0000	81.7407	-1.7407
15	90.0000	81.7407	8.2593
16	100.0000	87.0741	12.9259
17	100.0000	81.7407	18.2593
18	90.0000	70.0494	19.9506
19	90.0000	70.0494	19.9506

Model Inputs:
VAR241
VAR27; VAR127
PU2
PU2, PU2

Regression Results

OVERALL FIT

Multiple R	0.40166	Maximum Log Likelihood	-82.93810
R-Square	0.16133	Akaike Info Criterion (AIC)	9.04612
Adjusted R-Square	0.05649	Bayes Schwarz Criterion (BSC)	9.19524
Standard Error	25.71002	Hannan-Quinn Criterion (HQC)	9.07135
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	-4.45835	45.31303	-0.09839	0.92284	-100.51770	91.60099
VAR X1	10.16352	6.77761	1.49957	0.15320	-4.20437	24.53141
VAR X2	9.42259	9.62016	0.97946	0.34193	-10.97125	29.81642

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	2034.44	1017.22	1.53890	0.24476
Residual	16	10576.09	661.01		
Total	18	12610.53			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	30.0000	43.3955	-13.3955
2	10.0000	73.8861	-63.8861
3	30.0000	64.4635	-34.4635
4	40.0000	63.7225	-23.7225
5	40.0000	73.8861	-33.8861
6	80.0000	64.4635	15.5365
7	85.0000	73.8861	11.1139
8	100.0000	73.8861	26.1139
9	70.0000	73.8861	-3.8861
10	80.0000	53.5590	26.4410
11	90.0000	83.3086	6.6914
12	70.0000	54.2999	15.7001
13	75.0000	73.8861	1.1139
14	60.0000	64.4635	-4.4635
15	75.0000	63.7225	11.2775
16	100.0000	84.0496	15.9504
17	100.0000	83.3086	16.6914
18	70.0000	64.4635	5.5365
19	90.0000	64.4635	25.5365

Model Inputs:
VAR242
VAR28; VAR128
PU3
PU3, PU3

Regression Results

OVERALL FIT

Multiple R	0.21849	Maximum Log Likelihood	-81.70009
R-Square	0.04774	Akaike Info Criterion (AIC)	8.91580
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	9.06492
Standard Error	24.00117	Hannan-Quinn Criterion (HQC)	8.94104
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	53.16162	39.14919	1.35792	0.19333	-29.83096	136.15419
VAR X1	-1.96296	7.72911	-0.25397	0.80275	-18.34795	14.42202
VAR X2	7.38047	8.44847	0.87359	0.39527	-10.52949	25.29043

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	462.05	231.02	0.40104	0.67617
Residual	16	9216.90	576.06		
Total	18	9678.95			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	50.0000	69.4141	-19.4141
2	30.0000	74.8316	-44.8316
3	20.0000	69.4141	-49.4141
4	50.0000	76.7946	-26.7946
5	60.0000	76.7946	-16.7946
6	90.0000	71.3771	18.6229
7	85.0000	76.7946	8.2054
8	100.0000	67.4512	32.5488
9	80.0000	67.4512	12.5488
10	70.0000	78.7576	-8.7576
11	100.0000	84.1751	15.8249
12	75.0000	69.4141	5.5859
13	75.0000	74.8316	0.1684
14	70.0000	74.8316	-4.8316
15	80.0000	74.8316	5.1684
16	100.0000	78.7576	21.2424
17	100.0000	82.2121	17.7879
18	80.0000	67.4512	12.5488
19	90.0000	69.4141	20.5859

Model Inputs:
VAR243
VAR29; VAR129
PU4
PU4, PU4

Regression Results

OVERALL FIT

Multiple R	0.35948	Maximum Log Likelihood	-83.29870
R-Square	0.12922	Akaike Info Criterion (AIC)	9.08407
Adjusted R-Square	0.02038	Bayes Schwarz Criterion (BSC)	9.23320
Standard Error	26.23028	Hannan-Quinn Criterion (HQC)	9.10931
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	33.01134	40.53824	0.81433	0.42741	-52.92588	118.94856
VAR X1	-1.99286	7.09084	-0.28105	0.78228	-17.02478	13.03906
VAR X2	13.14364	8.66782	1.51637	0.14893	-5.23132	31.51860

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	1633.66	816.83	1.18721	0.33056
Residual	16	11008.44	688.03		
Total	18	12642.11			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	60.0000	79.6073	-19.6073
2	20.0000	77.6144	-57.6144
3	10.0000	53.3200	-43.3200
4	50.0000	77.6144	-27.6144
5	60.0000	79.6073	-19.6073
6	90.0000	81.6002	8.3998
7	85.0000	79.6073	5.3927
8	100.0000	77.6144	22.3856
9	90.0000	64.4708	25.5292
10	75.0000	83.5930	-8.5930
11	100.0000	92.7509	7.2491
12	80.0000	66.4637	13.5363
13	75.0000	77.6144	-2.6144
14	70.0000	77.6144	-7.6144
15	90.0000	77.6144	12.3856
16	100.0000	81.6002	18.3998
17	100.0000	90.7581	9.2419
18	100.0000	64.4708	35.5292
19	95.0000	66.4637	28.5363

Model Inputs:
VAR244
VAR30; VAR130
PEOU1
PEOU1, PEOU1

Regression Results

OVERALL FIT

Multiple R	0.10280	Maximum Log Likelihood	-79.95529
R-Square	0.01057	Akaike Info Criterion (AIC)	8.73214
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	8.88126
Standard Error	21.78386	Hannan-Quinn Criterion (HQC)	8.75737
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	68.75096	43.20200	1.59138	0.13108	-22.83318	160.33510
VAR X1	0.08071	8.54105	0.00945	0.99258	-18.02550	18.18692
VAR X2	2.77863	6.72523	0.41317	0.68497	-11.47821	17.03548

ANOVA

	DF	SS	MS	F	p-Value	
Regression	2	81.10	40.55	0.08545	0.91851	
Residual	16	7592.58	474.54			
Total	18	7673.68				

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	100.0000	80.1076	19.8924
2	40.0000	80.1883	-40.1883
3	80.0000	74.6311	5.3689
4	60.0000	77.4097	-17.4097
5	60.0000	80.1883	-20.1883
6	80.0000	80.1076	-0.1076
7	85.0000	77.4097	7.5903
8	40.0000	80.1883	-40.1883
9	100.0000	80.1883	19.8117
10	80.0000	80.1076	-0.1076
11	100.0000	82.9669	17.0331
12	95.0000	77.4097	17.5903
13	50.0000	80.1883	-30.1883
14	80.0000	82.8862	-2.8862
15	100.0000	80.1076	19.8924
16	100.0000	83.0477	16.9523
17	100.0000	80.2690	19.7310
18	75.0000	80.1883	-5.1883
19	90.0000	77.4097	12.5903

Model Inputs:
VAR245
VAR31; VAR131
PEOU2
PEOU2, PEOU2

Regression Results

OVERALL FIT

Multiple R	0.10961	Maximum Log Likelihood	-82.30150
R-Square	0.01202	Akaike Info Criterion (AIC)	8.97910
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	9.12823
Standard Error	24.81664	Hannan-Quinn Criterion (HQC)	9.00434
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	85.89744	28.19281	3.04678	0.00769	26.13134	145.66353
VAR X1	-1.06838	7.53207	-0.14184	0.88897	-17.03566	14.89891
VAR X2	-2.22222	5.51481	-0.40296	0.69231	-13.91309	9.46865

ANOVA

	DF	SS	MS	F	p-Value	
Regression	2	119.84	59.92	0.09729	0.90782	
Residual	16	9853.85	615.87			
Total	18	9973.68				

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	100.0000	74.8718	25.1282
2	10.0000	76.0256	-66.0256
3	90.0000	73.8034	16.1966
4	90.0000	77.1795	12.8205
5	60.0000	77.1795	-17.1795
6	80.0000	73.8034	6.1966
7	95.0000	81.5385	13.4615
8	40.0000	71.5812	-31.5812
9	90.0000	77.0940	12.9060
10	70.0000	76.0256	-6.0256
11	100.0000	70.5128	29.4872
12	70.0000	79.3162	-9.3162
13	75.0000	72.7350	2.2650
14	75.0000	74.8718	0.1282
15	50.0000	73.8034	-23.8034
16	80.0000	74.8718	5.1282
17	100.0000	76.0256	23.9744
18	60.0000	73.8034	-13.8034
19	95.0000	74.9573	20.0427

Model Inputs:
VAR246
VAR32; VAR132
PEOU3
PEOU3, PEOU3

Regression Results

OVERALL FIT

Multiple R	0.14188	Maximum Log Likelihood	-81.18086
R-Square	0.02013	Akaike Info Criterion (AIC)	8.86114
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	9.01027
Standard Error	23.31872	Hannan-Quinn Criterion (HQC)	8.88638
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	99.15448	42.32788	2.34253	0.03241	9.42339	188.88556
VAR X1	-3.06905	6.57814	-0.46655	0.64711	-17.01408	10.87599
VAR X2	-3.19778	8.73855	-0.36594	0.71920	-21.72267	15.32712

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	178.74	89.37	0.16436	0.84985
Residual	16	8700.20	543.76		
Total	18	8878.95			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	90.0000	77.1562	12.8438
2	10.0000	70.8894	-60.8894
3	80.0000	77.2850	2.7150
4	40.0000	77.2850	-37.2850
5	60.0000	77.1562	-17.1562
6	70.0000	77.2850	-7.2850
7	90.0000	77.1562	12.8438
8	100.0000	74.0872	25.9128
9	90.0000	71.0181	18.9819
10	85.0000	83.2943	1.7057
11	90.0000	77.2850	12.7150
12	75.0000	77.2850	-2.2850
13	75.0000	74.0872	0.9128
14	60.0000	77.1562	-17.1562
15	100.0000	77.1562	22.8438
16	100.0000	70.8894	29.1106
17	80.0000	74.0872	5.9128
18	70.0000	74.0872	-4.0872
19	80.0000	80.3540	-0.3540

Model Inputs:
VAR247
VAR33; VAR133
PEOU4
PEOU4, PEOU4

Regression Results

OVERALL FIT

Multiple R	0.10977	Maximum Log Likelihood	-82.60700
R-Square	0.01205	Akaike Info Criterion (AIC)	9.01126
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	9.16039
Standard Error	25.24143	Hannan-Quinn Criterion (HQC)	9.03650
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	98.47905	64.91439	1.51706	0.14876	-39.13331	236.09141
VAR X1	-4.50820	10.21996	-0.44112	0.66503	-26.17354	17.15715
VAR X2	-1.07468	11.99606	-0.08959	0.92973	-26.50520	24.35583

ANOVA

	DF	SS	MS	F	p-Value	
Regression	2	124.34	62.17	0.09758	0.90757	
Residual	16	10194.08	637.13			
Total	18	10318.42				

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	100.0000	80.6557	19.3443
2	20.0000	77.2222	-57.2222
3	90.0000	77.2222	12.7778
4	50.0000	77.2222	-27.2222
5	60.0000	80.6557	-20.6557
6	80.0000	77.2222	2.7778
7	90.0000	81.7304	8.2696
8	30.0000	71.6393	-41.6393
9	100.0000	72.7140	27.2860
10	70.0000	80.6557	-10.6557
11	100.0000	77.2222	22.7778
12	75.0000	77.2222	-2.2222
13	75.0000	76.1475	-1.1475
14	70.0000	80.6557	-10.6557
15	100.0000	76.1475	23.8525
16	100.0000	76.1475	23.8525
17	100.0000	76.1475	23.8525
18	70.0000	76.1475	-6.1475
19	90.0000	77.2222	12.7778

Model Inputs:
VAR248
VAR34; VAR134
IU1
IU1, IU1

Regression Results

OVERALL FIT

Multiple R	0.30137	Maximum Log Likelihood	-85.71785
R-Square	0.09082	Akaike Info Criterion (AIC)	9.33872
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	9.48784
Standard Error	30.00343	Hannan-Quinn Criterion (HQC)	9.36396
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	50.05657	33.94869	1.47448	0.15976	-21.91143	122.02457
VAR X1	9.08203	7.60715	1.19388	0.24993	-7.04441	25.20846
VAR X2	-1.90023	9.40337	-0.20208	0.84240	-21.83449	18.03403

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	1438.81	719.41	0.79916	0.46686
Residual	16	14403.29	900.21		
Total	18	15842.11			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	80.0000	69.7017	10.2983
2	10.0000	78.7837	-68.7837
3	10.0000	71.6020	-61.6020
4	30.0000	69.7017	-39.7017
5	50.0000	69.7017	-19.7017
6	80.0000	55.3381	24.6619
7	90.0000	78.7837	11.2163
8	100.0000	87.8658	12.1342
9	100.0000	82.5842	17.4158
10	90.0000	60.6197	29.3803
11	100.0000	85.9655	14.0345
12	90.0000	87.8658	2.1342
13	100.0000	78.7837	21.2163
14	70.0000	78.7837	-8.7837
15	80.0000	76.8835	3.1165
16	100.0000	87.8658	12.1342
17	100.0000	76.8835	23.1165
18	80.0000	80.6840	-0.6840
19	90.0000	71.6020	18.3980

Model Inputs:
VAR249
VAR35; VAR135
IU2
IU2, IU2

Regression Results

OVERALL FIT

Multiple R	0.18090	Maximum Log Likelihood	-84.25956
R-Square	0.03273	Akaike Info Criterion (AIC)	9.18522
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	9.33434
Standard Error	27.66852	Hannan-Quinn Criterion (HQC)	9.21045
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	82.89357	35.14100	2.35888	0.03138	8.39797	157.38917
VAR X1	-6.13636	8.34237	-0.73557	0.47264	-23.82140	11.54868
VAR X2	3.22062	10.30001	0.31268	0.75856	-18.61443	25.05567

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	414.41	207.20	0.27066	0.76630
Residual	16	12248.75	765.55		
Total	18	12663.16			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	80.0000	74.1463	5.8537
2	10.0000	71.2306	-61.2306
3	10.0000	74.1463	-64.1463
4	50.0000	74.1463	-24.1463
5	60.0000	77.3670	-17.3670
6	80.0000	83.1984	-3.1984
7	90.0000	68.0100	21.9900
8	70.0000	68.0100	1.9900
9	100.0000	74.1463	25.8537
10	80.0000	83.5033	-3.5033
11	100.0000	74.1463	25.8537
12	85.0000	74.1463	10.8537
13	75.0000	71.2306	3.7694
14	70.0000	71.2306	-1.2306
15	80.0000	71.2306	8.7694
16	100.0000	83.5033	16.4967
17	100.0000	74.4512	25.5488
18	75.0000	68.0100	6.9900
19	95.0000	74.1463	20.8537

Model Inputs:
VAR250
VAR36; VAR136
IU3
IU3, IU3

Regression Results

OVERALL FIT

Multiple R	0.43101	Maximum Log Likelihood	-87.77373
R-Square	0.18577	Akaike Info Criterion (AIC)	9.55513
Adjusted R-Square	0.08399	Bayes Schwarz Criterion (BSC)	9.70425
Standard Error	33.63365	Hannan-Quinn Criterion (HQC)	9.58037
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	26.93521	20.60401	1.30728	0.20959	-16.74333	70.61376
VAR X1	5.89246	6.33476	0.93018	0.36610	-7.53664	19.32156
VAR X2	-7.69651	5.46678	-1.40787	0.17830	-19.28557	3.89255

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	4129.39	2064.70	1.82519	0.19319
Residual	16	18099.55	1131.22		
Total	18	22228.95			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	0.0000	-5.6549	5.6549
2	5.0000	6.1300	-1.1300
3	50.0000	36.9161	13.0839
4	0.0000	17.4347	-17.4347
5	0.0000	17.4347	-17.4347
6	0.0000	25.1312	-25.1312
7	0.0000	31.0236	-31.0236
8	0.0000	36.9161	-36.9161
9	70.0000	25.1312	44.8688
10	20.0000	25.1312	-5.1312
11	100.0000	48.7010	51.2990
12	0.0000	-5.6549	5.6549
13	0.0000	42.8085	-42.8085
14	0.0000	31.0236	-31.0236
15	50.0000	42.8085	7.1915
16	0.0000	21.5231	-21.5231
17	80.0000	25.1312	54.8688
18	80.0000	23.3271	56.6729
19	0.0000	9.7381	-9.7381

Model Inputs:
VAR251
VAR37; VAR137
PU1
PU1, PU1

Regression Results

OVERALL FIT

Multiple R	0.27872	Maximum Log Likelihood	-82.86884
R-Square	0.07768	Akaike Info Criterion (AIC)	9.03882
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	9.18795
Standard Error	25.61129	Hannan-Quinn Criterion (HQC)	9.06406
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	96.58687	43.21243	2.23516	0.04002	4.98060	188.19313
VAR X1	1.08755	7.21418	0.15075	0.88206	-14.20582	16.38092
VAR X2	-9.61012	8.50785	-1.12956	0.27531	-27.64596	8.42571

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	883.94	441.97	0.67380	0.52365
Residual	16	10495.01	655.94		
Total	18	11378.95			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	80.0000	72.1067	7.8933
2	40.0000	51.7989	-11.7989
3	90.0000	62.4966	27.5034
4	70.0000	61.4090	8.5910
5	80.0000	62.4966	17.5034
6	30.0000	50.7114	-20.7114
7	75.0000	60.3215	14.6785
8	100.0000	61.4090	38.5910
9	60.0000	62.4966	-2.4966
10	60.0000	72.1067	-12.1067
11	20.0000	53.9740	-33.9740
12	75.0000	69.9316	5.0684
13	100.0000	62.4966	37.5034
14	60.0000	72.1067	-12.1067
15	90.0000	62.4966	27.5034
16	40.0000	71.0192	-31.0192
17	80.0000	72.1067	7.8933
18	25.0000	61.4090	-36.4090
19	40.0000	72.1067	-32.1067

Model Inputs:
VAR252
VAR38; VAR138
PU2
PU2, PU2

Regression Results

OVERALL FIT

Multiple R	0.23342	Maximum Log Likelihood	-83.11941
R-Square	0.05449	Akaike Info Criterion (AIC)	9.06520
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	9.21432
Standard Error	25.97031	Hannan-Quinn Criterion (HQC)	9.09044
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	110.70529	49.67523	2.22858	0.04053	5.39850	216.01208
VAR X1	-6.24685	7.87460	-0.79329	0.43921	-22.94025	10.44655
VAR X2	-5.66751	9.39904	-0.60299	0.55497	-25.59258	14.25757

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	621.85	310.92	0.46100	0.63877
Residual	16	10791.31	674.46		
Total	18	11413.16			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	100.0000	62.4685	37.5315
2	50.0000	69.2947	-19.2947
3	90.0000	63.0479	26.9521
4	80.0000	56.8010	23.1990
5	90.0000	63.0479	26.9521
6	30.0000	57.3804	-27.3804
7	75.0000	63.0479	11.9521
8	100.0000	63.0479	36.9521
9	30.0000	62.4685	-32.4685
10	60.0000	68.7154	-8.7154
11	20.0000	57.3804	-37.3804
12	80.0000	81.2091	-1.2091
13	75.0000	63.0479	11.9521
14	60.0000	68.7154	-8.7154
15	80.0000	63.0479	16.9521
16	40.0000	56.8010	-16.8010
17	80.0000	69.2947	10.7053
18	40.0000	68.7154	-28.7154
19	40.0000	62.4685	-22.4685

Model Inputs:
VAR253
VAR39; VAR139
PU3
PU3, PU3

Regression Results

OVERALL FIT

Multiple R	0.47186	Maximum Log Likelihood	-83.19208
R-Square	0.22265	Akaike Info Criterion (AIC)	9.07285
Adjusted R-Square	0.12548	Bayes Schwarz Criterion (BSC)	9.22197
Standard Error	26.07536	Hannan-Quinn Criterion (HQC)	9.09809
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	137.66764	37.11724	3.70899	0.00191	58.98261	216.35267
VAR X1	-6.74927	7.24780	-0.93122	0.36558	-22.11392	8.61538
VAR X2	-14.91983	7.80739	-1.91099	0.07409	-31.47075	1.63110

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	3115.95	1557.97	2.29139	0.13333
Residual	16	10878.79	679.92		
Total	18	13994.74			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	90.0000	72.6603	17.3397
2	40.0000	50.9913	-10.9913
3	80.0000	57.7405	22.2595
4	75.0000	57.7405	17.2595
5	90.0000	57.7405	32.2595
6	20.0000	56.3192	-36.3192
7	75.0000	64.4898	10.5102
8	100.0000	79.4096	20.5904
9	50.0000	50.9913	-0.9913
10	60.0000	65.9111	-5.9111
11	10.0000	36.0714	-26.0714
12	75.0000	94.3294	-19.3294
13	75.0000	57.7405	17.2595
14	30.0000	65.9111	-35.9111
15	70.0000	50.9913	19.0087
16	40.0000	42.8207	-2.8207
17	100.0000	57.7405	42.2595
18	20.0000	57.7405	-37.7405
19	50.0000	72.6603	-22.6603

Model Inputs:
VAR254
VAR40; VAR140
PU4
PU4, PU4

Regression Results

OVERALL FIT

Multiple R	0.15186	Maximum Log Likelihood	-87.11732
R-Square	0.02306	Akaike Info Criterion (AIC)	9.48603
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	9.63516
Standard Error	32.42923	Hannan-Quinn Criterion (HQC)	9.51127
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	44.33761	41.85366	1.05935	0.30517	-44.38818	133.06341
VAR X1	4.09541	8.00401	0.51167	0.61587	-12.87232	21.06315
VAR X2	1.93394	11.52212	0.16785	0.86881	-22.49187	26.35976

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	397.21	198.60	0.18885	0.82973
Residual	16	16826.48	1051.65		
Total	18	17223.68			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	100.0000	70.6165	29.3835
2	50.0000	68.4550	-18.4550
3	80.0000	68.4550	11.5450
4	100.0000	68.4550	31.5450
5	90.0000	64.3596	25.6404
6	20.0000	54.2349	-34.2349
7	75.0000	60.2642	14.7358
8	100.0000	58.3303	41.6697
9	50.0000	66.5211	-16.5211
10	60.0000	64.3596	-4.3596
11	10.0000	70.3890	-60.3890
12	70.0000	56.3963	13.6037
13	100.0000	64.3596	35.6404
14	30.0000	66.5211	-36.5211
15	75.0000	68.4550	6.5450
16	50.0000	62.4257	-12.4257
17	100.0000	68.4550	31.5450
18	10.0000	62.4257	-52.4257
19	60.0000	66.5211	-6.5211

Model Inputs:
VAR255
VAR41; VAR141
PEOU1
PEOU1, PEOU1

Regression Results

OVERALL FIT

Multiple R	0.73580	Maximum Log Likelihood	-72.32860
R-Square	0.54141	Akaike Info Criterion (AIC)	7.92933
Adjusted R-Square	0.48408	Bayes Schwarz Criterion (BSC)	8.07845
Standard Error	14.26009	Hannan-Quinn Criterion (HQC)	7.95456
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	52.70366	20.69753	2.54637	0.02156	8.82686	96.58046
VAR X1	16.55254	4.47291	3.70062	0.00194	7.07040	26.03468
VAR X2	-12.99882	4.07992	-3.18605	0.00574	-21.64786	-4.34978

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	3841.14	1920.57	9.44464	0.00196
Residual	16	3253.60	203.35		
Total	18	7094.74			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	90.0000	83.4711	6.5289
2	30.0000	50.3660	-20.3660
3	60.0000	83.4711	-23.4711
4	90.0000	79.9174	10.0826
5	80.0000	79.9174	0.0826
6	80.0000	83.4711	-3.4711
7	80.0000	79.9174	0.0826
8	50.0000	46.8123	3.1877
9	80.0000	76.3636	3.6364
10	70.0000	66.9185	3.0815
11	70.0000	53.9197	16.0803
12	90.0000	96.4699	-6.4699
13	50.0000	66.9185	-16.9185
14	50.0000	53.9197	-3.9197
15	100.0000	66.9185	33.0815
16	100.0000	83.4711	16.5289
17	50.0000	53.9197	-3.9197
18	50.0000	53.9197	-3.9197
19	70.0000	79.9174	-9.9174

Model Inputs:
VAR256
VAR42; VAR142
PEOU2
PEOU2, PEOU2

Regression Results

OVERALL FIT

Multiple R	0.54771	Maximum Log Likelihood	-76.53012
R-Square	0.29999	Akaike Info Criterion (AIC)	8.37159
Adjusted R-Square	0.21249	Bayes Schwarz Criterion (BSC)	8.52071
Standard Error	18.00919	Hannan-Quinn Criterion (HQC)	8.39683
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	109.70750	24.79647	4.42432	0.00043	57.14134	162.27365
VAR X1	3.94751	4.11591	0.95908	0.35179	-4.77784	12.67286
VAR X2	-14.65004	5.67340	-2.58223	0.02005	-26.67710	-2.62297

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	2223.87	1111.93	3.42839	0.05766
Residual	16	5189.29	324.33		
Total	18	7413.16			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	100.0000	70.8449	29.1551
2	30.0000	48.2998	-18.2998
3	70.0000	66.8974	3.1026
4	90.0000	66.8974	23.1026
5	100.0000	66.8974	33.1026
6	80.0000	85.4949	-5.4949
7	90.0000	88.3024	1.6976
8	70.0000	85.4949	-15.4949
9	80.0000	66.8974	13.1026
10	70.0000	81.5474	-11.5474
11	30.0000	56.1948	-26.1948
12	75.0000	70.8449	4.1551
13	50.0000	59.0024	-9.0024
14	70.0000	59.0024	10.9976
15	50.0000	66.8974	-16.8974
16	80.0000	70.8449	9.1551
17	50.0000	56.1948	-6.1948
18	70.0000	66.8974	3.1026
19	60.0000	81.5474	-21.5474

Model Inputs:
VAR257
VAR43; VAR143
PEOU3
PEOU3, PEOU3

Regression Results

OVERALL FIT

Multiple R	0.45478	Maximum Log Likelihood	-80.12070
R-Square	0.20683	Akaike Info Criterion (AIC)	8.74955
Adjusted R-Square	0.10768	Bayes Schwarz Criterion (BSC)	8.89867
Standard Error	21.98497	Hannan-Quinn Criterion (HQC)	8.77478
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	121.56686	29.51144	4.11931	0.00080	59.00541	184.12832
VAR X1	-0.61775	5.26163	-0.11741	0.90800	-11.77190	10.53640
VAR X2	-12.66154	6.21829	-2.03618	0.05864	-25.84372	0.52064

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	2016.58	1008.29	2.08609	0.15665
Residual	16	7733.42	483.34		
Total	18	9750.00			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	100.0000	80.4935	19.5065
2	40.0000	56.4059	-16.4059
3	90.0000	81.1112	8.8888
4	90.0000	81.1112	8.8888
5	90.0000	94.3905	-4.3905
6	90.0000	81.1112	8.8888
7	85.0000	82.3467	2.6533
8	100.0000	81.7290	18.2710
9	80.0000	69.6852	10.3148
10	90.0000	69.6852	20.3148
11	50.0000	80.4935	-30.4935
12	60.0000	69.0675	-9.0675
13	50.0000	69.6852	-19.6852
14	40.0000	56.4059	-16.4059
15	100.0000	69.0675	30.9325
16	100.0000	82.3467	17.6533
17	70.0000	55.7882	14.2118
18	30.0000	81.7290	-51.7290
19	70.0000	82.3467	-12.3467

Model Inputs:
VAR258
VAR44; VAR144
PEOU4
PEOU4, PEOU4

Regression Results

OVERALL FIT

Multiple R	0.31516	Maximum Log Likelihood	-80.84954
R-Square	0.09933	Akaike Info Criterion (AIC)	8.82627
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	8.97539
Standard Error	22.89343	Hannan-Quinn Criterion (HQC)	8.85151
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	35.77345	37.51409	0.95360	0.35447	-43.75287	115.29976
VAR X1	7.53350	5.67786	1.32682	0.20319	-4.50304	19.57003
VAR X2	2.31425	7.32283	0.31603	0.75606	-13.20946	17.83796

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	924.78	462.39	0.88224	0.43305
Residual	16	8385.75	524.11		
Total	18	9310.53			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	100.0000	80.3837	19.6163
2	40.0000	67.6309	-27.6309
3	80.0000	75.1644	4.8356
4	90.0000	72.8502	17.1498
5	90.0000	65.3167	24.6833
6	80.0000	75.1644	4.8356
7	85.0000	57.7832	27.2168
8	50.0000	65.3167	-15.3167
9	80.0000	78.0694	1.9306
10	85.0000	72.8502	12.1498
11	50.0000	78.0694	-28.0694
12	70.0000	67.6309	2.3691
13	50.0000	60.0974	-10.0974
14	50.0000	72.8502	-22.8502
15	100.0000	82.6979	17.3021
16	100.0000	82.6979	17.3021
17	80.0000	69.9452	10.0548
18	20.0000	75.1644	-55.1644
19	65.0000	65.3167	-0.3167

Model Inputs:
VAR259
VAR45; VAR145
IU1
IU1, IU1

Regression Results

OVERALL FIT

Multiple R	0.22485	Maximum Log Likelihood	-88.10298
R-Square	0.05056	Akaike Info Criterion (AIC)	9.58979
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	9.73891
Standard Error	34.25452	Hannan-Quinn Criterion (HQC)	9.61502
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	47.79453	40.20026	1.18891	0.25182	-37.42622	133.01528
VAR X1	-4.79488	7.56224	-0.63406	0.53501	-20.82612	11.23636
VAR X2	6.59362	9.00277	0.73240	0.47452	-12.49141	25.67864

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	999.73	499.86	0.42601	0.66031
Residual	16	18773.96	1173.37		
Total	18	19773.68			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	50.0000	50.1946	-0.1946
2	20.0000	59.7844	-39.7844
3	70.0000	48.3959	21.6041
4	90.0000	54.9895	35.0105
5	100.0000	59.7844	40.2156
6	0.0000	56.1869	-56.1869
7	85.0000	59.7844	25.2156
8	100.0000	64.5792	35.4208
9	50.0000	54.9895	-4.9895
10	50.0000	48.3959	1.6041
11	10.0000	56.7882	-46.7882
12	75.0000	41.8022	33.1978
13	100.0000	64.5792	35.4208
14	50.0000	41.8022	8.1978
15	75.0000	66.3780	8.6220
16	25.0000	43.6010	-18.6010
17	50.0000	54.9895	-4.9895
18	0.0000	59.7844	-59.7844
19	40.0000	53.1907	-13.1907

Model Inputs:
VAR260
VAR46; VAR146
IU2
IU2, IU2

Regression Results

OVERALL FIT

Multiple R	0.42708	Maximum Log Likelihood	-86.40853
R-Square	0.18240	Akaike Info Criterion (AIC)	9.41142
Adjusted R-Square	0.08020	Bayes Schwarz Criterion (BSC)	9.56055
Standard Error	31.17707	Hannan-Quinn Criterion (HQC)	9.43666
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	16.92773	38.29252	0.44206	0.66436	-64.24879	98.10424
VAR X1	15.39816	8.22775	1.87149	0.07968	-2.04388	32.84021
VAR X2	-4.30355	9.38788	-0.45842	0.65282	-24.20497	15.59787

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	3469.53	1734.76	1.78472	0.19968
Residual	16	15552.16	972.01		
Total	18	19021.68			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	80.0000	81.0079	-1.0079
2	40.0000	45.9080	-5.9080
3	80.0000	61.3062	18.6938
4	98.0000	65.6097	32.3903
5	100.0000	45.9080	54.0920
6	0.0000	19.4152	-19.4152
7	85.0000	39.1170	45.8830
8	20.0000	34.8134	-14.8134
9	30.0000	50.2116	-20.2116
10	40.0000	50.2116	-10.2116
11	10.0000	41.6045	-31.6045
12	60.0000	54.5151	5.4849
13	50.0000	45.9080	4.0920
14	40.0000	69.9133	-29.9133
15	75.0000	61.3062	13.6938
16	25.0000	65.6097	-40.6097
17	100.0000	50.2116	49.7884
18	10.0000	50.2116	-40.2116
19	40.0000	50.2116	-10.2116

Model Inputs:
VAR261
VAR47; VAR147
IU3
IU3, IU3

Regression Results

OVERALL FIT

Multiple R	0.46361	Maximum Log Likelihood	-86.36928
R-Square	0.21493	Akaike Info Criterion (AIC)	9.40729
Adjusted R-Square	0.11680	Bayes Schwarz Criterion (BSC)	9.55641
Standard Error	31.10915	Hannan-Quinn Criterion (HQC)	9.43253
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	34.21838	21.35004	1.60273	0.12855	-11.04169	79.47846
VAR X1	-10.94921	6.28627	-1.74177	0.10074	-24.27552	2.37709
VAR X2	4.11681	7.09439	0.58029	0.56980	-10.92263	19.15625

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	4239.22	2119.61	2.19018	0.14430
Residual	16	15484.46	967.78		
Total	18	19723.68			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	75.0000	35.6196	39.3804
2	10.0000	13.7212	-3.7212
3	0.0000	16.4368	-16.4368
4	0.0000	31.5028	-31.5028
5	80.0000	31.5028	48.4972
6	50.0000	43.8532	6.1468
7	0.0000	16.4368	-16.4368
8	0.0000	5.4876	-5.4876
9	0.0000	31.5028	-31.5028
10	0.0000	27.3860	-27.3860
11	0.0000	5.4876	-5.4876
12	0.0000	27.3860	-27.3860
13	0.0000	-5.4617	5.4617
14	0.0000	-16.4109	16.4109
15	50.0000	27.3860	22.6140
16	0.0000	9.6044	-9.6044
17	100.0000	27.3860	72.6140
18	20.0000	20.5536	-0.5536
19	0.0000	35.6196	-35.6196

P. NONLINEAR ECONOMETRIC MODEL I: LOW LOA SYSTEM

Model Inputs:
VAR296
VAR15; VAR16; VAR17; VAR18; VAR19; VAR20; VAR21; VAR22; VAR23; VAR24; VAR25
SUSA
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Regression Results

OVERALL FIT

Multiple R	0.88698	Maximum Log Likelihood	-50.61399
R-Square	0.78673	Akaike Info Criterion (AIC)	6.59095
Adjusted R-Square	0.45159	Bayes Schwarz Criterion (BSC)	7.18743
Standard Error	6.45230	Hannan-Quinn Criterion (HQC)	6.69190
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	146.43508	29.41873	4.97761	0.00161	76.87085	215.99932
VAR X1	-15.92684	20.10171	-0.79231	0.45419	-63.45984	31.60615
VAR X2	7.98807	16.69306	0.47853	0.64686	-31.48474	47.46087
VAR X3	-49.53203	22.05808	-2.24553	0.05959	-101.69111	2.62705
VAR X4	-29.58373	18.72588	-1.57983	0.15816	-73.86340	14.69595
VAR X5	-8.65419	21.14538	-0.40927	0.69457	-58.65508	41.34669
VAR X6	-19.78808	9.88119	-2.00260	0.08529	-43.15338	3.57721
VAR X7	1.10349	14.73959	0.07487	0.94242	-33.75010	35.95707
VAR X8	5.39198	10.32642	0.52215	0.61767	-19.02612	29.81008
VAR X9	56.25472	15.24177	3.69083	0.00775	20.21366	92.29579
VAR X10	1.59737	11.14620	0.14331	0.89008	-24.75920	27.95394
VAR X11	-11.78828	3.82514	-3.08179	0.01777	-20.83330	-2.74327

ANOVA

	DF	SS	MS	F	p-Value
Regression	11	1075.02	97.73	2.34745	0.13337
Residual	7	291.43	41.63		
Total	18	1366.45			

Model Inputs:
VAR296
VAR115; VAR116; VAR117; VAR118; VAR119; VAR120; VAR121; VAR122; VAR123; VAR124; VAR125
SUSA
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Regression Results

OVERALL FIT

Multiple R	0.86067	Maximum Log Likelihood	-52.37119
R-Square	0.74074	Akaike Info Criterion (AIC)	6.77591
Adjusted R-Square	0.33334	Bayes Schwarz Criterion (BSC)	7.37240
Standard Error	7.11396	Hannan-Quinn Criterion (HQC)	6.87686
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	94.81437	18.17782	5.21594	0.00123	51.83066	137.79807
VAR X1	10.70905	12.97276	0.82550	0.43631	-19.96666	41.38477
VAR X2	-24.91218	13.62315	-1.82866	0.11016	-57.12582	7.30146

VAR X3	-3.18640	6.36412	-0.50068	0.63195	-18.23514	11.86234
VAR X4	0.18369	11.59050	0.01585	0.98780	-27.22348	27.59086
VAR X5	8.56411	13.76690	0.62208	0.55360	-23.98944	41.11765
VAR X6	6.20791	7.11861	0.87207	0.41208	-10.62493	23.04075
VAR X7	-27.14627	11.09639	-2.44641	0.04434	-53.38506	-0.90749
VAR X8	-2.94944	11.57757	-0.25475	0.80623	-30.32604	24.42715
VAR X9	32.25088	13.40786	2.40537	0.04709	0.54634	63.95543
VAR X10	-14.35025	9.32444	-1.53899	0.16770	-36.39905	7.69855
VAR X11	5.53039	3.60408	1.53448	0.16878	-2.99190	14.05267

ANOVA

	DF	SS	MS	F	p-Value
Regression	11	1012.19	92.02	1.81822	0.21912
Residual	7	354.26	50.61		
Total	18	1366.45			

Model Inputs:
VAR296
VAR17; VAR23; VAR25
SUSA
PU3, IU1, IU3

Regression Results

OVERALL FIT

Multiple R	0.73016	Maximum Log Likelihood	-57.66530
R-Square	0.53313	Akaike Info Criterion (AIC)	6.49108
Adjusted R-Square	0.43976	Bayes Schwarz Criterion (BSC)	6.68991
Standard Error	6.52151	Hannan-Quinn Criterion (HQC)	6.52473
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	110.18471	10.55925	10.43490	0.00000	87.67821	132.69121
VAR X1	-46.61365	13.13907	-3.54771	0.00292	-74.61893	-18.60838
VAR X2	24.30736	7.75903	3.13278	0.00684	7.76938	40.84535
VAR X3	-6.35901	2.86529	-2.21933	0.04230	-12.46622	-0.25180

ANOVA

	DF	SS	MS	F	p-Value
Regression	3	728.50	242.83	5.70965	0.00821
Residual	15	637.95	42.53		
Total	18	1366.45			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 5.416965
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.287382
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.489788

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	95.0000	92.6715	2.3285
2	72.5000	72.2755	0.2245
3	70.0000	72.2755	-2.2755
4	75.0000	79.2616	-4.2616
5	75.0000	85.6787	-10.6787
6	82.5000	77.8746	4.6254

7	67.5000	74.8539	-7.3539
8	80.0000	78.6927	1.3073
9	75.0000	74.2841	0.7159
10	72.5000	68.8601	3.6399
11	80.0000	74.4512	5.5488
12	85.0000	84.6857	0.3143
13	72.5000	67.8611	4.6389
14	85.0000	74.8539	10.1461
15	87.5000	79.2616	8.2384
16	57.5000	67.2980	-9.7980
17	67.5000	75.8230	-8.3230
18	70.0000	72.2755	-2.2755
19	82.5000	79.2616	3.2384

Q. NONLINEAR ECONOMETRIC MODEL II: MEDIUM LOA SYSTEM

Model Inputs:
VAR297
VAR26; VAR27; VAR28; VAR29; VAR30; VAR31; VAR32; VAR33; VAR34; VAR35; VAR36
SUSB
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Regression Results

OVERALL FIT

Multiple R	0.45524	Maximum Log Likelihood	-74.67787
R-Square	0.20724	Akaike Info Criterion (AIC)	9.12399
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	9.72047
Standard Error	24.56490	Hannan-Quinn Criterion (HQC)	9.22494
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	71.55895	81.10619	0.88229	0.40690	-120.22671	263.34460
VAR X1	-18.72997	81.41096	-0.23007	0.82462	-211.23630	173.77635
VAR X2	4.86021	34.54625	0.14069	0.89208	-76.82870	86.54912
VAR X3	32.81394	120.40717	0.27252	0.79308	-251.90379	317.53166
VAR X4	8.98179	166.39394	0.05398	0.95846	-384.47737	402.44094
VAR X5	-14.12159	159.46387	-0.08856	0.93191	-391.19372	362.95054
VAR X6	-6.53891	35.44997	-0.18445	0.85889	-90.36476	77.28695
VAR X7	-0.30819	143.28494	-0.00215	0.99834	-339.12324	338.50686
VAR X8	2.67003	71.91777	0.03713	0.97142	-167.38847	172.72853
VAR X9	26.73597	68.18188	0.39213	0.70663	-134.48854	187.96049
VAR X10	-42.49615	178.53957	-0.23802	0.81868	-464.67514	379.68284
VAR X11	-5.46950	23.57506	-0.23200	0.82317	-61.21567	50.27667

ANOVA

	DF	SS	MS	F	p-Value	
Regression	11	1104.25	100.39	0.16636	0.99546	
Residual	7	4224.04	603.43			
Total	18	5328.29				

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.538166
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.603037
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.683924

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	70.0000	69.7275	0.2725
2	17.5000	58.9293	-41.4293
3	62.5000	56.8276	5.6724
4	52.5000	62.1410	-9.6410
5	40.0000	54.8876	-14.8876
6	77.5000	74.8609	2.6391
7	65.0000	56.4832	8.5168
8	47.5000	65.4910	-17.9910
9	82.5000	80.3418	2.1582
10	50.0000	54.0014	-4.0014
11	80.0000	60.4216	19.5784
12	72.5000	77.7470	-5.2470
13	50.0000	55.4746	-5.4746
14	65.0000	67.1813	-2.1813
15	80.0000	60.1088	19.8912
16	57.5000	61.7859	-4.2859
17	87.5000	61.7870	25.7130
18	72.5000	61.1469	11.3531
19	65.0000	55.6557	9.3443

Model Inputs:
VAR297
VAR126; VAR127; VAR128; VAR129; VAR130; VAR131; VAR132; VAR133; VAR134; VAR135; VAR136
SUSB
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Regression Results

OVERALL FIT

Multiple R	0.71362	Maximum Log Likelihood	-70.36150
R-Square	0.50926	Akaike Info Criterion (AIC)	8.66963
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	9.26612
Standard Error	19.32733	Hannan-Quinn Criterion (HQC)	8.77058
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	144.15681	68.43138	2.10659	0.07316	-17.65769	305.97131
VAR X1	-19.85530	14.77429	-1.34391	0.22090	-54.79094	15.08034
VAR X2	9.77247	13.47704	0.72512	0.49190	-22.09566	41.64059
VAR X3	-18.03786	27.35753	-0.65934	0.53076	-82.72814	46.65241
VAR X4	4.35736	19.03998	0.22885	0.82553	-40.66504	49.37976
VAR X5	23.41367	15.12588	1.54792	0.16557	-12.35336	59.18070
VAR X6	-6.98935	6.99968	-0.99852	0.35128	-23.54096	9.56227
VAR X7	-23.35786	12.56216	-1.85938	0.10531	-53.06264	6.34692
VAR X8	-1.18514	20.97284	-0.05651	0.95652	-50.77802	48.40774
VAR X9	9.73763	13.78441	0.70642	0.50275	-22.85733	42.33259
VAR X10	1.09762	18.07236	0.06073	0.95327	-41.63673	43.83197
VAR X11	-3.22113	4.87714	-0.66046	0.53009	-14.75373	8.31146

ANOVA

	DF	SS	MS	F	p-Value
Regression	11	2713.47	246.68	0.66037	0.74162
Residual	7	2614.82	373.55		
Total	18	5328.29			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.538166
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.603037
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.683924

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	70.0000	60.8043	9.1957
2	17.5000	28.6807	-11.1807
3	62.5000	62.8903	-0.3903
4	52.5000	67.5379	-15.0379
5	40.0000	67.5062	-27.5062
6	77.5000	67.8865	9.6135
7	65.0000	54.3905	10.6095
8	47.5000	66.6995	-19.1995
9	82.5000	77.8860	4.6140
10	50.0000	43.8826	6.1174
11	80.0000	82.5926	-2.5926
12	72.5000	61.7825	10.7175
13	50.0000	56.7486	-6.7486
14	65.0000	70.3898	-5.3898
15	80.0000	66.4862	13.5138
16	57.5000	50.3621	7.1379
17	87.5000	70.6651	16.8349
18	72.5000	66.4555	6.0445
19	65.0000	71.3531	-6.3531

R. NONLINEAR ECONOMETRIC MODEL III: HIGH LOA SYSTEM

Model Inputs:
VAR298
VAR37; VAR38; VAR39; VAR40; VAR41; VAR42; VAR43; VAR44; VAR45; VAR46; VAR47
SUSC
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Regression Results

OVERALL FIT

Multiple R	0.89265	Maximum Log Likelihood	-58.45594
R-Square	0.79683	Akaike Info Criterion (AIC)	7.41641
Adjusted R-Square	0.47756	Bayes Schwarz Criterion (BSC)	8.01290
Standard Error	9.97518	Hannan-Quinn Criterion (HQC)	7.51736
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	124.03364	47.11869	2.63237	0.03380	12.61564	235.45164
VAR X1	0.68233	6.42648	0.10617	0.91842	-14.51389	15.87854
VAR X2	-5.33325	6.05009	-0.88151	0.40729	-19.63944	8.97295
VAR X3	-14.79477	12.09981	-1.22273	0.26100	-43.40627	13.81673
VAR X4	-3.88013	8.19348	-0.47356	0.65023	-23.25463	15.49437
VAR X5	-5.32504	5.18321	-1.02736	0.33844	-17.58139	6.93131
VAR X6	-18.70452	5.38859	-3.47113	0.01039	-31.44652	-5.96252
VAR X7	5.37888	4.56624	1.17797	0.27730	-5.41856	16.17632
VAR X8	11.61093	6.83245	1.69938	0.13305	-4.54524	27.76711
VAR X9	5.63244	4.01871	1.40155	0.20380	-3.87030	15.13517
VAR X10	7.98640	6.32898	1.26188	0.24741	-6.97925	22.95205
VAR X11	-6.74464	2.74341	-2.45849	0.04356	-13.23178	-0.25751

ANOVA

	DF	SS	MS	F	p-Value
Regression	11	2731.76	248.34	2.49579	0.11717
Residual	7	696.53	99.50		
Total	18	3428.29			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.538166
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.603037
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.683924

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	72.5000	62.4626	10.0374
2	42.5000	34.8846	7.6154
3	47.5000	53.0272	-5.5272
4	55.0000	59.0813	-4.0813
5	42.5000	38.3684	4.1316
6	45.0000	40.0761	4.9239
7	60.0000	61.3668	-1.3668
8	20.0000	21.1984	-1.1984
9	50.0000	43.1607	6.8393
10	37.5000	35.4381	2.0619
11	30.0000	33.4265	-3.4265
12	47.5000	47.9480	-0.4480

13	40.0000	32.9212	7.0788
14	52.5000	55.3537	-2.8537
15	47.5000	50.9017	-3.4017
16	35.0000	31.9282	3.0718
17	32.5000	32.1283	0.3717
18	27.5000	42.5523	-15.0523
19	15.0000	23.7761	-8.7761

Model Inputs:
VAR298
VAR137; VAR138; VAR139; VAR140; VAR141; VAR142; VAR143; VAR144; VAR145; VAR146; VAR147
SUSC
PU1, PU2, PU3, PU4, PEOU1, PEOU2, PEOU3, PEOU4, IU1, IU2, IU3

Regression Results

OVERALL FIT

Multiple R	0.51129	Maximum Log Likelihood	-70.07211
R-Square	0.26142	Akaike Info Criterion (AIC)	8.63917
Adjusted R-Square	0.00000	Bayes Schwarz Criterion (BSC)	9.23566
Standard Error	19.01909	Hannan-Quinn Criterion (HQC)	8.74012
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	26.52106	58.26404	0.45519	0.66276	-111.25150	164.29363
VAR X1	16.65121	39.99706	0.41631	0.68965	-77.92681	111.22924
VAR X2	-7.85126	50.67046	-0.15495	0.88124	-127.66786	111.96533
VAR X3	-7.97742	35.82501	-0.22268	0.83014	-92.69009	76.73526
VAR X4	45.76043	45.08675	1.01494	0.34392	-60.85280	152.37365
VAR X5	-11.55287	25.66697	-0.45011	0.66624	-72.24561	49.13987
VAR X6	28.46720	31.84911	0.89381	0.40111	-46.84398	103.77839
VAR X7	-8.99679	26.39438	-0.34086	0.74321	-71.40959	53.41600
VAR X8	3.76567	24.20346	0.15558	0.88075	-53.46641	60.99774
VAR X9	-2.33263	24.59708	-0.09483	0.92710	-60.49548	55.83022
VAR X10	-51.01494	36.73991	-1.38854	0.20755	-137.89102	35.86114
VAR X11	5.56403	11.63606	0.47817	0.64710	-21.95089	33.07895

ANOVA

	DF	SS	MS	F	p-Value
Regression	11	896.21	81.47	0.22524	0.98587
Residual	7	2532.08	361.73		
Total	18	3428.29			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.538166
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.603037
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.683924

Forecasting

Period	Actual (Y)	Forecast (F)	Error (E)
1	72.5000	42.2323	30.2677
2	42.5000	47.5127	-5.0127
3	47.5000	36.5990	10.9010
4	55.0000	56.7009	-1.7009
5	42.5000	45.6727	-3.1727
6	45.0000	40.0054	4.9946
7	60.0000	53.7970	6.2030
8	20.0000	33.7852	-13.7852
9	50.0000	46.3644	3.6356
10	37.5000	39.1774	-1.6774
11	30.0000	35.5826	-5.5826
12	47.5000	44.9202	2.5798
13	40.0000	33.3397	6.6603
14	52.5000	51.2475	1.2525
15	47.5000	32.8192	14.6808

16	35.0000	35.3969	-0.3969
17	32.5000	45.8326	-13.3326
18	27.5000	40.9769	-13.4769
19	15.0000	38.0374	-23.0374

Model Inputs:
VAR298
VAR42; VAR47
SUSC
PEOU2, IU3

Regression Results

OVERALL FIT

Multiple R	0.38595	Maximum Log Likelihood	-71.34765
R-Square	0.14896	Akaike Info Criterion (AIC)	7.82607
Adjusted R-Square	0.04258	Bayes Schwarz Criterion (BSC)	7.97519
Standard Error	13.50374	Hannan-Quinn Criterion (HQC)	7.85131
Observations	19		

	Coeff	Std. Error	T-stat	P-value	Lower 5%	Upper 95%
Intercept	72.03358	18.16593	3.96531	0.00111	33.52353	110.54363
VAR X1	-5.58635	3.52730	-1.58375	0.13282	-13.06390	1.89119
VAR X2	-3.89392	3.03878	-1.28141	0.21831	-10.33585	2.54801

ANOVA

	DF	SS	MS	F	p-Value
Regression	2	510.67	255.34	1.40024	0.27517
Residual	16	2917.62	182.35		
Total	18	3428.29			

Hypothesis Test
Critical F-statistic (99% confidence with DFR1 and DFR2) : 6.226235
Critical F-statistic (95% confidence with DFR1 and DFR2) : 3.633723
Critical F-statistic (90% confidence with DFR1 and DFR2) : 2.668171

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