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THESIS

THE EFFECTS OF DEPARTMENT OF DEFENSE AND FEDERAL SPENDING UPON STATE ECONOMIC GROWTH

by

Ernest G. Anastos

December 1988

Thesis Advisor: Loren M. Solnick

Co-Advisor Stephen L. Mehay

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The Effects of Department of Defense and Federal Spending Upon State Economic Growth

by

Ernest G. Anastos
Lieutenant Commander, Supply Corps, United States Navy
M.B.A., University of Richmond, 1986
B.S., University of South Carolina, 1978

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December 1988

Author: E G Anastos
Ernest G. Anastos

Approved by: Loren M. Solnick
Loren M. Solnick, Thesis Co-Advisor

S. L. Mehay
Stephen L. Mehay, Thesis Co-Advisor

David R. Whipple, Chairman,
Department of Administrative Sciences

K. T. Marshall
Kneale T. Marshall,
Dean of Information and Policy Sciences

ABSTRACT

This thesis evaluates the impact of spending by the Department of Defense and the Federal Government upon the economic growth of the states in which funds are expended. A pooled cross-section and time-series analysis is performed on a data base describing the period 1976-1985 and including the forty-eight contiguous states. Personal income is used as a proxy to measure economic growth. The econometric models are estimated using three separate regression methodologies. Consistent parameter estimates permit the author to conclude that Defense Investment spending is highly associated with economic growth. Defense Expense spending is less highly associated with growth. Federal spending other than for defense or intergovernmental aid to state and local governments exhibits an inconclusive relationship with economic growth.

TABLE OF CONTENTS

I. INTRODUCTION

A. GENERAL DISCUSSION

Economists have devoted considerable attention to the study of regional economic growth. Substantial differences exist in the rate at which regions develop. This research focuses on identifying the factors that contribute to explaining different rates of development. These factors fall into several categories, which may be classified as: geographic, demographic, infrastructural, public policy, and economic momentum. This study introduces the role of Department of Defense expenditures which have not been considered in most prior research.

That regions develop at different rates has been clearly demonstrated throughout history. The industrialization of Great Britain, in the mid-eighteenth century, occurred substantially before that of other nations. This development contributed greatly to her status as the preeminent world power at the time. Differences in economic development can most clearly be seen today in the disparities between the Western industrialized nations and the "third-world" states of Latin America and Africa.

On a smaller scale, dramatic differences in economic growth can be seen between various regions of the United

States. For example, few would argue that Montana has achieved the level of economic development of California, New York, or Pennsylvania. Not only do regions develop at uneven rates but the rates themselves vary over time. Recently, the phenomenon of the American Sunbelt has prompted economists to examine why growth rates there have exceeded those in other regions.

The focus of this study will be to identify factors that affect regional growth and quantify their effects on regional economic development within the contiguous United States. For the purposes of this study a region will be considered an individual state.

Beyond the identification/quantification of general factors affecting growth, this study will evaluate the impact of the distribution of Federal Government funds generally and Department of Defense (DoD) funds particularly. In a four and one-half trillion dollar economy (as measured by Gross National Product (GNP)) the Federal Government distributes/spends over one trillion dollars and the DoD controls slightly less than 30% of that. This research is based on the belief that the magnitude of federal and DoD expenditures have a significant measurable effect on state economic growth. This theory is supported, by the obstacles encountered by the Pentagon when it desires to close unneeded installations. Congress' recent passage of the base-closings legislation reflects the inherent reluctance to allow reduction of federal spending in a specific region.

> The bill sets up a complicated base-closing procedure which essentially cuts through the thicket of laws enacted by Congress in the past decade to thwart Pentagon efforts to shut down bases....
>
> The bill endorses a Pentagon-appointed commission which has been meeting for months, trying to put together a list of bases to be closed. The current panel will be expanded to 12 members by the bill. The panel will make its recommendations by Dec. 31 and Defense Secretary Frank C. Carlucci would have until Jan. 15 - five days before he leaves office - to either accept or reject the entire list. He could not change the list. If Carlucci approves the list, Congress would have until mid-April to overturn the proposal, but it could only do that by approving a resolution which could then be vetoed by the incoming president. (Ahern, 1988, p.1)

This policy makes it extremely difficult to hold an individual elected or appointed official responsible for failing to keep open a specific installation.

Additionally, the specific state-by-state distribution of these funds may aid in explaining differing state economic growth rates. In this era of rapid expansion of the Sunbelt, federal fiscal policies are fingered as exacerbating the decline of the Manufacturing Belt. A 1976 analysis concluded:

> federal tax and spending policies are causing a massive flow of wealth from the Northeast and Midwest to the

> fast growing Southern and Western regions of the nation. (Havemann and Stanfield, 1976, p.878)

Although the disparity narrowed somewhat in a 1981 study update, the inequities amongst the regions in tax burden and spending benefits continue to exist (Havemann and Stanfield, 1981).

With public criticism of the federal budget deficit increasing, it becomes imperative that a greater understanding be achieved of the effects of federal funds distribution. Throughout the latter half of the twentieth century government has sought to achieve economic ends through fiscal policies. The results of these taxation and spending initiatives upon regional economic growth has never been precisely established.

> Finally, the Joint Economic Committee noted the lack of solid statistical information on the impact of federal tax, expenditure, credit and employment policies on decisions of businesses and individuals to relocate. ... Over-all, however, 'not enough is known about the extent to which national economic policies affect the economies of regions and areas within regions', the JEC said. (Havemann and Stanfield, 1976, p.890)

With DoD spending being targeted for future reductions, the need to clearly establish the relationship between federal spending and economic growth is critical. The implications, for policy makers of this relationship may be profound.

B. PURPOSE OF THE STUDY

Earlier research has provided preliminary statistically significant evidence of the impact of DoD spending upon state economic growth (James, 1987; Solnick and Mehay, 1988). These earlier studies established that the DoD spending for operations and investment type expenditures positively and significantly affects state economic growth as measured by changes in personal income (Solnick and Mehay, 1988, p.16). However, parameter estimates in these earlier models may have been distorted by the omission of several important variables.

Therefore, it is the purpose of this study to expand upon earlier works by testing omitted variables. Through the modification of earlier models with the inclusion of additional variables, we anticipate that a better understanding of the determinants of regional economic growth will be achieved. This understanding is expected to include specification of the role of overall federal and DoD spending. The findings of earlier research is discussed in depth in Chapters II and III.

The research is framed by the following primary research question:

1) Does the spending of the U.S. Federal Government generally, and the Department of Defense in particular, significantly impact the economic growth of the states in which those dollars are expended?

In support of this broad objective, the following subsidiary research questions will provide the specific focus of this thesis:

1) Can an econometric model be structured that will estimate the magnitude of the impact of federal spending, while controlling for the impact of other major factors affecting state economic growth?

2) Can archival or empirical data be located that is of sufficient quality and specificity to enable the efficient estimation of the parameters of this model?

3) Once measured, what are the potential policy implications of these economic effects?

C. SCOPE OF THE STUDY

An econometric model is constructed to estimate the effects of Federal Government spending in general, and DoD spending in particular, upon state economic growth. This is accomplished with the use of a pooled, cross-sectional time-series data set. The data base consists of the forty-eight contiguous United States for the ten year time period, 1976-1985.

As mentioned above, this effort builds upon the earlier works identified. Specifically, the following additional variables beyond those of the previous works are tested to determine the significance of their effect on regional economic growth:

1) total Federal expenditures by state, other than DoD expenditures;

2) total revenue and expenditure data for state and local governments.

The effect of introducing these new variables in the model upon the parameter estimates for variables previously estimated is also examined.

D. ORGANIZATION OF THE STUDY

The remainder of this report is presented in Chapters II through VI.

Chapter II reviews the literature relevant to this study. While research on this topic goes back to the late 1950's, our focus is on the more recent studies.

Chapter III continues the discussion of earlier research begun in Chapter II. However, the focus of Chapter III is upon the specific models from which this work evolved. Also described, in general, in Chapter III are the models estimated in this effort.

Chapter IV presents the research methodologies employed and describes the variables and data sources. Chapter V presents the estimation results and analysis. The results are interpreted in view of the results contributed by the earlier researchers and with an eye toward their possible policy implications. Chapter VI summarizes the work, providing a brief overview of the study and results and presenting any conclusions and recommendations that follow logically from the research. Additionally, areas for future research are identified.

II. LITERATURE REVIEW

As discussed in Chapter I, considerable research has been conducted into how regions grow. It is our intention to review some of the more pertinent of these studies. The growth literature we will examine contains three distinct types of models.

In the first of these models growth is measured by a surrogate, and the selected measure is used as the dependent variable in a multiple regression equation. Most frequently, either personal income or employment is the surrogate measure. Typical of the explanatory variables used in this mode of research are: state taxes and expenditures, unemployment, measures of market accessibility, and labor force characteristics. The second set of models concern the location choices made by businesses. In this research, logit and multinomial logit techniques are used to identify factors which significantly affect firms' decisions to locate in a particular state. Finally, mathematical simulation has been used to examine the effects of changes in federal tax and spending policies. These models simulate the interactions of the national economy to predict the effects of factor changes upon other elements of the economy. Our review will discuss each of these methods in turn.

A. GROWTH MODELS

In this research multiple regression is used to examine the factors contributing to economic growth. While economists have adopted numerous focuses in this area, two themes appear to be most prevalent. The first is the use of income growth as a proxy for economic growth. In these cases income growth is specified most frequently as total personal income or per capita personal income. The second approach used in prior research is to measure employment growth as a proxy for economic growth. In these cases, employment is measured most often as either total employment or manufacturing employment.

A large number of independent variables have been used as predictors of the growth measures. Labor force characteristics, state and local fiscal policies, business climate, market accessibility, factors of production, and demographics are typical of broad categories of variables which are evaluated in these models. These categories often overlap, as one researcher may classify a specific variable as a labor force characteristic while another may classify the same item as a factor of production.

What becomes apparent in the discussion that follows is that the impact of an independent variable changes significantly depending upon independent variable selection and specification. We will now briefly highlight the suppositions, specifications, and conclusions of some of the works in this area.

Helms makes use of a pooled cross-section and time-series data set to investigate the impacts of combined state and local fiscal policies upon state economic growth. In this research, which influences the models developed later in this paper, Helms tests the hypothesis that the uses to which state and local funds are put matters significantly when measuring the effects of tax policies upon state economic growth. Tax increases used to fund transfer payments will retard economic growth, Helms believes. He writes: "a key feature to our approach is to recognize that it is not meaningful to evaluate the effects of tax or expenditure changes in isolation: both the sources and the uses of funds must be considered." (Helms, 1985, p.577)

In testing this hypothesis, Helms uses state personal income as the proxy for economic growth. He groups his independent variables into three categories: taxes and other revenues, public expenditures, and demographic and labor force characteristics. State and local tax and other revenue variables include: federal funds transfers, property taxes, other taxes, user fees, and deficit financing. Public expenditures, in Helm's model, are the funds spent on local schools, higher education, highways, health, and all other. The demographic and labor force characteristics include average manufacturing wage, unionization rates, and population density. (Helms, 1985)

Expenditures on health, highways, local schools, and higher education all had significant positive effects on economic growth in Helms' models. Taxes that are used to fund transfer payments consistently had a significant negative contribution to personal income growth. Wage rates and unionization had marginally significant negative contributions, and population density had significant negative effects. Helms evaluates the negative impact of population density as the result of its probable "...proxy for economic maturity and stable agglomerative externalities." (Helms, 1985, p.580)

Finally, Helms concludes:

> A state's ability to attract, retain, and encourage business activity is significantly affected by its pattern of taxation: however, taxes cannot be studied in isolation. To the extent that tax revenues are devoted to the provision of public services which are valued by businesses and their employees, a state may encourage economic activity within its borders with appropriate expenditures....
>
> Our results indicate that the effects of taxation on a state's economy depend crucially on the use to which the revenues are put. (Helms, 1985, p.581)

In analyzing long-term differences in the levels of income in states' economies, Canto and Webb employ per capita personal income to measure economic growth. They assume that over time the variations in income across regions should tend to balance out. However, Canto and Webb acknowledge that this leveling has not occurred. This leads to their supposition that there must be regional factors that contribute to the persistent differences in income. Defining states as their regions, Canto and Webb proceed to analyze the effect of state fiscal policy on economic performance. (Canto and Webb, 1987)

Using single and two-stage least squares techniques, Canto and Webb estimate the effects of the following independent variables: state government purchases, state transfer payments, and relative state tax burdens. Of these, only relative state tax burdens was determined to have significant effects. As anticipated the effects of the relative tax burden on per capita income were negative. Relative tax burden is defined as the ratio of taxes in each state to the average of taxes in other states. (Canto and Webb, 1987)

The researchers conclude:

> ... that individual state fiscal policies can and do influence relative state per capita income levels. In contrast, federal fiscal policy mainly influences absolute or national economic performance. As a result, the empirical analysis suggests that both state and federal policies matter in the determination of the overall economic performance of a state or region. (Canto and Webb, 1987, p.201)

Romans and Subrahmanyam theorize that relocation decisions of individuals and business firms are impacted by a desire to minimize tax burdens. They recognize the inability of both firms and individuals to completely remove their tax burden. They assume these parties will attempt to optimize the benefits received in return for their tax dollars. Benefits take the form of health, highways, and education expenditures. Consequently, "...insofar as tax progression is greater than benefit progression in one locality relative to another, incentives exist for lower or zero income individuals to stay or enter and higher income individuals to depart." (Romans and Subrahmanyam, 1979, p.435) This hypothesis is similar to that of Helms, in that the growth effect of spending on public goods and services is viewed as positive and transfer payments negative.

To test this theory, the researchers assume that neighboring states are alike with the exception of their fiscal policies. Three separate growth models are estimated. The dependent variables of the models are: growth in state personal income, growth in state personal income per capita, and growth in non-agricultural employment. The independent variables evaluated in these models are: transfer payments, average marginal personal tax rates as a percentage of family income, personal taxes, and business taxes.

Both transfer payments and marginal tax rates were found to have significantly negative effects regardless of the dependent variable specification. Surprisingly, business taxes had a significant positive effect in each model. The authors propose: "either that businesses were getting something in return for the taxes they paid or else locational rents were high enough in faster-growing states to allow higher tax rates on business without discouraging industry location or growth." (Romans and Subrahmanyam, 1979, p.439) Personal taxes did not have a significant impact. It is important to note that consistent results were obtained in these models with both personal income and non-agricultural employment as dependent variables.

Romans and Subrahmanyam concluded: "the result supports the hypothesis that high tax progression and the absorption of tax revenues into transfer payments can drive out firms and higher income individuals and perhaps attract lower income individuals, leading to lower state economic growth." (Romans and Subrahmanyam, 1979, p.439)

Quan and Beck propose that educational services within a state may impact growth. In analyzing the nature of this proposed relationship, the authors suggest two possible explanations. First, the existence of quality education programs within a state attracts migration and contributes to both increases in the supply of labor and the local demand for goods and services. Second, they suggest that education may increase the productivity of workers and thereby contribute to higher wage rates. Quan and Beck allow that this relationship may be one which occurs in a subsequent period to the administration of education. (Quan and Beck, 1987)

Quan and Beck test this theory with the estimation of three separate models. The dependent variables which serve as the proxies for economic growth are: changes in wage levels, employment levels, and state per capita income. The model specification uses polynomial distributed-lag estimation techniques on a pooled cross-section time-series data base. The authors are able to eliminate the use of variables for climate, natural resources, and other factors affecting the attractiveness of a state which do not change over time by including state dummy variables. As a result, Quan and Beck's models contain only four independent variables. Those variables are: the ratio of state and local taxes to U.S. personal income, the ratio of state and local expenditures for local education to the U.S. average, the same ratio for higher education expenditures, and the same ratio specification again for general expenditures other than welfare. (Quan and Beck, 1987)

The significance of the explanatory variables differs in each model specification. When wage rates are the dependent variable, state and local taxes have a significant negative effect and local education expenditures have a significant positive impact. The local education expenditure relationship exhibits a distributed-lag impact. The most significant effects occur at the seven to eight year point. Under this specification the other variables are not significant. When employment is the dependent variable: higher education and other expenditures have significant positive effects, while the tax variables again have significant negative effects. Local education is not significant in this model. Finally, if the dependent variable is per capita income both local and higher education expenditures have significant positive impacts, while the remaining variables are not significant. (Quan and Beck, 1987)

This research also segregated the Northeast and Sunbelt regions and different independent-dependent relationships were observed between these regions. The authors concluded:

> The evidence seems to indicate that the effects of educational expenditures on the levels of wages and employment differ in the Northeast and Sunbelt. Education expenditures have positive and significant effects on the levels of wage and employment in the

> Northeast, while the reverse is true in the Sunbelt. In the latter subsample, non-transfer non-education expenditures have positive and significant effects on the two variables. (Quan and Beck, 1987, p.375)

Leonard Wheat attempts to answer the specific question: why are the Southern and Western regions of the U.S. growing faster than other regions. For this study, Wheat groups the forty-eight contiguous states into five regions: the Manufacturing Belt, the Northwest, the South, the Southwest, and the Transition Zone. In regression analysis, Wheat uses manufacturing employment growth as the dependent variable. (Wheat, 1986)

Wheat concludes that six general factors explain 96% of the variance in growth rates across the regions. The six factors are: strength of markets, climate, a rural state attraction, unionization, thresholds, and amenities. Several of these variables require further explanation.

Strength of markets is measured by the ratio of demand to supply, hence regions which are distant from production sources have strong markets. Rural state attraction attempts to measure migration out of the city. Thresholds is a label for the author's theory that a state must reach a certain level of development before rapid growth can occur. Wheat subjectively identifies Montana and Wyoming as the only two states below threshold. He bases this on the size of a state's principal city. The variable included in his model is a dummy which identifies the two selected states. Finally, amenities is an attempt to identify those states to which leisure seeking individuals, such as retirees, are drawn. The variable, amenities, is also a dummy which identifies those states which have both fifteen percent or more of its population sixty-five years or older and a positive in migration of seven percent or more. (Wheat, 1986)

Each of the six factors above is a significant contributor to manufacturing employment growth and the direction of that effect was the one which would be anticipated. The researcher summarized his results:

> Putting the factors together, we see that the Manufacturing Belt's chronic slow growth results from an overwhelming combination of liabilities. The Manufacturing Belt has by far the weakest markets of any region, severe winters, a weak rural attraction, and the most adverse labor conditions to be found.
>
> The Southwest has the fastest growth because this region is where the two most important locational factors - markets and climate - overlap. Markets are strongest in the two western regions; climate is strongest in the two southern regions. And the Southwest fits both regional categories. Compared to the Northwest, the Southwest has the additional advantage of having all its states above threshold. It also leads in amenities. These assets overpower a weak rural attraction and so-so labor conditions. (Wheat, 1986, pp.652-653)

Another regional study using changes in employment as proxy for growth was conducted by Wasylenko and McGuire. The expression of employment growth in this model, however, is total employment, a much broader indicator of economic activity than manufacturing employment. This variable was chosen by the authors to permit a focus on "...the relationship between a state's business climate and jobs in the state." (Wasylenko and McGuire, 1985, p.497) Wasylenko and McGuire's primary focus is to specify the impact of business climate on economic expansion. Business climate used in this work, is expressed in the variables: state and local revenue and expenditure patterns including the highest and the effective personal and corporate tax rates.

The study combines an analysis of six independent industries and the total economy. Their results indicate that higher: wages, utility prices, personal income tax rates, and an increase in the overall level of taxation significantly discourage employment growth in the industries examined. Corporate tax rates were not significant. Higher state and local spending on education, and higher per capita income favorably impact employment growth. We must understand that the relationships vary substantially from industry to industry. (Wasylenko and McGuire, 1985, p.497)

The researchers point out, similar to Wheat, that because numerous factors are at work, not all will be affecting employment in the same direction. Therefore, the effects of state policy decisions may not be as anticipated:

> ... while states should pay close attention to their tax burdens, it is noteworthy that expenditures on education appear to increase employment growth. How those taxes are spent appears to matter. Finally, variables beyond the direct control of policy makers such as wages, energy prices and other variables are the largest contributors to low employment growth rates. Raiding the state treasury to increase employment growth may not necessarily produce significant results. (Wasylenko and McGuire, 1985, p.509)

A slightly different focus with employment growth models is conducted by Newman. Newman measures industry growth as the comparative change in state industry employment growth to national growth in the same industry. The thrust of this research was to analyze empirically the reasons for the rapid growth of the South and Southwest. Three possible explanations offered by Newman are: differing state and local tax policies, business climate, and unionization. These explanations become his independent variables. (Newman, 1983)

In specifying the explanatory variables, Newman's business climate is a dummy variable which identifies those states having Right-to-Work laws. Tax policies are measured as the year-to-year changes vice tax rate levels, as the author hypothesizes: "...induced movements will depend upon changes in relative rates." (Newman, 1983, p.79)

Each of the variables described above is significant in four or more of the thirteen industries scrutinized. This enables Newman to conclude: "Contrary to the previous work, the results from this study lend considerable support to the heretofore unsubstantiated argument that corporate tax rate differentials between states as well as the extent of unionization and favorable business climate have been major factors influencing the acceleration of industry movement to the South." (Newman, 1983, p.77)

Plaut and Pluta also examined the impact of business climate on growth. Three separate model specifications are employed by Plaut and Pluta, with overall, capital intensive, and labor intensive industrial growth serving as the surrogates for economic growth. These surrogates are reflected by the following dependent variable proxies: percent change in value added, percent change in employment, and percent change in capital stock. The authors employ principal components analysis and multiple regression techniques on pooled cross-sectional data for the forty-eight contiguous states. Plaut and Pluta argue that the relationship between business climate and growth cannot be viewed in isolation (Plaut and Pluta, 1983, p.102). As a consequence, they include a broad series of additional variables in their model, to ensure business climate is not improperly specified. (Plaut and Pluta, 1983)

The independent variables tested are classified into four groups: accessibility to markets, cost and availability of the factors of production, climate and environment, and state and local taxes and expenditures (business climate). In all, eighteen explanatory variables are used. Independent variable significance fluctuated as a function of the dependent variable selected. (Plaut and Pluta, 1983)

Energy costs, labor characteristics, land cost and availability, and climate are significant when the specification is percent change in value added. Climate, labor, business climate, and accessibility to markets are significant when the dependent variable is percent change in employment. Finally, when percent change in capital stock is selected; energy costs, land, markets, and business climate are significant. These results led the researchers to remark:

> Accessibility to markets, which most previous studies have identified as the primary factor explaining differences in regional industrial growth, was found to be relatively unimportant in our model. After controlling for other factors, the business climate, tax and expenditure variables as a group were found to be not significantly related to overall state industrial growth but significantly related to state employment and capital stock growth.
>
> While empirical support is, therefore, provided for the almost universal finding in the literature that state and local taxes have little effect on state industrial growth, our results suggest that overall state and local tax effort is an important determinant

> of state employment growth. Even where business climate, tax and expenditure variables were found to be significant determinants of regional growth, however, their role was still less important than that of traditional market factors (land and labor), newly emerging market factors (energy), and climate variables. (Plaut and Pluta, 1983, p.115)

In addition to the studies discussed above, a number of growth models have been developed which employ less traditional dependent variables. We will briefly review three of these. Benson and Johnson theorize that the impact of tax policy changes occurs over a period of time rather than in the period in which the tax is enacted and effected. To test this hypothesis, Benson and Johnson estimate the lagged impact of tax changes upon capital formation. (Benson and Johnson, 1986)

Benson and Johnson use a six-period lag for the state tax variable. The other explanatory variables include: relative manufacturing wage, welfare expenditures as a percent of total state and local expenditures, and state and local debt as a percent of state personal income. The authors deem the use of state dummy variables critical to their results. "Excluding them yields the finding that none of our explanatory variables are significant, the same result as found in many simple cross-sectional studies." (Benson and Johnson, 1986, p.392)

The state tax rate variable was found to be significant for periods t-1, t-2, and t-3, with a mean lag of 2.2 years. Both the manufacturing wage and welfare expenditures variables were found to have significant negative effects on capital formation. The debt variable was not significant. (Benson and Johnson, 1986)

The authors summarized the importance of their findings:

> The principal findings of this study suggest that taxes negatively affect economic activity, contradicting widely accepted conclusions of numerous empirical studies. While we have argued that interstate tax competition is a prevailing force, it does appear that states have power within a narrow range. The finding of a distributed-lag effect suggests states can vary taxes somewhat without immediately experiencing massive capital influxes or decreases in formation rates. Although the mean lag is only 2.2 years, the lag effect does extend out 3 years beyond the initial time period. (Benson and Johnson, 1986, p.400)

Booth proposes that cycles of regional economic growth, which includes expansion, stability, decline, decay, and renewal, are substantially longer than what is typically called the business cycle. His analysis purports to demonstrate that only the Northeast has endured a complete cycle. Using new business formations as the dependent variable, Booth shows how the Northeast is substantially further along in this cycle than the Midwest. The proof of his hypothesis consists of a higher rate of business formation in the Northeast than the Midwest. This is because Northeastern decay has proceeded far enough to make room for/free up the resources required for new business enterprise. (Booth, 1986)

Booth expresses this theory:

> ... the principal barrier to new business formation in older regions is simply the existence of established industries that drive potential entrepreneurs and other resources from the new business formation process. The formation of new businesses needed to provide the basis for high growth industries thus only occurs with the decline of the old industries in a region, and the period during which employment destruction in the old industries overpowers employment creation in new industries can be lengthy. (Booth, 1986, pp.459-60)

Lastly, Nardinelli, Wallace and Warner model the fluctuations in state income as a function of the long-term income growth rate plus annual variation from that rate. Further, they propose that the variation term is itself a function of the national business cycle plus state specific effects which are uncorrelated with the national economy. From here the authors attempt to estimate the ratio by which each state varies from the national trends. (Nardinelli, Wallace, and Warner, 1988) The fluctuation is measured by regression techniques and parallels estimation of stock price beta's, which reflect the degree of individual stock volatility in relation to overall market shifts.

Having estimated individual state volatility relative to the national economic cycle, Nardinelli et al. then proceed to attempt to identify the determinants of this volatility. Labeling cyclical instability as their dependent variable, the authors evaluate the explanatory powers of federal government dependence, the existence of Right-to-Work laws, and dependence on agriculture and manufacturing on volatility. Dependence of is defined as the percentage of state income derived from that sector. Only the dependence of the state economy on income derived from federal sources was found to be significant. Federal government dependence tends to decrease cyclical instability (i.e., increase stability). (Nardinelli, Wallace, and Warner, 1988)

B. BUSINESS LOCATION DECISIONS

The second type of model we will discuss concerns the analysis of business location decision making. This research attempts to answer the complex question: what influences a business to locate in a particular place.

Carlton examines business location choices in conjunction with employment generation. He uses the location choices of three narrowly defined industries (by four digit SIC codes) and attempts to predict the level of employment generated from the location decision. The author uses logit techniques in this research, the results of which allow Carlton to suggest: "...that by exploiting the link between firm location and firm size, one can not only obtain a more efficient estimation of the location model, but also accurately predict the crucial employment variable." (Carlton, 1983, pp.440-41)

This model evaluates the effects of the following factors: wages, electricity prices, natural gas prices, property taxes, personal income taxes, corporate taxes, agglomeration effects (existing employment within the appropriate SIC code), availability of technical expertise, unemployment, and business climate upon firm location and size decisions. He concluded that energy costs (particularly electricity) play a surprisingly large role, taxes and state incentive programs do not seem to be significant, the availability of technical expertise is likely to be very important for highly sophisticated industries, and the existing concentration of employment within the industry is highly significant. (Carlton, 1983)

A two-stage location choice model was developed by Schmenner, Huber, and Cook. It is their contention that businesses initially consider a large number of states when determining plant location. The initial consideration period, the researchers contend, is used to narrow the field of possible choices to a relatively small number of possibilities for detailed examination. Schmenner, Huber, and Cook also suggest that the factors impacting the process may vary from stage-one to stage-two. They propose that broad easily determinable characteristics are important in stage-one, acting as qualifiers for further consideration in stage-two. In stage-two, they suggest, these factors play a role of diminished importance. (Schmenner, Huber, and Cook, 1987)

The researchers use multinomial logit techniques in analyzing the impact of the following classes of state characteristics: input costs and availability, government influence, and geographic and demographic factors. Schmenner, Huber, and Cook claim that by combining the pure state characteristics with plant specific characteristics, their model is able to better identify significant relationships. Their evidence for this claim is that when the model is estimated using only state characteristics very few variables reach statistical significance. When plant factors are added several more terms achieve significance. (Schmenner, Huber, and Cook, 1987, p.94)

Stage-one results indicate that: unionism significantly deters selection and warmer climates are desired as state stand alone characteristics. While, when combined with plant specific characteristics, lower levels of education significantly attract and higher spending states are avoided. Tax programs are insignificant in stage-one analysis. In stage-two: unionism plays a somewhat less significant role, lower worker education levels are again favored, and property taxes play a significantly positive role. The authors do not have an explanation for the surprising role of property tax in stage-two. (Schmenner, Huber, and Cook, 1987}

In summarizing their work, Schmenner, Huber, and Cook write:

> Simple geographic differences among states are not sufficient, by themselves, to explain why some states do better than others in attracting new plant openings. The state characteristics should be modified by decision-specific factors that describe the character of either the new plant or its location decision process.
>
> The characterization of the company's location decision process as divided into stages is apt. The first-stage decision does appear to be more affected by different variables, and in different ways than the second-stage decision. (Schmenner, Huber, and Cook, 1987, p.101)

C. SIMULATION MODELS

Finally, we come to a special collection of models, called simulations. These models consist of a series of mathematical equations which attempt to describe the interrelationships amongst the various actors within the economy. With a simulation model changes in any number of variables can be evaluated in terms of their effect on input requirements and outputs. Several analyses of federal and

DoD spending pattern changes have been conducted using this technique. We will briefly review three of these.

Greenwood, Hunt, and Pfalzgraff use the Colorado Forecasting and Simulation Model of the Center for Economic Analysis to estimate the direct, indirect, and induced effects of federal space related expenditures upon Colorado's economy. They then project their analysis to the remaining Western states by assuming that the ratio of dollars spent to impact will be proportionately equal in the other states. Their measure of impact on the economy is employment changes. (Greenwood, Hunt, and Pfalzgraff, 1987)

The study was prompted by a large increase in federal space related spending over the period 1981 - 1986, and by the disproportionate distribution of those expenditures in the West (four times as high as non-West states on a per capita basis). Direct effects are defined to be the employment of military and civilian personnel in federal government space activities and employment supported by prime contract awards. Indirect effects are defined, by the authors, as the employment generated as a result of subcontracting and purchasing activities. Lastly, induced effects are the employment arising from consumer expenditure of salaries and wages earned in prime contract production. The indirect and induced effects are determined through an employment multiplier. The multiplier estimates that 87 additional indirect and induced jobs are created for each 100 direct jobs in government facilities. The simulation model results allow the researchers to conclude that between 2.2 and 2.8% of Colorado employment results from space activities. (Greenwood, Hunt, and Pfalzgraff, 1987)

In 1975, Roger Bezdek used the Center for Advanced Computation policy simulation model to estimate the effects of possible changes to 1980 projected DoD expenditures. His first step was to estimate the total federal budget for 1980, and the DoD portion of that budget. At this point he runs two simulations. In both cases the total federal budget is held constant at the original forecast level. In the first simulation, Bezdek makes a 30% decrease in defense expenditures which is offset by an equivalent dollar increase to other areas of the budget. The second simulation reflects a 30% increase in defense expenditures compensated by a similar decrease in other spending. (Bezdek, 1975)

Bezdek uses changes in employment as the measure of the effect of the proposed changes in defense spending. The results indicate that the simulated reduction in defense spending would increase national employment by more than 2%, and the increase in defense expenditure would reduce national employment by approximately 1.3%. Bezdek postulates that this is because defense spending is concentrated in capital intensive industry, whereas the compensating domestic spending would be effected through more labor intensive activities. (Bezdek, 1975, p.190) Additionally, the employment fluctuations would affect states, industries, and occupational groups to varying degrees. For example, the simulated defense spending decrease would increase employment in eight regions and decrease it in six. A simulated increase in defense spending, would decrease employment in eleven regions while raising it in only three. (Bezdek, 1975)

Henry and Oliver employ the Bureau of Economic Analysis 537-sector input-output matrix to estimate the effect of the interindustry transactions necessary to supply the 1977 - 1985 military buildup. Again the effects of defense expenditures are simulated on employment. Henry and Oliver concentrate their analysis on the industries that benefitted from the expenditures. This defense buildup occurred in a period of relatively low capacity utilization and high unemployment. (Henry and Oliver, 1987)

Henry and Oliver describe the impact on employment:

> All defense-generated jobs were estimated to have increased only slightly from 1977 to 1980 and then to have grown substantially from 1980 to 1985. Defense-related employment moved counter-cyclically during the recessions of the early 1980's. However, with defense

representing only 5 to 6 percent of GNP in that period, defense-related employment increases were not sufficient to offset job losses from declining demand in other sectors.

> The defense share of all jobs dropped from 5.5 percent in 1977 to 5.3 percent in 1980, and then increased to 6.0 percent in 1985. The net increase in total jobs in the private sector was 5.8 million over the 1980-85 period, with defense-related jobs accounting for 17 percent of the increase. (Henry and Oliver, 1987, p.8)

An important point brought out by this study is the increasing dependence of several industries upon defense demand. As described earlier, this was a period of low capacity utilization and of forty-five industries which produced greater than 10% of their output for defense, twenty-nine experienced a decline in total output between 1980 and 1985. As a result many of these industries became increasingly dependent upon defense: aerospace (66% defense in 1985, 43% in 1977), explosives (65% from 36%), machine tools (34% from 3%), and industrial trucks (22% from 2%) (Henry and Oliver, 1987, pp.4-7)

Chapter III will expand upon the discussion held here. Further, we will describe the specific earlier research efforts which prompted this study. Finally, in Chapter III we will describe the models estimated in this research.

III. MODEL DEVELOPMENT

A. INTRODUCTION

The literature reviewed in Chapter II demonstrates clearly how model specification can affect empirical results. The varied regression results and conclusions are a direct result of different specifications of dependent and independent variables. Understanding this, one must be cautious in developing regression models. Care must be taken in both dependent variable selection and functional form. Equal diligence must be applied to the choice and form of explanatory variables.

The choice of variables and functional form must not only reflect the hypothesized real world relationship being investigated, but also must take into consideration the technical requirements of multiple regression. The use of multiple regression methodology requires that the following assumptions hold:

1) the model is represented by the form:
   $Y_c = b_1 + b_2X_2 + b_3X_3 + \ldots b_nX_n + e_1$

2) no exact linear relationship exists amongst any two or more of the independent variables;

3) the error term:
   a) is normally distributed,
   b) has a mean of zero, constant variance, and
   c) the errors associated with different observations are uncorrelated. (Pindyck and Rubinfeld, 1976, p.55)

Keeping these considerations in mind is not an easy thing to do. Moreover, results can often be biased towards the focus of the research. Consequently, progress in understanding the regional growth phenomenon is slow. The studies build upon one another, with each new effort contributing additional understanding. With these fundamentals in mind, we begin the development of the models estimated later in this thesis.

B. THEORETICAL FOUNDATION

Early researchers uncovered little evidence that state fiscal policies significantly affect economic growth or business location choices. (Due, 1961) However, more recent analyses have begun to unearth the empirical nature of the long-suspected theoretical relationship between taxes and state growth. This development has been the result of improving model construction. The work of Helms, discussed in Chapter II, provides the foundation for the models in this thesis.

Prior to Helms, few economic growth models had observed a significant relationship between taxes and growth. This occurred despite the intuitive appeal that conceptually, higher taxes must retard growth. Helms major contribution was to relate tax burden to the types of spending it supports. By specifically identifying where money is expended, Helms was able to demonstrate that taxes used to fund transfer payments slows growth. However, when state and local government revenues are employed to finance enhanced public services such as health, education, and highways they provide a favorable impact on growth that may more than offset the negative effects of the tax. (Helms, 1985, pp.574-75)

Helms uses a combined state and local government financing constraint, which accounts for both sources and uses of funds. Consequently, his explanatory variables include total state and local government revenues and expenditures. The revenues consist of property taxes, other taxes, user fees, intergovernmental transfers from federal sources, and deficit financing when necessary. The expenditures include: health, highways, local schools, higher education, and others. (Helms, 1985)

This state and local government budget constraint serves as the basic framework upon which this effort builds. Our primary interest is the effect of federal and DoD spending policies. Therefore, these spending patterns will be reflected in our model as well. To omit state fiscal policy, however, would have the effect of improperly specifying the model. Therefore, we will incorporate Helms' constraints into our model. In the next section we will examine earlier research on the effects of DoD spending.

C. IMPACT OF DEPARTMENT OF DEFENSE SPENDING

Lt. Craig James, in a 1987 Naval Postgraduate School Masters Thesis, performed an explicit analysis of DoD spending on state economic growth (James, 1987). This thesis served as a starting point for a 1988 paper by Loren Solnick and Stephen Mehay (Solnick and Mehay, 1988). These two papers, combined with the aforementioned work of Helms, serve as the basis for the models developed and specified in this work. Before outlining the model to be estimated in this paper, we will briefly review the two works cited above.

James estimates two empirical models. The first, which James calls the Volume Growth Model, has as its dependent variable state total personal income. The second, called the Welfare Growth model, uses state per capita personal income as its dependent variable. Having incorporated various categories of DoD spending, James concludes: "results from the linear regression models ... showed that all types of defense contracts had a significant positive influence on economic growth as measured by ... total personal income." (James, 1987, p.84) He also commented that DoD spending for civilian pay had a significant negative impact and spending for military pay had no significant impact on total personal income (James, 1987, p.84). The results for his Welfare growth Model were less dramatic; only DoD spending for procurement and for research and development contracts had a significant impact.

We will now examine the structure of his models more closely. The explanatory variables are grouped into three broad categories: defense expenditures, state expenditures and taxation, and business climate measures. (James, 1987)

Defense expenditures are disaggregated into six individual independent variables. First payroll spending is measured as military pay and civilian pay. Defense contracting effort produces the remaining four defense spending variables. They are: procurement contracts, research and development contracts, service contracts, and construction contracts. (James, 1987, pp.56-57)

State expenditures and taxation are reported in four additional explanatory variables. State expenditures on infrastructure are combined into one variable labeled "state health, hospitals, education, and highways." State transfer payments are incorporated as "state welfare". Tax structure is described in the James model with proxies for both the personal and corporate income tax rate. (James, 1987, pp.59-60)

Finally, James uses three variables in an attempt to capture a state's business climate. The first of these is population density, which is included to measure the potential strength of market demand. The cost of labor is approximated by the inclusion of the average manufacturing wage. Lastly, to identify those states tied to the declining Manufacturing Belt, James uses manufacturing employment in the model. In addition, he makes use of state and time dummies to factor out effects that are constant from year-to-year in an individual state, and those that are common across states in a particular year. The explanatory variables differ between the two models by the fact that in the Welfare Growth Model, the DoD spending and State government spending variables are converted to a per capita basis to parallel the dependent variable. (James, 1987)

The model estimates reveal that the use of the time and state dummy variables substantially improved the estimates. In addition, James found the following variables to be significant in the Volume Growth model: population density, and state expenditures on both infrastructure and welfare. Surprisingly, and contrary to Helms' conclusion, state welfare expenditures have a positive impact on total personal income. Population density and state infrastructure spending also have positive impacts. The coefficients of the two tax variables have the expected negative signs and come very close to statistical significance. (James, 1987)

In James' Welfare Growth Model, state expenditures for both infrastructure and welfare no longer achieve statistical significance. Of note is the fact that under this specification the infrastructure coefficient becomes negative. This is contrary to its intuitive sign and contrary to Helms' result for this variable. The coefficient of welfare expenditures remains surprisingly positive. In this model, the tax rate variables both have the anticipated negative sign and are now significant. The remaining three explanatory variables, manufacturing employment, population density, and manufacturing wage all have significant positive effects. The signs of coefficients of the employment and wage variables are the opposite of that expected. (James, 1987)

Solnick and Mehay's analysis begins with the James effort and takes that paper several additional steps. Their estimation also draws heavily upon the work of Helms. Two models are developed. Additionally, Solnick and Mehay perform three separate estimations of each model. (Solnick and Mehay, 1988)

The models measure growth as total personal income. However, they differ in that the variable specification in one case is personal income and in the other it is the log of personal income. (Solnick and Mehay, 1988) Substantially different results are produced by the two forms of the dependent variable.

The three estimation methods used are: ordinary least squares (OLS), fixed effects, and random effects. The OLS model is the simplest of the three methods. Under OLS no controls are placed in the model for effects which may be common from year-to-year within a given state, or effects which may be common from state-to-state within a given year. The fixed effects method controls for these effects by the use of time and state dummy variables. Finally, the random effects method "...treats the state and time effects as random variables." (Solnick and Mehay, 1988, p.13)

For independent variables Solnick and Mehay adopt, following McLure, a model specification that includes a one-period lag of personal income. This is done to reflect the time-series nature of the model. Further, it incorporates McLure's fundamental theory that total output in time period t is partially determined by factors that are immobile in the short term. These factors are represented by a portion of the total output in period t-1, and are expressed in the model as a lag term. (Solnick and Mehay, 1988; McLure, 1970) This specification is also employed by Helms.

Solnick and Mehay use four general classes of explanatory variables: state government expenditures, state tax rates, other state characteristics, and DoD expenditures. The specification of the state budget constraint used by Helms is not explicitly established. Solnick and Mehay utilize the data set employed in the James' models. Specifically: state welfare spending, state infrastructure spending, corporate income taxes, personal income taxes, population density, and manufacturing wage are precisely the same as the James' specification, although manufacturing employment is not included. In addition, variables are included to account for DoD expenditures.

The six DoD spending variables presented by James are aggregated to form two new variables by Solnick and Mehay. Military pay, civilian pay, and services contracts are combined to form the new explanatory variable, DoD expenses. This variable represents the portion of DoD spending which is typically expended in the same fiscal year as it is available for obligation. Likewise procurement contracts, research and development contracts, and construction contracts are aggregated to form the new variable, DoD investment. This variable specification describes the portion of DoD spending which typically is paid out over a series of up to seven years after its availability for obligation. (James, 1987; Solnick and Mehay, 1988)

The estimation results, not surprisingly, vary as a function of both the dependent variable specification and the regression technique employed. However, the authors utilize an F-test to determine if the state and time dummy variables (fixed effects specification) are warranted. The test results indicate that the fixed effects estimation is statistically superior to the OLS estimation. A similar test is not possible with the random effects estimation. (Solnick and Mehay, 1988, pp.14-15)

With the log personal income model, the one-period lag personal income variable is clearly the dominant variable, and is highly significant in all three estimations. Under the OLS specification, only corporate tax rates and manufacturing wages achieve significance and have the expected negative coefficients. With the statistically superior fixed effects estimation, population density and state infrastructure expenditures also achieve significance. While the population density coefficient is positive as expected, the infrastructure coefficient is surprisingly negative. Finally, with the random effects estimation only manufacturing wage and corporate tax rates achieve significance. The coefficients of both variables are negative. (Solnick and Mehay, 1988, p.15)

In the personal income model, the lagged personal income variable again dominates the estimation and is highly significant in each specification. Solnick and Mehay find this model preferable to the log personal income model. Under the OLS estimation manufacturing wage, state infrastructure spending, DoD investment, and DoD expenditure all achieve statistical significance. In addition, the coefficients have the anticipated signs. For both DoD spending variables a positive relationship was expected. With the fixed effects specification both DoD variables, population density, and manufacturing wage are all significant with the expected signs. However, under this specification state welfare expenditures have unanticipated significant positive effects. Lastly, in the random effects estimation DoD expenditures, state infrastructure spending, and manufacturing wage are all significant with the expected signs. State welfare spending again has significant positive effects on the growth variable. (Solnick and Mehay, 1988, p.15)

D. ANALYSIS

This section will provide an analysis of the models that have included DoD spending data. This analysis culminates with the presentation of the generalized models estimated in this research.

James' two models, Volume and Welfare Growth, break significant new ground in the realm of economic growth research. This is accomplished by the incorporation of specific measures of DoD spending into a multiple regression model of state growth. As discussed above, James identifies significant effects of several of his DoD spending variables.

In the analysis of time-series data, however, James fails to include the single-period lag of the dependent variable as an explanatory variable. This omission leads to several problems in the model estimation. First, without the lagged variable, the coefficients of the other included variables are biased, and both the effects and significance of those variables is probably overstated. Second, because the time-series effect is not effectively backed out of the estimation, this contributes to serial correlation amongst the error terms. This effect is reflected in the Durbin-Watson statistics provided by the author.

A separate problem in James' Volume Growth model is high levels of correlation amongst the independent variables. Particularly, the DoD expenditure variables are highly correlated. This violates one of the assumptions of the multiple regression method, distorts the standard errors of the estimated coefficients, and makes conclusions based on that model somewhat questionable. Correlation amongst the variables in the Welfare Growth model is substantially less severe. This is especially true for the DoD expenditure variables.

The inclusion of the single-period lag of personal income in Solnick and Mehay's specifications corrects two of the problems in James' models. First, the distortion of the coefficients and significance of the other explanatory variables is reduced. This is demonstrated by the dramatic reduction in the values of the coefficients and their associated t-statistics. This statement is based on the comparison of James' Volume Growth model to Solnick and Mehay's personal income-OLS specification.

Second, the inclusion of the lagged personal income variable substantially reduces the problem of serial correlation amongst the error terms. This reduction is reflected in their computation of Durbin-Watson H-statistics.

It may be assumed that Solnick and Mehay substantially reduce the problem of correlation amongst the DoD spending explanatory variables. This is accomplished by reducing the number of DoD variables from six to two. This assumed reduction of correlation amongst independent variables makes the total personal income model more acceptable. However, there remains significant correlation among the other independent variables in that model.

The variables state welfare and state infrastructure expenditures do not capture the full effect of these activities in a given state. This is because, as specified, these variables do not capture spending for these functions by local governments within a state. In addition, these state spending variables are bothersome for other reasons. The coefficient of welfare spending is always positive, contrary to expectations. And the coefficient of infrastructure spending changes from negative in the log personal income model to positive in the personal income model.

E. GENERALIZED MODEL

Three basic growth models are estimated in this thesis. Several variations of each basic model are estimated. The work builds upon the efforts cited above and draws heavily upon the contributions of all three. We employ the most frequently used proxy for economic growth, personal income, for our dependent variable.

Therefore, personal income serves as the basic measure of economic growth in all of the models discussed below.

The three models will be estimated first using personal income as the dependent variable. Then the same models will be estimated using the log of personal income as the dependent variable.

Our first model attempts to replicate the work of Helms. The two specifications of this model, personal income and log personal income, will validate the use of Helms' budget constraint on a data base describing a later time period. One difference is that we ignore the unionization measures employed by Helms. (Helms, 1985, p.578)

Second, we add measures of DoD spending to the models described above. Two categories of defense spending are introduced into the basic model of state economic growth. First, we add spending by the Defense Department on investment type items, such as ships, aircraft, and research and development. Secondly, we include, as an explanatory variable, a measure of spending on expense type items. Expenses include both military and civilian salaries as well as expenditures for services contracts.

Finally, our third set of models adds other Federal Government spending which is not included in either the DoD variables or the intergovernmental transfers portion of Helms' budget constraint.

Each of the three models is specified with both personal income and the log of personal income as the dependent variable, thereby producing a total of six model specifications. Further, each of the six specifications is estimated by three statistical models, producing a total of eighteen regression equations.

The variable specifications and regression methodologies are presented in Chapter IV. The model estimation results are presented in Chapter V.

IV. RESEARCH METHODOLOGIES, VARIABLES, AND DATA SOURCES

A. INTRODUCTION

This chapter presents an outline of our research methodology. Detailed descriptions of the variable specifications and a discussion of the hypotheses prompting the inclusion of each variable are also provided. Additionally, data sources are presented to aid future researchers.

B. RESEARCH METHODOLOGY

Given the prior research, discussed at length in the previous chapters, we assume that we can construct a model of state economic growth which will permit evaluation of the effects of DoD and federal spending on the states. Our work is prompted by the a priori hypothesis that DoD and federal spending have significant effects on state economic growth. Consequently, our research is in the deductive mode, attempting to prove an existent theory (Buckley, Buckley, and Chiang, 1976, pp.15-25).

As the data needed to test our hypothesis are available in published form, we are employing an archival strategy in data collection. The data employed in this thesis are published in derived form by various U. S. Governmental Agencies. Therefore, necessary information is collected by library research of the appropriate publications and data series.

Analysis of data is accomplished by the use multivariate statistical techniques. The use of a ten-year sample from each of the forty-eight contiguous states enables us to make use of pooled cross-section and time-series regression procedures, thereby achieving a significantly more powerful model than available through either time-series or cross-sectional analysis alone.

Regression analysis is a mathematical technique designed to identify the best-fitting line, describing the relationship between one or more independent variables and a dependent variable. The best-fitting line is defined as the one which provides the minimum sum of the squares of the deviations of the actual observed values of the dependent variable from the predicted values. (Mendenhall and Reinmuth, 1974, p.329) Because of the very complex relationships involved within a state's economy, multiple explanatory variables are required for our models of economic growth.

Pooling is a technique which facilitates the aggregation of time-series (multiple period) and cross-section (multiple subject) data to permit the estimation of a single regression equation (Pindyck and Rubinfeld, 1976, p.202).

In our research, the time period 1976-1985 serves as the time-series base, and the forty-eight individual states serve as the cross-section base.

Three regression equations are estimated for each model: ordinary least squares (OLS), fixed effects or covariance, and Parks' cross-sectionally correlated and time-wise autoregressive.

C. VARIABLE SPECIFICATION

The paragraphs that follow discuss the specification of the estimating models. The models discussed, generally, in Chapter III have been designed to permit the evaluation of the effects of DoD and Federal Government spending upon state economic growth. We have been careful to frame this evaluation on a sound theoretical basis. Helms' model which effectively controls for the impacts of state and local government fiscal policies serves as this base. (Helms, 1985) Further, variables are included to account for a state's business climate. To this structural framework, we add DoD and federal spending variables.

All variables, dependent and independent, that are enumerated in dollars have been converted to constant year (1982) dollars.

1. **Dependent Variable**

Personal Income serves as our proxy for economic growth. This is the approach taken by the majority of the prior studies reviewed in Chapter II. We consider personal income superior to total employment, the other commonly used proxy, as a measure of economic growth. We reach this conclusion because changes in total employment do not reflect shifts from higher paid industrial and manufacturing jobs to lower paid services jobs.

Personal income (PERINC) is derived from the sum of salaries, wages, and other labor and proprietor income. From this subtotal, personal contributions for social security are deducted, and to it dividends, interest, rent, and transfer payments are added (James, 1987, p.56).

Our models employ, first personal income and then the log of personal income (LPERINC) as dependent variables.

2. **Single-Period Lag of Dependent Variable**

A fundamental characteristic of time-series data is that the value a variable takes on in any period is determined to a large extent by the value held by the variable in the prior period. To reflect this fact, we choose to include the single-period lag of the dependent variable as an explanatory variable.

Based on prior applications of this variable, we anticipate LAGPI will have coefficients close to unity and be highly positively significant.

In our log personal income models, we employ the log of the single-period lag of personal income, LLAGPI.

3. Budget Constraint Variables

The state and local government budget constraint employed by Helms is adopted here. The constraint is constructed so that the analyst can distinguish between the effects of governmental revenues used to finance transfer payments and the effects of governmental spending on desired public goods and services. (Helms, 1985) We support Helms contention that the effects of taxes cannot be evaluated in isolation, but rather one must consider both the sources and uses of governmental revenues. (Helms, 1985, p.581)

Our state budget constraint incorporates both revenues and non-transfer type expenditures. In the models we have estimated, revenues are comprised of the sum of intergovernmental aid from federal sources, property taxes, other taxes, user fees, and deficit (surplus) financing. Expenditures are comprised of spending for health and hospitals, highways, local schools, higher education, and other non-transfer spending.

When the sum of revenues (including deficit financing) exceeds the sum of expenditures, the excess represents outlays on transfer payments. Consequently, because increases in the revenue variables represent increases in transfer payments (when not accompanied by increases in the explicit expenditure variables) we anticipate the coefficients of the revenue variables to be negative in sign. (Helms, 1985, p.578)

The revenue variables are represented in our results and discussion by the following symbols:

	SYMBOL	VARIABLE REPRESENTED
1)	BCPRPTAX	property tax revenues
2)	BCOTHTAX	other taxes
3)	BCUSRFEE	user fees
4)	BCINTGOV	intergovernmental aid from federal sources
5)	BCDEFICT	budget deficit, calculated as total expenditures less total revenues

State and local government expenditures which benefit workers and firms by improving a state's infrastructure, educational system, or quality of life should foster economic development (Helms, 1985, p.578). These investments tend to draw both labor and capital to the state. Labor is attracted to personal benefits such as educational programs for family members. Capital should be attracted to locate near markets, transportation, and labor. These positive expenditures are represented in our models with the variables local schools, higher education, highways, health and hospitals, and other non-transfer expenditures. Given our expectations for their role in economic growth, we anticipate the coefficients of these variables to be positive in sign.

Expenditures are represented in our models by the following symbols:

	SYMBOL	VARIABLE REPRESENTED
1)	BCHLHOSX	expenditures for health and hospitals
2)	BCHWYEX	expenditures for highway construction and maintenance
3)	BCLOCEDX	expenditures for local schools
4)	BCHIEDEX	expenditures for higher education
5)	BCOTHEX	other non-transfer expenditures

All variables in the budget constraint are expressed as a percentage of state personal income.

4. Business Climate Variables

A state's business climate is represented by three variables. First, we estimate the average cost of labor by employing a measure of manufacturing wages. The overall strength of market demand is captured by including population density. In addition, dummy variables have been incorporated some of the models to account for the effects of conditions that do not vary from state-to-state within an individual year and conditions that do not vary from year-to-year within an individual state.

The cost of labor is represented in our results by the symbol BCMFGWGE. The variable is constructed to reflect the relative cost of labor in a state in a particular year. This is done by expressing the manufacturing wage as a percentage of the average U. S. manufacturing wage for the year under examination. (Helms, 1985, p.578) Because higher wage states imply higher costs of operations for businesses, we expect higher wage rates will be associated with slower economic growth. Therefore, the coefficient of BCMFGWGE should carry a negative sign in our estimation results.

Population density is included in our estimation results as POPDEN. This is calculated as state population divided by total land area. Population density serves as our measure for the strength of market demand. Unfortunately, population density is at best a weak proxy for demand. This is so because large markets in adjacent states are not reflected by this variable. We anticipate the coefficient of POPDEN to be weakly positive. Were a better proxy for market demand available, we would anticipate a strongly positive relationship with economic growth.

The state and time dummy variables can be expected to reflect consistent differences amongst the states and years. For example, we anticipate the year dummies to mirror the effects of the national economic cycle. The state dummies should reflect persistent state-specific characteristics not otherwise represented in the model. One of these state-specific characteristics not included is the role of labor unions.

The effect of the relative strength of unions in each state is desired as a measure of business climate. Unfortunately, data on state unionization rates for the period studied by our model are not available. Originally collected and published by the U. S. Bureau of Labor Statistics, unionization rates by state ceased to be collected and published after 1980. These union membership statistics change very slowly over time, therefore we expect much of this impact will be reflected in the coefficients of the state dummy variables.

5. DoD and Federal Government Expenditure Variables

Three variables are included to permit evaluation of the DoD and Federal Government spending on state economic growth. From DoD, we include both investment and expense type spending measures. Federal spending as reflected in our models consists of non-defense, non-intergovernmental aid to state and local governments.

DODINV is the symbol assigned to defense investment spending. This explanatory variable is the sum of procurement contracts, construction contracts, and research and development contracts. (Solnick and Mehay, 1988, p.12) The total contract dollar value is assigned to the state in which the prime contractor is located. This procedure ignores subcontracting effects. In many large defense contracts subcontracting actions are executed in states other than the home of the prime contractor. Unfortunately, no data are available on the flow of subcontract dollars.

Distinctive of the nature of investment spending is the expenditure pattern that occurs. Once a contract is awarded, payment occurs unevenly over the life of the contract. Contracts such as shipbuilding contracts may cause payout periods as long as seven years. Consequently, a large portion of the effect of defense investment spending occurs several periods after the award of the contract. This effect is not accounted for by the explanatory variable: DODINV.

Investment spending produces direct, indirect, and induced effects upon the economy in which it is effected. These effects were described above in our Chapter II review of the work of Greenwood, Hunt, and Pfalzgraff. The authors describe the multiplier effects produced as individuals spend salaries earned from space contracts, and the subcontracting and purchasing functions of contracts for space activity itself. (Greenwood, Hunt, and Pfalzgraff, 1987, p.38) We assume that similar effects will be observable from DODINV spending. This assumption is based on knowledge that subcontracting and purchasing actions which accompany space-related contracts also accompanies DoD investment spending. Consequently, we anticipate that DODINV will be associated with high economic growth. The coefficient of DODINV is anticipated to be statistically significant and carry a positive sign.

Expense spending is a measure of the cost of operations for the Defense Department. DODEXP includes therefore: payments made by DoD for the salaries and benefits of both civilian and military personnel and contracts for services. These expenditures differ from DODINV in that: (1) expenditure typically takes place in the same fiscal year as funds are authorized for obligation, and (2) in the case of services contracts the effects of subcontracting are minimal.

Expense spending does not exhibit the generative behavior of investment spending. The indirect and induced effects upon the economy are not as great as in investment spending. The majority of these funds are used for wages and benefits of employees who might otherwise be employed in some other job. Hence, the payroll portion of DODEXP is not reflective of increased economic activity. Also the services contracts do not generate the same level of subcontracting activity experienced in investment spending. These contracts are typically for activities such as: base custodial and maintenance services, warehouse operations, and transportation.

Because DODEXP is typically expended in a short period of time, the immediate effects of DODEXP may be greater than those of DODINV. This instantaneous effect, however may not be measurable in our models which evaluate year-to-year changes in the dependent variable. We, therefore, expect the variable DODEXP to be positively associated with economic growth, though not as strongly as DODINV.

Other federal spending, NETFED in our models, is a collection of miscellaneous expenditures. Greater than fifty percent of these expenditures represent transfer payments to individuals. This variable is calculated by taking total federal expenditures in the states and subtracting from it both defense expenditures and intergovernmental aid to state and local governments.

Because NETFED consists of a large portion of transfer payments, we expect that it will be partially associated with slower economic growth. However, we do not anticipate its effect to be clearly negative. This is a result of the fact that there are multiple types of spending involved. The various spending activities may have counteracting effects. Consequently, we expect NETFED to carry a negative sign, but it is not expected to be statistically significant.

DODINV, DODEXP, and NETFED, like the budget constraint variables, are expressed as a percentage of personal income.

D. DATA SOURCES

Sources for the raw data used in the estimating process are provided below.

1. Deflators

Constant 1982 dollars are used for all the dollar denominated variables in the estimating equations. Deflators are drawn from the U. S. Bureau of the Census, Statistical Abstract of the United States. Personal income and manufacturing wages are deflated/inflated using the GNP deflator. The state budget constraint variables are converted to constant dollars using the State and Local Government Purchases deflator. DoD expenditures, both DODINV and DODEXP, are converted using the Defense purchases deflator. Finally, other non-defense, non-intergovernmental aid federal expenditures are deflated/inflated using the deflator for federal non-defense purchases.

2. Dependent Variable

The dependent variable, personal income, is drawn from the U. S. Bureau of Economic Analysis, State Personal Income - Survey of Current Business.

3. Budget Constraint Variables

The ten variables comprising the state and local budget constraint are collected from the U. S. Bureau of the Census, Government Finances series.

4. Business Climate Variables

Manufacturing wages, population, state land area are drawn from the U. S. Bureau of the Census, Statistical Abstract of the United States.

5. Defense and Federal Government Spending Variables

Data for Defense expenditures for 1976 are drawn from the Community Services Administration, Federal Outlays in Summary. For 1977 through 1980 the series was retitled, Geographical Distribution of Federal Funds in Summary. The data are drawn form the Directorate for Information Operations and Reports, DoD Atlas/State Data Abstract for the United States for fiscal years 1982 through 1985.

Defense expenditure data for 1981 are pieced together from several sources. Payroll data are drawn from the U. S. Bureau of the Census, **Statistical Abstract of the United States.** Research and Development contract awards are drawn from the Directorate for Information Operations and Reports, DoD Prime Contract Awards by Regions and State. Due to breaks in data publication, both procurement and construction contracts for 1981 are unavailable. As a result, these series were estimated by a weighted average mechanism (James, 1987, pp.58-59).

Federal expenditures other than defense and intergovernmental aid are extracted from several sources. For 1976, the series is reported by the Community Services Administration, Federal Outlays in Summary. For 1977 through 1980 the data are published by the Community Services Administration in the publication: Geographic Distribution of Federal Funds in Summary. This series ceased publication with the 1981 issue. Data for 1981 through 1985 are drawn from the U. S. Bureau of the Census, Federal Expenditures by State series.

V. ESTIMATION RESULTS AND ANALYSIS

This thesis presents solid statistically significant evidence that DoD investment spending is positively associated with state economic growth. Less significant evidence is presented that DoD expense spending is associated with economic growth. Inconclusive results are obtained with other federal non-defense, non-intergovernmental aid spending.

We present, first, the results of our model specifications employing personal income as the dependent variable. This is followed by our estimation results for the log personal income models. We provide descriptive statistics for all variables. Analysis of correlational matrices of the variables is also included. We follow these preliminaries with the parameter estimates of the models. The chapter concludes with a discussion of problems encountered in model development.

A. PERSONAL INCOME MODELS

1. Descriptive Statistics and Correlation Analysis

Table 1 presents descriptive statistics for each of the variables included in the personal income models. All Tables and Exhibits are presented in the Appendices at the end of the text. The mean, standard deviation, minimum, and maximum are presented for each variable. A cursory review of the data reveals that the variables have been scaled to similar magnitudes. In addition, LAGPI represents the largest portion of PERINC; this is reflected by the similarity of means and standard deviations.

Some concern is generated by the size of the standard deviation of the dependent variable relative to its mean. The large standard deviation creates a skewed distribution of the variable.

> Tests of significance and statistical inference for regression models are based on the assumption that the values of the dependent variable are normally distributed. When this condition is not met, it is usually reflected in the error terms. Since the normal distribution is symmetric, it is important that the Y's are approximately symmetrical. (Liao, 1987, p.4-3)

Exhibit 1 shows a plot of the distribution of the dependent variable, PERINC. Because of the skewed nature of this variable, statistical inference from these models will be difficult.

Table 2 presents the correlation matrix of simple correlation coefficients for each pair of variables included in our models. Interpretation of simple correlation coefficients can be misleading when multivariate analysis is to be performed. This is because when multiple factors are at work the simple correlation coefficient cannot control for the effects of the other variables. Consequently, a variable may have a negative simple correlation coefficient and a positive partial regression coefficient or vice versa.

However, it is apparent from Table 2 that multicollinearity will not be a problem in our models. Multicollinearity is the condition where two or more independent variables are highly correlated with each other (Pindyck and Rubinfeld, 1976, p.67). A general rule of thumb is that multicollinearity should be suspected when the simple correlation coefficients of any two or more variables exceed .70 (Liao, 1987, p.3-18). In our model, the largest simple correlation coefficient is .668 between BCLOCEDX and BCINTGOV. In addition, only two other variable combinations exceed .60.

Multicollinearity has been removed as a result of expressing the governmental spending variables as a percent of personal income. Without this variable conversion, numerous simple correlation coefficients exceed the threshold level of .70. This reduction of multicollinearity does not come without a price. The conversion of the variables significantly reduces each of the independent variables' simple correlation coefficient with the dependent variable.

2. Regression Model Estimation Results

Estimation results are discussed below, sequenced in the order of model presentation in Chapter III. First, we present our replication of the work of Helms; this is followed by the addition of DoD spending variables, and then other federal spending variable.

What is clear from the discussion that follows is the consistency of parameter estimates across the differing model specifications. This differs from previous research efforts surveyed in Chapter II.

a. Helms' Basic Model

Tables 3 through 5 present the results of three separate estimations of Helms' model. The first estimation is performed using the Ordinary Least Squares technique. This procedure does not control for state or time effects. Second, the parameters are estimated using the Covariance or Fixed Effects technique. Dummy variables are employed in this model specification to account for fixed time and state effects. Finally, the model parameters are estimated using Parks' cross-sectionally correlated and time-wise autoregressive method. This procedure assumes that because of arbitrarily drawn boundaries (such as the borders of states) the cross-sections are not completely independent and therefore, makes adjustments in the treatment of error terms to compensate (Kmenta, 1971, p.512). The results of the three estimating methods are remarkably similar.

A statistical test (F-test) to determine superiority of the OLS and Covariance models has been performed. The test attempts to measure if the reduction in the sum of squares for error achieved by the introduction of the dummy variables is large enough to compensate for the resultant loss in degrees of freedom (Pindyck and Rubinfeld, 1976, p.205). The test results, calculated F value equal to 5.068 versus critical value of 1.453, indicate that the Covariance model is statistically superior. A similar test is not possible for the Parks' model.

Not surprisingly, LAGPI dominates the model in each of the specifications. Its t-statistic is never less than 64.2 and is by far the most clearly significant explanatory variable.

Support is provided for Helms' conclusion that tax increases used to fund transfer payments are associated with lower economic growth (Helms, 1985, p.578). Our specification reveals that all the revenue variables have negative coefficients, and this is true across model specifications. More importantly, the coefficients are statistically significant at the 5% level in every case except two. Under the Covariance equation BCOTHTAX and

BCUSRFEE are significant at the 10 and 7% levels respectively.

The positive impact of expenditures upon growth, proposed by Helms, is not as clearly supported by our estimates. While eight of the fifteen expenditure variables, across the three equations, achieve positive statistical significance, three of these are in the statistically inferior OLS model. However, the coefficients of expenditure variables are positive in all cases except one.

BCOTHEX carries a negative, but non-significant, sign in the Covariance equation. BCHWYEX, significant in each estimation, appears to be strongly associated with higher economic growth. BCHIEDEX and BCOTHEX are significant in two of the three equations. The significance of BCHLHOSX and BCLOCEDX are less convincing. BCHLHOSX is significant only in the Parks' equation. BCLOCEDX does not achieve significance in any of our personal income models. This does not agree with Helms' findings. However, further investigation may support the finding of Quan and Beck that the most significant effects of local education expenditures upon growth occur as much as seven to eight years after the initial outlay (Quan and Beck, 1987, p.369).

Our results with measures of business climate do not provide clear evidence of their effects. Amongst our business climate variables, only BCMFGWGE in the OLS equation achieves significance. BCMFGWGE in the OLS, as well as the other equations, carries the anticipated negative sign. POPDEN never achieves significance, and is positive in the OLS equation but negative in the others. This is indicative of the fact that POPDEN is not an ideal measure of the strength of markets. A better measure would be expected to have consistently positive effects on economic growth.

Coefficients were estimated for eight of the time variables and forty-seven of the state variables. Four of the time dummies, representing the years 1979-1982, achieve statistical significance. Each of the significant coefficients is negative. We will assume this reflects the slippage of the overall economy into a recession during this time period. Coincidently, the most significant coefficient is associated with 1982, the trough of the recession.

The state coefficients for the most part are not significant. Only state number four, representing California, is significant at the 5% level. In this case the coefficient is significantly positive. The coefficients for Florida, Louisiana, and New York are positively significant at the nine, ten, and eleven percent levels respectively. A dummy variable coefficient is not estimated for Alabama. The lack of significance of the state dummy variables lends support to the use of Parks' cross-sectionally correlated estimating process, based on its assumptions outlined above.

b. Basic Model with Defense Spending

Tables 6 through 8 present the estimation results when DoD spending variables are introduced into the basic model. The parameter estimates of the variables previously included in the model change only slightly when the DoD spending variables are included. In no case does one of the previously included variables achieve or lose significance, at the 5% level, as a result of the inclusion of the DoD variables. This statement also includes the state and time variables, which likewise exhibit consistent behavior. This would imply that the additional explanatory power of the DoD variables is extracted from the error term rather than the coefficients of the other explanatory variables. It is important to note, however, that the t-statistic of each explanatory variable is reduced slightly from the level achieved when the DoD variables are omitted.

Again, an F-test was performed to compare the OLS and Covariance equations. The calculated F value of

4.995 exceeds the critical value of 1.453. Consequently, the results indicate the Covariance model is statistically superior.

DODINV is positive and significant at the 5% level in both the OLS and Parks' equation. DODINV is also positively significant at the 14% level in the Covariance equation. These results strongly support our contention that direct, indirect, and induced effects of DoD investment type spending do have a positive effect upon state economic growth.

DODEXP does not achieve statistical significance in any of these estimations. However, the coefficient is consistently positive in each of our equations. This also supports our supposition that the nature of these expenditures, payroll and services contracts, does not have a major impact upon the economy external to the Defense Department. This is so because of the reduced level of subcontracting and purchasing activities generated by these expenditures as compared to DODINV.

c. Introduction of Other Federal Spending

The inclusion of other federal spending also produces results consistent with those presented above. Tables 9 through 11 present these results. The addition of an another explanatory variable tends to drive down the significance levels of the other variables. Specifically, the impact is most obvious on the DoD investment spending variable in the Parks' equation, which is no longer significant at the 5% level. DODINV is now significant at only the 9% level under this estimation method.

DODINV remains positively significant at the 5% level under the OLS equation, and at the 12% level under the Covariance method. The coefficients of DODEXP continue to be positive but insignificant in each of the three equations.

The OLS and Covariance models were again tested to determine statistical superiority. In this case, as previously, the Covariance model tested statistically superior. This is reflected by the calculated F value of 5.100 which exceeds the critical value of 1.453. Under the Covariance equation, the time variables representing 1979-1982 are again significant at the 5% level. Only California has a state dummy variable with a coefficient positively significant at the 5% level. Coefficients for Florida, Louisiana, and New York are now positive and significant at the ten, twelve, and thirteen percent levels respectively.

As anticipated, the results for NETFED are mixed. The variable carries a positive coefficient under the OLS equation and negative coefficients under the other two procedures. The coefficients never achieve significance at the 5% level. However, the coefficient in the Covariance equation is negative and significant at the 6% level. It appears from these mixed results, that non-defense federal spending is associated with slower economic growth. We base this conclusion on the significance level achieved under the Covariance equation, the negative coefficient of Parks' equation, and the statistical superiority of the Covariance to the OLS equation, which carries the positive coefficient.

B. LOG PERSONAL INCOME MODELS

The models discussed above have also been estimated using the log of personal income as the dependent variable. This has been done for two reasons. First, to use this specification makes our results more comparable to those of Helms. Second, the dependent variable specified as log personal income exhibits a more symmetrical distribution than does personal income. Exhibit 2 provides a plot of the distribution of the dependent variable, LPERINC. A symmetrical distribution of the dependent variable satisfies the assumptions required of regressions for tests of significance and statistical inference (Liao, 1987, p.4-3).

1. Descriptive Statistics and Correlation Analysis

Table 12 presents descriptive statistics for the variables employed in the log personal income models. The data provided parallels that presented for the personal income models. Only the dependent variable and the form of the one-period lag of the dependent variable change. The lagged variable is also expressed in log form to match that of the dependent variable. Because of these limited changes, the descriptive statistics differ only for two of the variables from the personal income model.

Notable improvement is displayed by the ratio of the standard deviation of the dependent variable to its mean. In the personal income model the standard deviation of PERINC exceeded the mean. In this model, however, the standard deviation of LPERINC is less than one-third its mean.

Table 13 presents the correlation matrix for the model variables. Again, because only the dependent variable and its one-period lag have changed, the correlation matrix is similar to that of the personal income model.

As in the personal income models, multicollinearity will not be a problem in our regression estimations. The largest simple correlation coefficient is -.683 between BCHWYEX and LLAGPI. In addition, only three other variable combinations have simple correlation coefficients exceeding .60.

The dependent variable specification, LPERINC, somewhat reduces the loss of simple correlation between the dependent variable and each of the explanatory variables. This is evidenced by the consistently higher simple correlation coefficients (as measured by absolute value and compared to the personal income matrix) between the dependent variable and the independent variables.

2. Regression Model Estimation Results

The model estimation results presented below parallels the sequence used to present the personal income models. The models presented below do not exhibit the stability across estimation methods of the personal income models. The results of the OLS and Parks estimation procedures tend to be similar. However, the Covariance (fixed effects) model tends to produce substantially different results. Of note, in the Covariance models a greater number of the coefficients of the state dummy variables are statistically significant than in the personal income models.

a. Helms' Basic Model

Tables 14 through 16 present our estimation results for the basic model, using log personal income as the dependent variable. A statistical test was performed on the OLS and Covariance models to determine if it is statistically preferable to include the state and time effects dummy variables. The computed F value of 14.328 greatly exceeds the critical value of 1.453. Therefore, as we observed for the personal income models, the Covariance equation is statistically superior. However, the estimation results of the OLS and Parks methods are intuitively preferable because of their consistency.

The OLS and Parks' equations provide strong support for Helms' conclusion that state revenue increases used to fund transfer payments are associated with slower economic growth. This conclusion is based on the negative and statistically significant coefficients, at the 5% level, of the revenue variables. This significance is observed for all the revenue variables, in both the OLS and Parks' equation. In the Covariance equation, the revenue variables all have negative coefficients, however, only BCINTGOV is significant at the 5% level. In that specification, the remaining revenue variables are significant at no higher than the 18% level.

As in the personal income models, the support for Helms' conclusion that state and local government spending other than for transfer payments is associated with economic growth is less than absolute. In fact the coefficients of the expenditure variables in the Covariance equation all carry unexpected negative signs with the exception of BCHWYEX. Additionally, BCOTHEX is significant at the 11% level with the unexpected negative coefficient. The parameter estimates for the state expenditure variables obtained by the OLS and Parks methods more closely reflect our expectations.

Under OLS and Parks methods, BCHLHOSX, BCHIEDEX, and BCOTHEX are all positive and significant at the 5% level. This duplicates the result of Helms. However, in these estimations, BCHWYEX and BCLOCEDX achieve positive significance at no higher than the 10% level. With LPERINC as the dependent variable, due to inconsistency amongst the estimates, no more than marginal support can be provided for Helms' fundamental conclusions.

Our business climate variables also exhibit inconsistent behavior in this series of model estimations. As above, the parameter estimates of the OLS and Parks methods are similar, while those of the Covariance equation are substantially different.

BCMFGWGE carries a negative coefficient in both the OLS and the Parks' equation. The coefficient is significant at the 7% level for the OLS method, it does not approach significance under Parks' method. However, when using the Covariance/Fixed Effects approach, BCMFGWGE is positively associated with economic growth and significant at the 5% level. The inconsistencies continue when we look at POPDEN. POPDEN, contrary to Helms, is positively associated with economic growth in the Covariance model. In this equation POPDEN is significant at the 5% level. However, matching Helms, the coefficient of POPDEN carries a negative sign and is significant at the 5% level under both the OLS and Parks' equations. This confused result may be the result of the inaccuracy of POPDEN as a measure of the strength of market demand.

In the Covariance equation, coefficients were again estimated for eight time and forty-seven state dummy variables. The results differ markedly from the estimations produced by the non-log personal income models.

Again, four of the dummy variables representing time achieved significance at the 5% level. However, the years represented were: 1978, 1980, 1982, and 1984 vice 1979-1982 as in the personal income model. The coefficients of the recession years, 1979-1982, continue to have negative signs. However, only 1980 and 1982 are significant. 1978, 1984 and to a lessor extent 1983 all carry strongly positive coefficients.

The state dummy variables are substantially more significant under this model specification than when personal income is used as the dependent variable. The explanation for this inconsistency is not clear to us. However, at the 5% level, the dummy variables for thirty-eight of the forty-seven states are significant. Thirteen of these are positive and significant, and twenty-five are negative and significant.

b. Basic Model with Defense Spending

Tables 17 through 19 present the results of our expanding the log personal income model to include the DoD investment and expense variables. The estimation results reported for the Helms' Basic Model tend to repeat themselves when the DoD spending variables are entered into the model. The differences between the OLS/Parks and the Covariance estimation methods persist.

Compared to the models without DoD spending, no variable that is significant at the 5% level under those models loses that significance when the DoD spending measures are included. Additionally, none of the original variables experiences a change in sign in this model specification, as compared to the basic model. The OLS and Covariance models were compared for statistical preferability through the application of an F-test. As before, the test results, a calculated F value of 14.129 versus a critical value of 1.453, indicate the Covariance model is superior, and that the employment of state and time effects dummy variables is warranted.

The behavior of the time dummy variables repeats that experienced in the basic model. The state dummy variable coefficients are also highly significant in this model. Thirty-six of the forty-seven variables representing the states are significant at the 5% level. Of these twenty-six are significantly negative and ten are significantly positive. This result is very similar to that exhibited by the basic model, but again differs radically from the non-log personal income models.

These model specifications do not provide strong evidence of the impacts of Defense spending upon state economic growth. DODINV carries a positive coefficient sign in each of the three estimations. However, it is significant at the 11% level only in the Parks' equation. Although, the coefficients are consistently positive, the statistical insignificance is puzzling given the a priori assumptions of this research.

DODEXP exhibits inconsistent behavior in these models. DODEXP is significant at the 5% level and positively associated with economic growth under the OLS equation. However, DODEXP carries a negative but insignificant coefficient under both the Covariance and

Parks' equation. These mixed parameter estimation results are not surprising for DODEXP, given the theorized lack of indirect and induced effects of this spending.

c. Inclusion of Other Federal Spending

The inclusion of NETFED into our log personal income model produces results consistent with those of the DoD models. Tables 20 through 22 present these regression estimation results. While the results are generally consistent amongst the three estimation techniques compared to the DoD models, several variables either lose significance at the 5% level or change coefficient signs.

An F-test determined the Covariance equation to be statistically superior to the OLS equation. The computed F value is 14.161 and the critical value is 1.453. This test tells us that the use of state and time effects variables is warranted.

In the OLS equation, the coefficient of BCLOCEDX changes from positive and non-significant in the DoD model to negative and non-significant. Again, under the OLS equation POPDEN loses significance at the 5% level, but remains negative and significant at the 7% level. BCMFGWGE now carries a negative non-significant coefficient vice positive and non-significant.

The behavior of the coefficients of the state and time effects variables parallels that already described for the basic and DoD models. The time effects dummy coefficients exactly mimic that of the DoD and Basic models. Thirty-seven of the forty-seven state effects dummy coefficients are significant. Twenty-six of these are negative and the remaining eleven are positive.

The effects of DODEXP become even less clear. Previously significant at the 5% level, DODEXP is now significant at the 7% level under the OLS equation. Its coefficients do not appreciably change under the other two estimating procedures. DODINV is also disappointing, exhibiting positive significance in the Parks equation, however it is significant at only the 23% level.

NETFED, in this model, exhibits inconsistent behavior. Positive and significant under OLS, NETFED is negative and significant in the Covarianc equation. NETFED carries a positive but insignificant coefficient in Parks' equation. This replicates the mixed impacts measured by the personal income model. These results support our a priori assumption that the effects of this spending measure will not be statistically significant.

C. MODEL DEVELOPMENT PROBLEMS

The models developed and discussed in this thesis suffer from two specific deficiencies. The existence of deficiencies is a problem in the vast majority of multiple regression models. Discussed below are the problems encountered in the development and evaluation of the thesis models. The problems are discussed here to provide future researchers insights into problems that may be anticipated in furthering our understanding of the economic growth phenomenon. We discuss first data availability, followed by regression mechanics.

1. Data Series Availability

Several data series used or desired for these models were either incomplete or unavailable. These problems are the result of changing priorities at U. S. Governmental Agencies on what data are necessary and desirable for collection and/or publication, and in what format.

First, our results with the variable NETFED are inconclusive. We believe this results from the aggregation of several distinctly different types of spending into one variable. NETFED consists of at least: transfer payments to individuals; salaries paid to governmental employees; and contracts for investment items, expense items, and services. This aggregation was necessary, because the data series available do not segregate this information for each of the years under study.

Disaggregation of these different types of spending would permit a better understanding of their varied effects on economic growth. Sufficient detail is available for years 1981-1985 to permit some sorting of this data. However, for the other years of our analysis, 1976-1980, segregation is not possible.

Second, the nonavailability of DoD data for 1981, discussed in Chapter IV, required both splicing the data series together from multiple sources and statistically estimating missing variable observations. Both of these necessities tend to create minor distortions in the raw data, which may affect the regression estimates for DoD spending.

2. Regression Mechanics

In Chapter III, we outlined several basic assumptions of multiple regression. One of these assumptions may be violated when one employs pooled cross- ection and time-series data. This results from the attempt to estimate a single regression equation to cover what potentially could be multiple individual equations. We will now examine each of the basic regression assumptions in turn.

a. Linearity Assumption

By the pooling process, the fundamental assumption that a linear relationship exists between the dependent variable and each independent variable is not clearly established. Exhibits 3 through 18 display plots of the dependent variable, PERINC, against each of its independent variables. Exhibits 19 through 34 display plots of the dependent variable, LPERINC, against each of its independent variables. What is clear from a review of these exhibits is:

1) a clear linear relationship exists between only the variables: PERINC and LAGPI and LPERINC and LLAGPI; and

2) that even if linear relationships exist between the variables for each individual state, the estimation of a single regression equation is somewhat distorted by the aggregation.

This problem is also reflected in Tables 2 and 13, the correlation matrices for both the PERINC and LPERINC models. Low correlation coefficients exist between the majority of the independent variables and the dependent variables. The coefficients are somewhat higher in the LPERINC models.

This low correlation between independent and dependent variables results from the independent variable specification used to replicate the work of Helms. Highly linear relationships existed prior to variable conversion.

However, the unconverted variables suffer from extremely high levels of multicollinearity amongst the independent variables. Hence, this variable conversion solves one problem but creates another.

Further analysis of the relationship between an independent variable and its associated dependent variable reveals similar patterns across different states. This is observed by sorting the data set by state, and then plotting the dependent variable against each independent variable. These plots are not presented here. However, this knowledge, that the relationships are similar, may assist future researchers in exploring data transformations of the independent variables that will improve the models adherence to the linearity assumption.

b. **Residual Analysis**

The assumption that the observations of the dependent variable are drawn independently from a common population is not satisfied by our models. This is often the case in time-series analysis and is discussed below. However, despite the apparent failure of our models to satisfy the linearity and independence assumptions, analysis of regression residuals indicates the assumptions of: normal distribution of error terms, expected value of error terms equal to zero, and constant variance of error terms are generally satisfied.

The existence of serial correlation is measured by the use of the Durbin-Watson (D-W) statistic. However, the commonly used Durbin-Watson D statistic is not appropriate when the lagged value of the dependent variable is employed as and explanatory variable. Alternatively, we are able to use the Durbin H-statistic for these situations. (Pindyck and Rubinfeld, 1981, p.194)

If present, serial correlation generally reflects a lack of independence of the original observations of the dependent variable. Durbin H-statistics are presented in Table 23 for twelve of our models. The Durbin H is distributed according to the normal distribution (Pindyck and Rubinfeld, 1981, p.194). The Durbin H-statistics provide evidence to reject the null hypothesis of no serial correlation at the 5% level for eleven of our twelve models. Only in the Covariance estimation of the personal income model including both DoD and federal spending is serial correlation largely eliminated.

Exhibits 35 through 42 provide the frequency distribution of the error terms for the OLS and Covariance estimations of our DoD and DoD/NETFED models. These plots provide evidence to support the conclusion that the error terms are normally distributed with a mean of zero.

Exhibits 43 and 44 provide the residual variances by state for the PERINC and LPERINC models respectively. The variances of the residuals for the OLS and Covariance estimations of the models including DoD and DoD/NETFED spending are provided, in these exhibits. These data support the conclusion that the error terms generally have a constant variance.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

The goal of this thesis has been to evaluate the effects of Department of Defense and other Federal Government spending upon the economic growth of the states in which those funds are expended. We have accomplished this by estimating econometric models of state economic growth.

The work is based on fundamentally sound earlier research efforts. The earlier works provide the theoretical basis upon which we build. The models are estimated using advanced multivariate statistical techniques. Specifically, pooled cross-section and time-series regression methods are applied to estimate the model parameters. The forty-eight contiguous states serve as our cross-section base, and the years 1976-1985 serve as our time-series period.

Four models are developed and estimated, two employing DoD spending and two employing DoD with other federal expenditures. The model parameters are developed using three different estimation techniques. A total of twelve estimates of the parameters of our models have been developed and reported.

Finally, two problems experienced in model development and evaluation were identified and discussed.

B. CONCLUSIONS

Our conclusions refer to the research questions provided in Chapter I. The questions will not be repeated here, because our conclusions do not answer each question individually, but rather each of the questions will be answered in conjunction with the others.

First, we are convinced that not only is it possible to locate data and construct a model to evaluate the effects of DoD and other federal spending, but that we have developed models which are stable and provide consistent parameter estimates. It is our belief that the PERINC models are preferable to the LPERINC models because of their more consistent behavior across estimating methods. This is despite the fact that the LPERINC models better satisfy some of the multiple regression assumptions.

The effect of DODINV is clearly beneficial to state economic growth in the state in which it is spent. In all twelve of our model estimations, DODINV carries a positive coefficient. Further, seven of the twelve estimates have coefficients that are statistically significant at the 14% or better level. We would conclude that this type of spending is related to strong economic growth. Regression coefficients do not prove causality. However, it is clear from these estimates that states with high levels of Defense investment spending tend to be states with above average growth rates.

The estimates for DODEXP do not demonstrate as strong a relationship between Defense expense spending and state growth as is exhibited with investment spending. These results are supportive of our a priori assumptions. DODEXP carries a positive coefficient in eight of our twelve estimating equations, but the coefficients are significant at the 7% level or better in only two cases. While DODEXP appears to be associated with state economic growth, this evidence is not convincing or conclusive.

Inconclusive results have been obtained with the variable NETFED. The variable carries a positive coefficient in exactly half, three of six, of our estimating equations. To further confuse the issue, NETFED is positive and significant at the 5% level once and negative and significant at the 6% level twice. These conflicting results are not unexpected since NETFED is composed of different types of spending that may have very different effects. If these different types of spending could be segregated, improved results may be obtained.

The policy implications of these results are varied. First, DODINV appears desirable from the point of view of state decision makers, because of its clear association with economic growth. However, the association with growth demonstrated by DODINV does not prove causality. Further, from a national perspective, it is not clear that defense spending policies should be established based upon their economic consequences. While these consequences may play a role in the decision making process, national security considerations must be the paramount consideration.

DODEXP does not provide clear policy implications. However, while the closing/opening of local defense installations may not affect the state in which they are located, the same conclusion cannot be made at the community level. Given the performance of NETFED in our models, no policy implications can be drawn from our results about this type of federal spending.

C. RECOMMENDATIONS FOR FUTURE RESEARCH

Four recommendations for future research are provided below.

First, the models developed here may be improved by investigation of independent variable data transformations. The goal of any data transformation employed should be to improve the adherence of the model to the linearity assumption. That is the assumption that a linear relationship exists between the dependent variable and each independent variable. That assumption is violated to some degree in these models. Therefore, any mathematical interpretations of our parameter estimates entails some inaccuracies. Data transformations employed should also seek to avoid reintroducing multicollinearity into the model.

Second, DODINV is not paid out entirely in the same year in which the contract is awarded. In cases such as shipbuilding, the final payment may be made as late as seven years following contract award. Consequently, an improved understanding of the relationship of DODINV to state economic growth may be obtained be modeling this extended payout period. The use of a seven-period distributed lag estimation, similar to that used by Quan and Beck for educational expenditures, may be useful in examining this relationship.

Third, an investigation of the effect of DODEXP upon local communities in which defense establishments are located may provide insights into this relationship at a local level. Currently, a debate rages about the homeporting of the USS Missouri battle group at Hunter's Point in San Francisco. The debate concerns the city's willingness to pay at least $2,000,000 for the dredging and renovation of Hunter's Point. (Monterey Herald, Nov. 2, 1988, p.10) Clearly, the DODINV spending fostered by this homeporting would be beneficial to the community. However, the DODEXP spending effects remain unclear. Further research into the effects of DODEXP at the local level may help to answer this and similar questions.

Finally, poor results were achieved with the variable NETFED. We believe this is because of the composition of this variable. As discussed earlier, segregation of the different types of spending contained in NETFED may result in an improved understanding of the relationship of Federal Government spending to state economic growth.

APPENDIX A: REGRESSION MODEL COMPUTER OUTPUT

TABLE 1 - DESCRIPTIVE STATISTICS PERINC MODELS

VARIABLE	MEAN	STD DEV	SUM	MAXIMUM	MINIMUM
PERINC	52.60928966	59.48814663	25252.45903815	380.90467626	4.08716323
LAGPI	51.63700800	58.03945861	22307.18745541	362.96100279	4.08716323
BCPRPTAX	0.03362868	0.01345650	16.14176814	0.08574906	0.01017565
BCOTHTAX	0.07124408	0.01340190	34.19715644	0.12551957	0.02728929
BCUSRFEE	0.04053467	0.01503094	19.45664266	0.14615926	0.01974280
BCDEFICT	-0.00906815	0.01217116	-4.35271232	0.01638382	-0.09426454
BCINTGOV	0.04040438	0.01127694	19.39410303	0.07687274	0.01996107
BCHLHOSX	0.01500798	0.00496847	7.20383248	0.03197738	0.00575780
BCHWYEX	0.01895513	0.00780844	9.09846237	0.06140528	0.00709449
BCLOCEDX	0.04498814	0.00818233	21.59430522	0.08610006	0.02971925
BCHIEDEX	0.01845965	0.00559574	8.86063310	0.03675847	0.00716716
BCOTHEX	0.06075586	0.01201752	29.16281143	0.11439750	0.03589756
BCMFGWGE	1.00000000	0.14242300	479.99999998	1.37413623	0.74662238
POPDEN	0.15853889	0.22423915	76.09866516	1.01258704	0.00407263
DODINV	0.02460334	0.02214640	11.80960389	0.12763415	0.00152127
DODEXP	0.02584052	0.01848232	12.40345053	0.12231491	0.00231312
NETFED	0.16307281	0.04018182	78.27494838	0.34530036	0.06746909

TABLE 2 - CORRELATION MATRIX PERINC MODELS

PEARSON CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / NUMBER OF OBSERVATIONS

	PERINC	LAGPI	BCPRPTAX	BCOTHTAX	BCUSRFEE	BCDEFICT	BCINTGOV	BCHLHOSX	BCHHYEX	BCLOCEDX	BCHIEDEX	BCOTHEX	BCMFGWGE
PERINC	1.00000 0.0000 480	0.99935 0.0001 432	0.03489 0.4457 480	0.03845 0.4007 480	-0.27447 0.0001 480	0.05787 0.2057 480	-0.35402 0.0001 480	0.00816 0.8585 480	-0.52905 0.0001 480	-0.25214 0.0001 480	-0.37459 0.0001 480	-0.02012 0.6601 480	0.23946 0.0001 480
LAGPI	0.99935 0.0001 432	1.00000 0.0000 432	0.02895 0.5485 432	0.04241 0.3792 432	-0.27866 0.0001 432	0.06595 0.1712 432	-0.34648 0.0001 432	-0.00154 0.9745 432	-0.53904 0.0001 432	-0.25748 0.0001 432	-0.37634 0.0001 432	-0.03262 0.4989 432	0.24141 0.0001 432
BCPRPTAX	0.03489 0.4457 480	0.02895 0.5485 432	1.00000 0.0000 480	-0.18763 0.0001 480	-0.05013 0.2730 480	-0.18870 0.0001 480	0.21193 0.0001 480	-0.20118 0.0001 480	0.16080 0.0004 480	0.45694 0.0001 480	-0.02790 0.5420 480	0.38363 0.0001 480	0.18549 0.0001 480
BCOTHTAX	0.03845 0.4007 480	0.04241 0.3792 432	-0.18763 0.0001 480	1.00000 0.0000 480	0.40765 0.0001 480	-0.42737 0.0001 480	0.45573 0.0001 480	0.36716 0.0001 480	0.23542 0.0001 480	0.45110 0.0001 480	0.35478 0.0001 480	0.50727 0.0001 480	0.05028 0.2716 480
BCUSRFEE	-0.27447 0.0001 430	-0.27866 0.0001 432	-0.05013 0.2730 430	0.40765 0.0001 480	1.00000 0.0000 480	-0.63429 0.0001 480	0.29536 0.0001 480	0.32738 0.0001 480	0.46135 0.0001 480	0.46658 0.0001 480	0.50983 0.0001 480	0.41938 0.0001 480	-0.01972 0.6666 480
BCDEFICT	0.05787 0.2057 480	0.06595 0.1712 432	-0.18870 0.0001 480	-0.42737 0.0001 480	-0.63429 0.0001 480	1.00000 0.0000 480	-0.28967 0.0001 480	-0.16866 0.0002 480	-0.20264 0.0001 480	-0.34471 0.0001 480	-0.16696 0.0002 480	-0.24553 0.0001 480	0.06539 0.1526 480
BCINTGOV	-0.35402 0.0001 480	-0.34648 0.0001 432	0.21193 0.0001 480	0.45573 0.0001 480	0.29536 0.0001 480	-0.28967 0.0001 480	1.00000 0.0000 480	0.19473 0.0001 480	0.65852 0.0001 480	0.66844 0.0001 480	0.47654 0.0001 480	0.42480 0.0001 480	-0.22308 0.0001 480
BCHLHOSX	0.00816 0.8385 480	-0.00154 0.9745 432	-0.20118 0.0001 480	0.36716 0.0001 480	0.32738 0.0001 480	-0.16866 0.0002 480	0.19473 0.0001 480	1.00000 0.0000 480	0.07389 0.1059 480	0.12898 0.0046 480	0.14254 0.0017 480	0.02112 0.6444 480	-0.22271 0.0001 480
BCHHYEX	-0.52905 0.0001 480	-0.53904 0.0001 432	0.16080 0.0004 480	0.23542 0.0001 480	0.46135 0.0001 480	-0.20264 0.0001 480	0.65852 0.0001 480	0.07389 0.1059 480	1.00000 0.0000 480	0.59663 0.0001 480	0.49667 0.0001 480	0.23171 0.0001 480	-0.04778 0.2962 480
BCLOCEDX	-0.25214 0.0001 480	-0.25748 0.0001 432	0.45694 0.0001 480	0.45110 0.0001 480	0.46658 0.0001 480	-0.34471 0.0001 480	0.66844 0.0001 480	0.12898 0.0046 480	0.59663 0.0001 480	1.00000 0.0000 480	0.56793 0.0001 480	0.46705 0.0001 480	0.14906 0.0011 480
BCHIEDEX	-0.37459 0.0001 480	-0.37634 0.0001 432	-0.02790 0.5420 430	0.35478 0.0001 480	0.50983 0.0001 480	-0.16696 0.0002 480	0.47654 0.0001 480	0.14254 0.0017 480	0.49667 0.0001 480	0.56793 0.0001 480	1.00000 0.0000 480	0.13761 0.0025 480	-0.02701 0.5549 480
BCOTHEX	-0.02012 0.6601 480	-0.03262 0.4989 432	0.38363 0.0001 480	0.50727 0.0001 480	0.41938 0.0001 480	-0.24553 0.0001 480	0.42480 0.0001 480	0.02112 0.6444 480	0.23171 0.0001 480	0.46705 0.0001 480	0.13761 0.0025 480	1.00000 0.0000 480	0.09836 0.0312 480
BCMFGWGE	0.23946 0.0001 480	0.24141 0.0001 432	0.18549 0.0001 480	0.05028 0.2716 480	-0.01972 0.6666 480	0.06539 0.1526 480	-0.22308 0.0001 480	-0.22271 0.0001 480	-0.04778 0.2962 480	0.14906 0.0011 480	-0.02701 0.5549 480	0.09836 0.0312 480	1.00000 0.0000 480
POPDEN	0.23821 0.0001 480	0.23890 0.0001 432	0.24128 0.0001 480	-0.11571 0.0112 480	-0.35204 0.0001 480	0.04661 0.3082 480	-0.21205 0.0001 480	-0.20071 0.0001 480	-0.51441 0.0001 480	-0.25105 0.0001 480	-0.53478 0.0001 480	0.17880 0.0001 480	-0.04587 0.3159 480
DODINV	0.19158 0.0001 480	0.19363 0.0001 432	0.05006 0.2737 430	-0.14557 0.0014 480	-0.24506 0.0001 480	-0.00194 0.9662 480	-0.21749 0.0001 480	-0.13512 0.0030 480	-0.31484 0.0001 480	-0.25420 0.0001 480	-0.27628 0.0001 480	-0.13093 0.0041 480	-0.07519 0.0999 480
DODEXP	-0.10065 0.0275 480	-0.10012 0.0375 432	-0.29263 0.0001 480	0.04133 0.3605 430	0.11273 0.0135 480	-0.01964 0.6678 480	0.00538 0.9064 480	0.09664 0.0343 480	-0.00142 0.9752 480	-0.01519 0.7399 480	0.21963 0.0001 480	-0.13465 0.0031 480	-0.42490 0.0001 480
NETFED	-0.33954 0.0001 480	-0.36290 0.0001 432	-0.16097 0.0004 480	0.19706 0.0001 480	0.23594 0.0001 480	-0.04076 0.3729 480	0.42979 0.0001 480	0.16990 0.0002 480	0.41387 0.0001 480	0.29653 0.0001 480	0.24434 0.0001 480	0.11793 0.0097 480	-0.33212 0.0001 480

TABLE 2 - CONTINUED

	POPDEN	DODINV	DODEXP	NETFED
PERINC	0.23821	0.19158	-0.10065	-0.33954
	0.0001	0.0001	0.0275	0.0001
	480	480	480	480
LAGPI	0.23890	0.19363	-0.10012	-0.36290
	0.0001	0.0001	0.0375	0.0001
	432	432	432	432
BCPRPTAX	0.24128	0.05006	-0.29263	-0.16097
	0.0001	0.2737	0.0001	0.0004
	480	480	480	480
BCOTHTAX	-0.11571	-0.14557	0.04183	0.19706
	0.0112	0.0014	0.3605	0.0001
	480	480	480	480
BCUSRFEE	-0.35204	-0.24506	0.11273	0.23594
	0.0001	0.0001	0.0135	0.0001
	480	480	480	480
BCDEFICT	0.04661	-0.00194	-0.01964	-0.04076
	0.3082	0.9662	0.6678	0.3729
	480	480	480	480
BCINTGOV	-0.21205	-0.21749	0.00538	0.42979
	0.0001	0.0001	0.9064	0.0001
	480	480	480	480
BCHLHOSX	-0.20071	-0.13512	0.09664	0.16990
	0.0001	0.0030	0.0343	0.0002
	480	480	480	480
BCHWYEX	-0.51441	-0.31484	-0.00142	0.41387
	0.0001	0.0001	0.9752	0.0001
	480	480	480	480
BCLOCEDX	-0.25105	-0.25420	-0.01519	0.29653
	0.0001	0.0001	0.7399	0.0001
	480	480	480	480
BCHIEDEX	-0.53478	-0.27628	0.21963	0.24434
	0.0001	0.0001	0.0001	0.0001
	480	480	480	480
BCOTHEX	0.17880	-0.13093	-0.13465	0.11793
	0.0001	0.0041	0.0031	0.0097
	480	480	480	480
BCMFGWGE	-0.04587	-0.07519	-0.42490	-0.33212
	0.3159	0.0999	0.0001	0.0001
	480	480	480	480
POPDEN	1.00000	0.27409	-0.12118	-0.28430
	0.0000	0.0001	0.0079	0.0001
	480	480	480	480
DODINV	0.27409	1.00000	0.11435	-0.16191
	0.0001	0.0000	0.0122	0.0004
	480	480	480	480
DODEXP	-0.12118	0.11435	1.00000	0.25728
	0.0079	0.0122	0.0000	0.0001
	480	480	480	480
NETFED	-0.28430	-0.16191	0.25728	1.00000
	0.0001	0.0004	0.0001	0.0000
	480	480	480	480

TABLE 3 - OLS ESTIMATION OF HELMS' BASIC PERINC MODEL

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	13	1571335.49	120871.96	27916.478	0.0001
ERROR	418	1809.84437	4.32977121		
C TOTAL	431	1573145.34			

ROOT MSE	2.08081	R-SQUARE	0.9988
DEP MEAN	53.4721	ADJ R-SQ	0.9988
C.V.	3.891394		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	4.92377492	1.08299332	4.546	0.0001
LAGPI	1	1.04610166	0.002354132	444.368	0.0001
BCPRPTAX	1	-70.68665229	22.37780073	-3.159	0.0017
BCOTHTAX	1	-80.73432370	22.98991955	-3.512	0.0005
BCUSRFEE	1	-90.17423473	24.77119441	-3.640	0.0003
BCDEFICT	1	-105.81495	23.39254732	-4.523	0.0001
BCINTGOV	1	-70.73197164	20.88640894	-3.387	0.0008
BCHLHOSX	1	43.43507834	31.35016672	1.385	0.1666
BCHWYEX	1	94.02564818	30.01070827	3.133	0.0019
BCLOCEDX	1	25.67332240	30.53586581	0.841	0.4010
BCHIEDEX	1	143.19036	35.47971733	4.036	0.0001
BCOTHEX	1	77.36974998	24.80563589	3.119	0.0019
BCMFGWGE	1	-2.77004573	0.88357293	-3.135	0.0013
POPDEN	1	0.10685522	0.69676794	0.153	0.8732

TABLE 4 - COVARIANCE ESTIMATION OF HELMS' BASIC PERINC MODEL

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	68	1572159.95	23119.99926	8517.016	0.0001
ERROR	363	985.38733	2.71456564		
C TOTAL	431	1573145.34			

ROOT MSE	1.647594	R-SQUARE	0.9994
DEP MEAN	53.4721	ADJ R-SQ	0.9993
C.V.	3.081222		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	12.55767904	4.82961264	2.600	0.0097
LAGPI	1	1.02677345	0.01599795	64.182	0.0001
BCPRPTAX	1	-132.87057	63.54096923	-2.091	0.0372
BCOTHTAX	1	-100.65459	59.68262894	-1.686	0.0926
BCUSRFEE	1	-112.29578	60.79124773	-1.847	0.0655
BCDEFICT	1	-137.39383	58.41808878	-2.352	0.0192
BCINTGOV	1	-130.25676	60.28795057	-2.161	0.0314
BCHLHOSX	1	72.05601196	91.47686502	0.788	0.4314
BCHWYEX	1	209.45530	69.07663767	3.032	0.0026
BCLOCEDX	1	118.65085	73.84175102	1.607	0.1090
BCHIEDEX	1	72.42667094	93.91942452	0.771	0.4411
BCOTHEX	1	-8.44372968	65.49878950	-0.129	0.8975
BCNFGUGE	1	-2.16617430	3.87832595	-0.559	0.5768
POPDEN	1	-21.68599732	33.06210450	-0.656	0.5123
YR3	1	0.06057719	0.35933917	0.169	0.8662
YR4	1	-0.85225346	0.37960307	-2.245	0.0254
YR5	1	-1.37178353	0.41282270	-3.323	0.0010
YR6	1	-1.10475555	0.46132070	-2.395	0.0171
YR7	1	-2.55626246	0.54545645	-4.686	0.0001
YR8	1	0.81025837	0.59360300	1.365	0.1731
YR9	1	0.51241484	0.62956702	0.814	0.4162
YR10	1	-0.70738266	0.62853830	-1.125	0.2611
ST2	1	0.73622331	2.60650415	0.282	0.7778
ST3	1	-2.35881565	1.63780057	-1.440	0.1507
ST4	1	11.71763325	4.27420862	2.741	0.0064
ST5	1	-0.23747889	2.45180826	-0.097	0.9229
ST6	1	13.35589965	18.28047386	0.731	0.4655
ST7	1	7.01720853	7.96375730	0.881	0.3788
ST8	1	5.77177102	3.39730206	1.699	0.0902
ST9	1	1.07987288	1.28626024	0.840	0.4017
ST10	1	-1.79587568	2.64692989	-0.678	0.4979
ST11	1	2.43793913	3.88043546	0.628	0.5302
ST12	1	0.03435959	2.56251764	0.013	0.9893
ST13	1	-1.18005051	2.19896526	-0.537	0.5918
ST14	1	-1.76608701	2.49568851	-0.708	0.4796
ST15	1	0.27912028	1.48392222	0.188	0.8509
ST16	1	2.21139124	1.34241071	1.647	0.1004
ST17	1	0.90754481	2.39973376	0.378	0.7055
ST18	1	9.92789054	11.46260904	0.866	0.3870
ST19	1	18.51122085	21.38468821	0.866	0.3873
ST20	1	4.22813215	3.17343376	1.332	0.1836
ST21	1	2.23098249	1.99270294	1.120	0.2636
ST22	1	-0.55527214	1.20479216	-0.461	0.6452
ST23	1	-1.34163028	1.54947132	-0.866	0.3871
ST24	1	-0.10554119	3.55405543	-0.030	0.9763
ST25	1	-2.43795166	2.66129782	-0.916	0.3602
ST26	1	0.42720436	2.86800853	0.149	0.8817
ST27	1	0.41465242	2.30887664	0.180	0.8576
ST28	1	22.92274016	29.50508150	0.777	0.4377
ST29	1	-1.40061514	2.43010420	-0.576	0.5647
ST30	1	13.92805697	8.90627546	1.564	0.1187
ST31	1	0.56676863	1.79159039	0.316	0.7519
ST32	1	-0.72558723	2.78142823	-0.261	0.7943
ST33	1	3.96457946	5.50856338	0.720	0.4722
ST34	1	-1.48066940	1.80263162	-0.821	0.4120
ST35	1	3.11802864	2.85868571	1.091	0.2761
ST36	1	4.38597678	5.61828309	0.781	0.4355
ST37	1	22.87161523	27.57336502	0.829	0.4074

TABLE 4 - CONTINUED

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
ST38	1	0.80551269	1.42797822	0.564	0.5730
ST39	1	-1.27368736	2.97023437	-0.429	0.6683
ST40	1	0.83943426	1.44443784	0.581	0.5615
ST41	1	1.93368446	3.12419820	0.619	0.5363
ST42	1	-0.09984125	2.52849679	-0.039	0.9685
ST43	1	2.13974743	1.93678253	1.105	0.2700
ST44	1	1.02159422	2.08922262	0.489	0.6251
ST45	1	1.66997911	2.33829297	0.714	0.4756
ST46	1	-0.62921609	1.69418084	-0.371	0.7106
ST47	1	2.41193304	1.83075975	1.317	0.1885
ST48	1	-1.15583057	3.00779470	-0.384	0.7010

TABLE 5 - PARKS' ESTIMATION OF HELMS' BASIC PERINC MODEL

SOURCE	B VALUES	T FOR H:B=0	PROB>|T|	STD ERR B
$INT	5.79441	3.8568	0.0001	1.5024
LAGPI	1.04963	140.11	0.0	0.0074916
BCPRPTAX	-99.8979	-3.3673	0.0008	29.667
BCOTHTAX	-120.342	-5.8133	0.0000	20.701
BCUSRFEE	-134.531	-5.4295	0.0000	24.778
BCDEFICT	-141.867	-6.4159	0.0000	22.112
BCINTGOV	-84.9193	-4.3127	0.0000	19.691
BCHLHOSX	73.0901	2.8101	0.0052	26.010
BCHWYEX	98.0395	2.9506	0.0033	33.227
BCLOCEDX	32.3631	1.0212	0.3077	31.690
BCHIEDEX	172.064	5.3830	0.0000	31.964
BCOTHEX	110.684	4.4722	0.0000	24.749
BCMFGWGE	-1.29857	-0.72161	0.4709	1.7996
POPDEN	-1.16129	-1.2531	0.2109	0.92671

DEGREES OF FREEDOM FOR T-STATISTICS = 418

TABLE 6 - OLS ESTIMATION OF DOD PERINC MODEL

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	15	1571359.13	104757.28	24397.518	0.0001
ERROR	416	1786.20735	4.29376766		
C TOTAL	431	1573145.34			

ROOT MSE	2.072141	R-SQUARE	0.9989
DEP MEAN	53.4721	ADJ R-SQ	0.9988
C.V.	3.875181		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	3.68085859	1.25840290	2.925	0.0036
LAGPI	1	1.04584260	0.002354367	444.214	0.0001
BCPRPTAX	1	-69.88930505	23.25148013	-3.006	0.0028
BCOTHTAX	1	-80.78824117	23.25298599	-3.474	0.0006
BCUSRFEE	1	-88.74524308	24.96987618	-3.554	0.0004
BCDEFICT	1	-102.53159	23.56680068	-4.351	0.0001
BCINTGOV	1	-67.81207731	21.39501041	-3.170	0.0016
BCHLHOSX	1	49.07642775	31.45654659	1.560	0.1195
BCHWYEX	1	99.42627669	30.13863298	3.299	0.0011
BCLOCEDX	1	24.81310693	31.65756417	0.784	0.4336
BCHIEDEX	1	141.30310	36.33316048	3.889	0.0001
BCOTHEX	1	79.12505996	25.04487413	3.159	0.0017
BCHFGNGE	1	-2.27482633	0.97052846	-2.344	0.0196
POPDEN	1	0.01345855	0.69495764	0.022	0.9823
DODINV	1	10.19583701	5.06160958	2.014	0.0446
DODEXP	1	5.49073935	6.84216815	0.802	0.4227

TABLE 7 - COVARIANCE ESTIMATION OF DOD PERINC MODEL

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	70	1572166.41	22459.52021	8282.462	0.0001
ERROR	361	978.92233	2.71169621		
C TOTAL	431	1573145.34			

ROOT MSE	1.646723	R-SQUARE	0.9994
DEP MEAN	53.4721	ADJ R-SQ	0.9993
C.V.	3.079593		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	12.13808765	4.88209995	2.486	0.0134
LAGPI	1	1.02648123	0.01600145	64.149	0.0001
BCPRPTAX	1	-131.64196	63.62889917	-2.069	0.0393
BCOTHTAX	1	-100.84863	60.02681518	-1.680	0.0938
BCUSRFEE	1	-112.28132	61.07508590	-1.838	0.0668
BCDEFICT	1	-137.78287	58.61081297	-2.351	0.0193
BCINTGOV	1	-135.77314	60.48499086	-2.245	0.0254
BCHLHCSX	1	84.80987677	91.99206804	0.922	0.3572
BCHWYEX	1	208.55337	69.49095041	3.001	0.0029
BCLOCEDX	1	119.11244	74.03102349	1.609	0.1085
BCHIEDEX	1	68.76442186	96.78686882	0.710	0.4779
BCOTHEX	1	-8.91537411	65.48632509	-0.136	0.8918
BCMFGWGE	1	-2.27570927	3.87803595	-0.587	0.5577
POPDEN	1	-22.49056112	33.04883251	-0.681	0.4966
DODINV	1	17.52700459	11.76089850	1.490	0.1370
DODEXP	1	10.46555331	23.73864852	0.441	0.6596
YR3	1	0.04023326	0.36023187	0.112	0.9111
YR4	1	-0.80353599	0.38598370	-2.082	0.0381
YR5	1	-1.32945217	0.41674313	-3.190	0.0015
YR6	1	-1.14528641	0.46252418	-2.476	0.0137
YR7	1	-2.69652769	0.55299230	-4.876	0.0001
YR8	1	0.68177824	0.59922334	1.138	0.2560
YR9	1	0.39637335	0.63400648	0.625	0.5322
YR10	1	-0.82969598	0.63381293	-1.309	0.1913
ST2	1	0.51652723	2.64386963	0.195	0.8452
ST3	1	-2.04835272	1.70894371	-1.199	0.2315
ST4	1	11.30684177	4.28041368	2.642	0.0086
ST5	1	-0.22195650	2.45972406	-0.090	0.9281
ST6	1	12.53217169	18.29029984	0.685	0.4937
ST7	1	7.47241761	7.97515461	0.937	0.3494
ST8	1	5.84885060	3.39992347	1.720	0.0862
ST9	1	0.84644625	1.30080620	0.651	0.5156
ST10	1	-1.29130918	2.72551143	-0.474	0.6359
ST11	1	3.10105233	3.92976875	0.789	0.4306
ST12	1	0.16249641	2.65879799	0.061	0.9513
ST13	1	-0.71723145	2.39779525	-0.299	0.7650
ST14	1	-2.02184189	2.52262405	-0.801	0.4234
ST15	1	0.70220803	1.51300776	0.464	0.6428
ST16	1	2.33863848	1.37626349	1.699	0.0901
ST17	1	0.66486171	2.41527548	0.275	0.7833
ST18	1	9.85392711	11.45831884	0.860	0.3904
ST19	1	18.47546094	21.37776684	0.864	0.3880
ST20	1	4.68080539	3.25280746	1.439	0.1510
ST21	1	2.43710087	2.10233814	1.159	0.2471
ST22	1	-1.27580538	1.30629267	-0.977	0.3294
ST23	1	-2.38468739	1.75722408	-1.357	0.1756
ST24	1	0.40105423	3.59523074	0.112	0.9112
ST25	1	-2.13268421	2.69617615	-0.791	0.4295
ST26	1	0.67143426	2.87116557	0.234	0.8152
ST27	1	0.16386644	2.32050012	0.071	0.9437
ST28	1	23.88098689	29.49823908	0.810	0.4187
ST29	1	-1.54811605	2.44739204	-0.633	0.5274
ST30	1	14.31135562	8.90720578	1.607	0.1090
ST31	1	0.77537331	1.79714315	0.431	0.6664
ST32	1	-0.47881662	2.78524809	-0.172	0.8636
ST33	1	4.38276104	5.53750899	0.791	0.4292
ST34	1	-1.34476340	1.80414943	-0.745	0.4565
ST35	1	3.79741611	2.98262768	1.273	0.2038

TABLE 7 - CONTINUED

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
ST36	1	4.83696891	5.62923246	0.859	0.3908
ST37	1	23.62154228	27.56324026	0.857	0.3920
ST38	1	0.74186698	1.47622034	0.503	0.6156
ST39	1	-0.77914739	3.01071302	-0.259	0.7959
ST40	1	1.19442158	1.54334083	0.774	0.4395
ST41	1	1.69640991	3.13794180	0.541	0.5891
ST42	1	-0.34600011	2.53388441	-0.137	0.8915
ST43	1	2.40966330	2.16020522	1.115	0.2654
ST44	1	-0.03346841	2.63883626	-0.013	0.9899
ST45	1	1.23054216	2.36084694	0.521	0.6025
ST46	1	0.07649344	1.90283237	0.040	0.9680
ST47	1	2.93155772	2.03747572	1.439	0.1511
ST48	1	-0.79605259	3.07706790	-0.259	0.7960

TABLE 8 - PARKS' ESTIMATION OF DOD PERINC MODEL

SOURCE	B VALUES	T FOR H:B=0	PROB>|T|	STD ERR B
$INT	4.93975	2.6582	0.0082	1.8583
LAGPI	1.05199	130.70	0.0	0.0080488
BCPRPTAX	-87.8816	-2.7458	0.0063	32.006
BCOTHTAX	-112.191	-4.0449	0.0001	27.736
BCUSRFEE	-121.436	-4.5654	0.0000	26.599
BCDEFICT	-118.998	-4.6727	0.0000	25.466
BCINTGOV	-70.9590	-3.5900	0.0004	19.766
BCHLHOSX	68.6388	2.2216	0.0269	30.897
BCHWYEX	99.5892	2.9288	0.0036	34.003
BCLOCEDX	22.0746	0.62604	0.5316	35.261
BCHIEDEX	166.579	4.5033	0.0000	36.991
BCOTHEX	96.5067	3.3619	0.0008	28.706
BCMFGWGE	-1.05119	-0.56049	0.5754	1.8755
POPDEN	-1.61540	-1.6223	0.1055	0.99576
DODINV	9.44957	2.2175	0.0271	4.2613
DODEXP	2.00016	0.14725	0.8830	13.584

DEGREES OF FREEDOM FOR T-STATISTICS = 416

TABLE 9 - OLS ESTIMATION OF DOD/NETFED PERINC MODEL

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	16	1571359.70	98209.98112	22824.963	0.0001
ERROR	415	1785.63889	4.30274432		
C TOTAL	431	1573145.34			

ROOT MSE	2.074306	R-SQUARE	0.9989
DEP MEAN	53.4721	ADJ R-SQ	0.9988
C.V.	3.87923		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	3.47097222	1.38575969	2.505	0.0126
LAGPI	1	1.04591478	0.002365179	442.214	0.0001
BCPRPTAX	1	-68.48638806	23.59362499	-2.903	0.0039
BCOTHTAX	1	-80.27419066	23.32020394	-3.442	0.0006
BCUSRFEE	1	-88.63929370	24.99766343	-3.546	0.0004
BCDEFICT	1	-102.77585	23.60099201	-4.355	0.0001
BCINTGOV	1	-68.51174621	21.50369389	-3.186	0.0016
BCHLHOSX	1	49.10738854	31.48952657	1.559	0.1196
BCHWYEX	1	98.40967999	30.29948419	3.248	0.0013
BCLOCEDX	1	22.31357649	32.42817357	0.688	0.4913
BCHIEDEX	1	143.16418	36.72975962	3.898	0.0001
BCOTHEX	1	78.62381254	25.10893803	3.131	0.0019
BCMFGWGE	1	-2.19570925	0.99562760	-2.205	0.0280
POPDEN	1	0.04435347	0.70021103	0.063	0.9495
DODINV	1	10.22306246	5.06745139	2.017	0.0443
DODEXP	1	5.19966695	6.39597174	0.754	0.4513
NETFED	1	1.19285916	3.28181942	0.363	0.7164

TABLE 10 - COVARIANCE ESTIMATION OF DOD/NETFED PERINC MODEL

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	71	1572175.96	22143.32345	8223.464	0.0001
ERROR	360	969.37208	2.69270023		
C TOTAL	431	1573145.34			

ROOT MSE	1.640945	R-SQUARE	0.9994
DEP MEAN	53.4721	ADJ R-SQ	0.9993
C.V.	3.068787		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	14.34342255	5.00391843	2.866	0.0044
LAGPI	1	1.02433693	0.01598591	64.077	0.0001
BCPRPTAX	1	-125.60752	63.48655259	-1.978	0.0486
BCOTHTAX	1	-101.40401	59.81692259	-1.695	0.0909
BCUSRFEE	1	-109.32316	60.88105471	-1.796	0.0734
BCDEFICT	1	-132.74207	58.46646200	-2.270	0.0238
BCINTGOV	1	-134.18288	60.27869334	-2.226	0.0266
BCHLHOSX	1	84.49242715	91.66944516	0.922	0.3573
BCHWYEX	1	206.66414	69.25439323	2.984	0.0030
BCLOCEDX	1	112.72917	73.84909039	1.526	0.1278
BCHIEDEX	1	89.00549551	97.04427270	0.917	0.3597
BCOTHEX	1	-7.02559722	65.26426407	-0.108	0.9143
BCMFGWGE	1	-3.15721677	3.89267283	-0.811	0.4179
POPDEN	1	-20.03679793	32.95863592	-0.608	0.5436
DODINV	1	18.06498149	11.72311326	1.541	0.1242
DODEXP	1	15.73775737	23.82043195	0.661	0.5092
NETFED	1	-10.27383444	5.45530687	-1.883	0.0605
YR3	1	0.009263644	0.35934437	0.026	0.9794
YR4	1	-1.03964301	0.40454591	-2.570	0.0106
YR5	1	-1.62605272	0.44414181	-3.661	0.0003
YR6	1	-1.53416995	0.50504409	-3.038	0.0026
YR7	1	-3.00982686	0.57561580	-5.229	0.0001
YR8	1	0.40162339	0.61537197	0.653	0.5144
YR9	1	0.07939730	0.65381729	0.121	0.9034
YR10	1	-1.06093056	0.64341312	-1.649	0.1000
ST2	1	0.41804109	2.63511190	0.159	0.8740
ST3	1	-1.77256967	1.70923203	-1.037	0.3004
ST4	1	11.13132351	4.26641282	2.609	0.0095
ST5	1	-0.42518987	2.45346794	-0.173	0.8625
ST6	1	10.71197528	18.25173189	0.587	0.5576
ST7	1	6.13218378	7.97897148	0.769	0.4427
ST8	1	5.71567628	3.38873197	1.687	0.0925
ST9	1	0.47905382	1.31083951	0.365	0.7150
ST10	1	-0.81968486	2.72746937	-0.301	0.7639
ST11	1	2.86210966	3.91803508	0.730	0.4656
ST12	1	-0.20608236	2.65668752	-0.078	0.9382
ST13	1	-0.84199328	2.39030017	-0.352	0.7249
ST14	1	-2.25862042	2.51691495	-0.897	0.3701
ST15	1	0.68563744	1.50772465	0.455	0.6496
ST16	1	2.18691311	1.37379885	1.592	0.1123
ST17	1	0.59308654	2.40710260	0.246	0.8055
ST18	1	9.13492912	11.42449529	0.800	0.4245
ST19	1	16.68835333	21.32388217	0.783	0.4344
ST20	1	4.34506897	3.24629284	1.338	0.1816
ST21	1	2.26899288	2.09685239	1.082	0.2799
ST22	1	-1.35135788	1.30232725	-1.038	0.3001
ST23	1	-2.10348570	1.75741305	-1.197	0.2321
ST24	1	0.93685062	3.59389466	0.261	0.7945
ST25	1	-2.08785806	2.68682136	-0.777	0.4376
ST26	1	0.77478427	2.86161760	0.271	0.7867
ST27	1	-0.55063848	2.34327558	-0.235	0.8144
ST28	1	21.32259352	29.42616117	0.725	0.4692
ST29	1	-0.49548658	2.50203478	-0.198	0.8431
ST30	1	13.70367102	8.88181604	1.543	0.1237
ST31	1	0.02087608	1.83510316	0.011	0.9909
ST32	1	-0.46363385	2.77548703	-0.167	0.8674
ST33	1	4.01210566	5.52158801	0.727	0.4679
ST34	1	-1.46529473	1.79895794	-0.815	0.4159

TABLE 10 - CONTINUED

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
ST35	1	3.79165132	2.97216394	1.276	0.2029
ST36	1	4.79905565	5.60951698	0.856	0.3928
ST37	1	20.99275302	27.50197383	0.763	0.4458
ST38	1	0.26824363	1.49238316	0.180	0.8575
ST39	1	-0.53538520	3.00293998	-0.178	0.8586
ST40	1	1.67517114	1.55896752	1.075	0.2833
ST41	1	1.48487178	3.12894832	0.475	0.6354
ST42	1	-0.78376558	2.53567061	-0.309	0.7574
ST43	1	1.93983129	2.16703376	0.895	0.3713
ST44	1	-0.68535121	2.65226162	-0.258	0.7962
ST45	1	1.26751802	2.35264523	0.539	0.5904
ST46	1	0.64805500	1.92029039	0.337	0.7360
ST47	1	2.55055852	2.04038101	1.250	0.2121
ST48	1	-1.10351201	3.07061433	-0.359	0.7195

TABLE 11 - PARKS' ESTIMATION OF DOD/NETFED PERINC MODEL

SOURCE	B VALUES	T FOR H:B=0	PROB>|T|	STD ERR B
$INT	6.21769	2.8608	0.0044	2.1734
LAGPI	1.05286	130.81	0.0	0.0080488
BCPRPTAX	-90.6302	-2.7911	0.0055	32.471
BCOTHTAX	-112.280	-4.0514	0.0001	27.714
BCUSRFEE	-126.703	-4.6045	0.0000	27.517
BCDEFICT	-123.351	-4.7469	0.0000	25.985
BCINTGOV	-73.7699	-3.6068	0.0003	20.453
BCHLHOSX	64.2013	1.9866	0.0476	32.317
BCHWYEX	93.2390	2.7096	0.0070	34.410
BCLOCEDX	30.1471	0.82082	0.4122	36.728
BCHIEDEX	166.753	4.4071	0.0000	37.837
BCOTHEX	102.933	3.5132	0.0005	29.299
BCMFGWGE	-2.12935	-1.0317	0.3028	2.0640
POPDEN	-1.66695	-1.6680	0.0961	0.99939
DODINV	7.51896	1.7053	0.0889	4.4093
DODEXP	6.67579	0.46927	0.6391	14.226
NETFED	-3.03940	-0.94926	0.3430	3.2018

DEGREES OF FREEDOM FOR T-STATISTICS = 415

TABLE 12 - DESCRIPTIVE STATISTICS LPERINC MODELS

VARIABLE	MEAN	STD DEV	SUM	MINIMUM	MAXIMUM
LPERINC	3.45205716	1.03028258	1656.98743842	1.40785114	5.94254915
LLAGPI	3.43584366	1.02850055	1484.28446244	1.40785114	5.89429540
BCPRPTAX	0.03362868	0.01345650	16.14176814	0.01017565	0.08574906
BCOTHTAX	0.07124408	0.01340190	34.19715644	0.02728929	0.12551957
BCUSRFEE	0.04053467	0.01503094	19.45664266	0.01974280	0.14615926
BCDEFICT	-0.00906815	0.01217116	-4.35271232	-0.09426454	0.01638382
BCINTGOV	0.04040438	0.01127694	19.39410303	0.01996107	0.07687274
BCHLHOSX	0.01500798	0.00496847	7.20383248	0.00575780	0.03197738
BCHWYEX	0.01895513	0.00780844	9.09846237	0.00709449	0.06140528
BCLOCEDX	0.04498814	0.00818233	21.59430522	0.02971925	0.08610006
BCHIEDEX	0.01845965	0.00559574	8.86063310	0.00716716	0.03675847
BCOTHEX	0.06075586	0.01201752	29.16281143	0.03589756	0.11439750
SCMFGWGE	1.00000000	0.14242300	479.99999998	0.74662238	1.37413623
POPDEN	0.15853289	0.22423915	76.09866516	0.00407263	1.01258704
DODINV	0.02460334	0.02214640	11.80960389	0.00152127	0.12763415
DODEXP	0.02584052	0.01848232	12.40345053	0.00231312	0.12231491
NETFED	0.16307281	0.04018182	78.27494838	0.06746909	0.34530036

TABLE 13 - CORRELATION MATRIX LPERINC MODELS

PEARSON CORRELATION COEFFICIENTS / PROB > |R| UNDER H0:RHO=0 / NUMBER OF OBSERVATIONS

	LPERINC	LLAGPI	BCPRPTAX	BCOTHTAX	BCUSRFEE	BCDEFICT	BCINTGOV	BCHLHOSX	BCHWYEX	BCLOCEDX	BCHIEDEX	BCOTHEX	BCMFGHGE
LPERINC	1.00000	0.99951	-0.11874	-0.03969	-0.39077	0.18603	-0.56102	0.08814	-0.67798	-0.37052	-0.48343	-0.24055	0.27976
	0.0000	0.0001	0.0092	0.3856	0.0001	0.0001	0.0001	0.0536	0.0001	0.0001	0.0001	0.0001	0.0001
	480	432	480	480	480	480	480	480	480	480	480	480	480
LLAGPI	0.99951	1.00000	-0.12375	-0.03365	-0.39394	0.19953	-0.55039	0.08291	-0.68318	-0.37416	-0.48004	-0.25395	0.28318
	0.0001	0.0000	0.0100	0.4854	0.0001	0.0001	0.0001	0.0852	0.0001	0.0001	0.0001	0.0001	0.0001
	432	432	432	432	432	432	432	432	432	432	432	432	432
BCPRPTAX	-0.11874	-0.12375	1.00000	-0.18763	-0.05013	-0.18870	0.21193	-0.20118	0.16080	0.45694	-0.02790	0.38363	0.18549
	0.0092	0.0100	0.0000	0.0001	0.2730	0.0001	0.0001	0.0001	0.0004	0.0001	0.5420	0.0001	0.0001
	480	432	480	480	480	480	480	480	480	480	480	480	480
BCOTHTAX	-0.03969	-0.03365	-0.18763	1.00000	0.40765	-0.42737	0.45573	0.36716	0.23542	0.45110	0.35478	0.50727	0.05028
	0.3856	0.4854	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.2716
	480	432	480	480	480	480	480	480	480	480	480	480	480
BCUSRFEE	-0.39079	-0.39394	-0.05013	0.40765	1.00000	-0.63429	0.29536	0.32738	0.46135	0.46658	0.50983	0.41938	-0.01972
	0.0001	0.0001	0.2730	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.6666
	480	432	480	480	480	480	480	480	480	480	480	480	480
BCDEFICT	0.18603	0.19953	-0.18870	-0.42737	-0.63429	1.00000	-0.28967	-0.16866	-0.20264	-0.34471	-0.16696	-0.24553	0.06539
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0002	0.0001	0.0001	0.0002	0.0001	0.1526
	480	432	480	480	480	480	480	480	480	480	480	480	480
BCINTGOV	-0.56102	-0.55039	0.21193	0.45573	0.29536	-0.28967	1.00000	0.19473	0.65852	0.66844	0.47654	0.42480	-0.22308
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	480	432	480	420	430	430	480	480	480	480	480	480	480
BCHLHOSX	0.08814	0.08291	-0.20118	0.36716	0.32738	-0.16866	0.19473	1.00000	0.07389	0.12898	0.14254	0.02112	-0.22271
	0.0536	0.0252	0.0001	0.0001	0.0001	0.0002	0.0001	0.0000	0.1059	0.0046	0.0017	0.6444	0.0001
	480	432	480	480	480	480	480	480	480	480	480	480	480
BCHWYEX	-0.67798	-0.68318	0.16080	0.23542	0.46135	-0.20264	0.65852	0.07389	1.00000	0.59663	0.49667	0.23171	-0.04778
	0.0001	0.0001	0.0004	0.0001	0.0001	0.0001	0.0001	0.1059	0.0000	0.0001	0.0001	0.0001	0.2962
	480	432	430	480	480	480	480	480	480	480	430	480	480
BCLOCEDX	-0.37052	-0.37416	0.45694	0.45110	0.46658	-0.34471	0.66844	0.12898	0.59663	1.00000	0.56793	0.46705	0.14906
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0046	0.0001	0.0000	0.0001	0.0001	0.0011
	480	432	480	480	480	480	480	480	480	480	480	480	480
BCHIEDEX	-0.48343	-0.48004	-0.02790	0.35478	0.50983	-0.16696	0.47654	0.14254	0.49667	0.56793	1.00000	0.13761	-0.02701
	0.0001	0.0001	0.5420	0.0001	0.0001	0.0002	0.0001	0.0017	0.0001	0.0001	0.0000	0.0025	0.5549
	480	432	480	480	480	480	480	480	480	480	480	480	480
BCOTHEX	-0.24055	-0.25395	0.38363	0.50727	0.41938	-0.24553	0.42480	0.02112	0.23171	0.46705	0.13761	1.00000	0.09836
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.6444	0.0001	0.0001	0.0025	0.0000	0.0312
	480	432	480	480	480	480	480	480	480	430	480	480	480
BCMFGHGE	0.27976	0.28318	0.18549	0.05028	-0.01972	0.06539	-0.22308	-0.22271	-0.04778	0.14906	-0.02701	0.09836	1.00000
	0.0001	0.0001	0.0001	0.2716	0.6666	0.1526	0.0001	0.0001	0.2962	0.0011	0.5549	0.0312	0.0000
	480	432	480	480	480	480	480	480	480	480	480	480	480
POPDEN	0.29374	0.29332	0.24128	-0.11571	-0.35204	0.04661	-0.21205	-0.20071	-0.51441	-0.25105	-0.53478	0.17880	-0.04587
	0.0001	0.0001	0.0001	0.0112	0.0001	0.3082	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.3159
	480	432	480	480	480	480	480	480	480	480	480	480	480
DODINV	0.23568	0.24078	0.05006	-0.14557	-0.24506	-0.00194	-0.21749	-0.13512	-0.31484	-0.25420	-0.27628	-0.13093	-0.07519
	0.0001	0.0001	0.2737	0.0014	0.0001	0.9662	0.0001	0.0030	0.0001	0.0001	0.0001	0.0041	0.0999
	480	432	480	480	480	480	480	480	480	480	480	480	480
DODEXP	-0.07691	-0.06901	-0.29263	0.04183	0.11273	-0.01964	0.00538	0.09664	-0.00142	-0.01519	0.21963	-0.13465	-0.42490
	0.0924	0.1522	0.0001	0.3605	0.0135	0.6678	0.9064	0.0343	0.9752	0.7399	0.0001	0.0031	0.0001
	420	432	480	460	480	430	480	480	480	480	480	480	480
NETFED	-0.35372	-0.38015	-0.16097	0.19706	0.23594	-0.04076	0.42979	0.16990	0.41387	0.29653	0.24434	0.11793	-0.33212
	0.0001	0.0001	0.0004	0.0001	0.0001	0.3729	0.0001	0.0002	0.0001	0.0001	0.0001	0.0097	0.0001
	480	432	480	480	480	480	480	430	480	480	480	480	480

TABLE 13 - CONTINUED

	POPDEN	DODINV	DODEXP	NETFED
LPERINC	0.29374 0.0001 480	0.23568 0.0001 480	-0.07691 0.0924 480	-0.35372 0.0001 480
LLAGPI	0.29332 0.0001 432	0.24078 0.0001 432	-0.06901 0.1522 432	-0.38015 0.0001 432
BCPRPTAX	0.24128 0.0001 480	0.05006 0.2737 480	-0.29263 0.0001 480	-0.16097 0.0004 480
BCOTHTAX	-0.11571 0.0112 480	-0.14557 0.0014 480	0.04183 0.3605 480	0.19706 0.0001 480
BCUSRFEE	-0.35204 0.0001 480	-0.24506 0.0001 480	0.11273 0.0135 480	0.23594 0.0001 480
BCDEFICT	0.04661 0.3032 480	-0.00194 0.9662 480	-0.01964 0.6678 480	-0.04076 0.3729 480
BCINTGOV	-0.21205 0.0001 480	-0.21749 0.0001 480	0.00538 0.9064 480	0.42979 0.0001 480
BCHLHOSX	-0.20071 0.0001 480	-0.13512 0.0030 480	0.09664 0.0343 480	0.16990 0.0002 480
BCHWYEX	-0.51441 0.0001 480	-0.31484 0.0001 480	-0.00142 0.9752 480	0.41387 0.0001 430
BCLOCEDX	-0.25105 0.0001 480	-0.25420 0.0001 480	-0.01519 0.7399 480	0.29653 0.0001 480
BCHIEDEX	-0.53478 0.0001 480	-0.27628 0.0001 480	0.21963 0.0001 480	0.24434 0.0001 480
BCOTHEX	0.17880 0.0001 480	-0.13093 0.0041 480	-0.13465 0.0031 480	0.11793 0.0097 480
BCMFGWGE	-0.04587 0.3159 480	-0.07519 0.0999 480	-0.42490 0.0001 480	-0.33212 0.0001 480
POPDEN	1.00000 0.0000 480	0.27409 0.0001 480	-0.12118 0.0079 480	-0.28430 0.0001 480
DODINV	0.27409 0.0001 480	1.00000 0.0000 480	0.11435 0.0122 480	-0.16191 0.0004 480
DODEXP	-0.12118 0.0079 480	0.11435 0.0122 480	1.00000 0.0000 480	0.25728 0.0001 480
NETFED	-0.28430 0.0001 430	-0.16191 0.0004 480	0.25723 0.0001 480	1.00000 0.0000 480

TABLE 14 - OLS ESTIMATION OF HELMS' BASIC LPERINC MODEL

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	13	455.19586	35.01506599	38271.238	0.0001
ERROR	418	0.38243596	0.000914919		
C TOTAL	431	455.57829			

ROOT MSE	0.03024762	R-SQUARE	0.9992
DEP MEAN	3.470105	ADJ R-SQ	0.9991
C.V.	0.871663		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	0.12188455	0.01766248	6.901	0.0001
LLAGPI	1	0.99944553	0.002539616	393.542	0.0001
BCPRPTAX	1	-1.08122943	0.32022621	-3.376	0.0008
BCOTHTAX	1	-1.34817450	0.33833421	-3.984	0.0001
BCUSRFEE	1	-1.93360483	0.35386894	-5.388	0.0001
BCDEFICT	1	-1.99921376	0.34302758	-5.828	0.0001
BCINTGOV	1	-1.04285266	0.30238404	-3.449	0.0006
BCHLHOSX	1	0.97648984	0.45456357	2.148	0.0323
BCHWYEX	1	0.60970546	0.44935638	1.357	0.1756
BCLOCEDX	1	0.40680684	0.43867563	0.927	0.3543
BCHIEDEX	1	1.89551621	0.53329838	3.554	0.0004
BCOTHEX	1	1.57407678	0.36940916	4.261	0.0001
BCMFGWGE	1	-0.02380377	0.01308278	-1.819	0.0696
POPDEN	1	-0.02014231	0.009920655	-2.030	0.0430

TABLE 15 - COVARIANCE ESTIMATION OF HELMS' BASIC LPERINC MODEL

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	68	455.46465	6.69800959	21395.058	0.0001
ERROR	363	0.11364201	0.000313063		
C TOTAL	431	455.57829			

ROOT MSE	0.0176936	R-SQUARE	0.9998
DEP MEAN	3.470105	ADJ R-SQ	0.9997
C.V.	0.5098866		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	0.99177406	0.08534509	11.621	0.0001
LLAGPI	1	0.74790479	0.02690738	27.796	0.0001
BCPRPTAX	1	-0.87776633	0.66846032	-1.313	0.1900
BCOTHTAX	1	-0.85735240	0.64196899	-1.336	0.1825
BCUSRFEE	1	-0.11287015	0.64902696	-0.174	0.8620
BCDEFICT	1	-0.73777917	0.62479459	-1.181	0.2384
BCINTGOV	1	-1.74891412	0.64966507	-2.692	0.0074
BCHLHOSX	1	-1.33701814	0.97694949	-1.369	0.1720
BCHWYEX	1	1.28282835	0.73786858	1.739	0.0830
BCLOCEDX	1	-0.23050874	0.78836499	-0.292	0.7702
BCHIEDEX	1	-1.15145993	1.02897089	-1.119	0.2639
BCOTHEX	1	-1.12165381	0.70183465	-1.598	0.1109
BCMFGWGE	1	0.11326119	0.04303573	2.632	0.0089
POPDEN	1	1.06898729	0.34826435	3.069	0.0023
YR3	1	0.01881915	0.003974171	4.735	0.0001
YR4	1	-0.001402198	0.004588701	-0.306	0.7601
YR5	1	-0.01464741	0.005331004	-2.748	0.0063
YR6	1	-0.005148064	0.005896516	-0.873	0.3832
YR7	1	-0.03502489	0.006795253	-5.154	0.0001
YR8	1	0.01240153	0.007029452	1.764	0.0785
YR9	1	0.02136108	0.007744179	2.758	0.0061
YR10	1	0.01016936	0.008287248	1.227	0.2206
ST2	1	0.01973108	0.02564303	0.769	0.4421
ST3	1	-0.12705095	0.01901977	-6.680	0.0001
ST4	1	0.46309012	0.05146722	8.998	0.0001
ST5	1	0.02927372	0.02449621	1.195	0.2329
ST6	1	-0.60728013	0.19415590	-3.128	0.0019
ST7	1	-0.65998192	0.11226960	-5.879	0.0001
ST8	1	0.16181839	0.03766885	4.296	0.0001
ST9	1	0.10438137	0.01675493	6.230	0.0001
ST10	1	-0.30427263	0.03790002	-8.028	0.0001
ST11	1	0.14157308	0.04344592	3.259	0.0012
ST12	1	-0.05000597	0.02655972	-1.883	0.0605
ST13	1	-0.06347309	0.02250770	-2.820	0.0051
ST14	1	-0.06632858	0.02450112	-2.707	0.0071
ST15	1	-0.06496497	0.01709787	-3.800	0.0002
ST16	1	0.02204313	0.01466022	1.504	0.1336
ST17	1	-0.24522032	0.03576450	-6.857	0.0001
ST18	1	-0.29680655	0.12033032	-2.467	0.0141
ST19	1	-0.51523723	0.22268938	-2.314	0.0212
ST20	1	0.14195758	0.03600322	3.943	0.0001
ST21	1	0.10373944	0.02076094	4.997	0.0001
ST22	1	-0.07814915	0.01502770	-5.200	0.0001
ST23	1	0.03810960	0.01840829	2.070	0.0391
ST24	1	-0.31481754	0.04771350	-6.598	0.0001
ST25	1	-0.16939416	0.02806741	-6.035	0.0001
ST26	1	-0.23973172	0.03987874	-6.012	0.0001
ST27	1	-0.36529954	0.04355637	-8.387	0.0001
ST28	1	-0.75942431	0.30716594	-2.472	0.0139
ST29	1	-0.14931917	0.03011403	-4.958	0.0001
ST30	1	0.21608078	0.09386283	2.302	0.0219
ST31	1	0.07429405	0.02017145	3.683	0.0003
ST32	1	-0.33143197	0.04263335	-7.774	0.0001
ST33	1	0.03313074	0.05671524	0.584	0.5595
ST34	1	-0.02812308	0.01795771	-1.566	0.1182
ST35	1	0.005328315	0.02866737	0.203	0.8390
ST36	1	0.07206613	0.05850464	1.334	0.1829
ST37	1	-1.14227764	0.30720980	-3.718	0.0002

TABLE 15 - CONTINUED

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
ST38	1	-0.06979667	0.01722712	-4.052	0.0001
ST39	1	-0.34672987	0.04377676	-7.920	0.0001
ST40	1	-0.001913576	0.01505094	-0.127	0.8989
ST41	1	0.35866620	0.04766106	7.525	0.0001
ST42	1	-0.14648949	0.03008756	-4.869	0.0001
ST43	1	-0.41488007	0.05122477	-8.099	0.0001
ST44	1	0.04489546	0.02243142	2.001	0.0461
ST45	1	0.05224838	0.02481938	2.105	0.0360
ST46	1	-0.21673059	0.02962176	-7.317	0.0001
ST47	1	0.07418422	0.02030269	3.654	0.0003
ST48	1	-0.31425292	0.04756870	-6.606	0.0001

TABLE 16 - PARKS' ESTIMATION OF HELMS' BASIC LPERINC MODEL

SOURCE	B VALUES	T FOR H:B=0	PROB>|T|	STD ERR B
$INT	0.127144	3.6862	0.0003	0.034492
LLAGPI	1.00112	345.69	0.0	0.0028960
BCPRPTAX	-1.55239	-3.7320	0.0002	0.41597
BCOTHTAX	-2.00044	-6.2617	0.0000	0.31947
BCUSRFEE	-2.92666	-6.0905	0.0000	0.48053
BCDEFICT	-2.76720	-7.2763	0.0000	0.38030
BCINTGOV	-1.17643	-3.8846	0.0001	0.30284
BCHLHOSX	1.49974	3.8967	0.0001	0.38488
BCHWYEX	1.11553	1.6355	0.1027	0.68207
BCLOCEDX	0.343985	0.69412	0.4880	0.49557
BCHIEDEX	2.68336	5.5349	0.0000	0.48481
BCOTHEX	2.30925	5.8687	0.0000	0.39348
BCMFGWGE	-0.00590560	-0.20063	0.8411	0.029435
POPDEN	-0.0438313	-2.2977	0.0221	0.019076

DEGREES OF FREEDOM FOR T-STATISTICS = 418

TABLE 17 - OLS ESTIMATION OF DOD LPERINC MODEL

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	15	455.20017	30.34667808	33386.571	0.0001
ERROR	416	0.37812263	0.000908949		
C TOTAL	431	455.57829			

ROOT MSE	0.03014877	R-SQUARE	0.9992
DEP MEAN	3.470105	ADJ R-SQ	0.9991
C.V.	0.8688145		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	0.10420312	0.01959912	5.317	0.0001
LLAGPI	1	0.99882657	0.002548216	391.971	0.0001
BCPRPTAX	1	-0.90548681	0.33290520	-2.720	0.0068
BCOTHTAX	1	-1.23616544	0.34255427	-3.609	0.0003
BCUSRFEE	1	-1.82330593	0.36201018	-5.037	0.0001
BCDEFICT	1	-1.88235066	0.34619797	-5.437	0.0001
BCINTGOV	1	-0.90579915	0.30903545	-2.931	0.0036
BCHLHOSX	1	0.95923352	0.45640323	2.102	0.0362
BCHWYEX	1	0.55621389	0.45093016	1.233	0.2181
BCLOCEDX	1	0.18925814	0.45388775	0.417	0.6769
BCHIEDEX	1	1.64390340	0.54672845	3.007	0.0028
BCOTHEX	1	1.47088425	0.37337215	3.939	0.0001
BCMFGWGE	1	-0.01044841	0.01441400	-0.725	0.4689
POPDEN	1	-0.02068091	0.009904421	-2.088	0.0374
DODINV	1	0.01363994	0.07369589	0.185	0.8533
DODEXP	1	0.20917697	0.09963941	2.099	0.0364

TABLE 18 - COVARIANCE ESTIMATION OF DOD LPERINC MODEL

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	70	455.46484	6.50664053	20703.023	0.0001
ERROR	361	0.11345673	0.000314285		
C TOTAL	431	455.57829			

ROOT MSE	0.01772807	R-SQUARE	0.9998
DEP MEAN	3.470105	ADJ R-SQ	0.9997
C.V.	0.51088		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	0.99715760	0.08780170	11.357	0.0001
LLAGPI	1	0.74659865	0.02733524	27.313	0.0001
BCPRPTAX	1	-0.89032529	0.67114685	-1.327	0.1855
BCOTHTAX	1	-0.88722699	0.64585635	-1.374	0.1704
BCUSRFEE	1	-0.14155060	0.65310549	-0.217	0.8285
BCDEFICT	1	-0.76274409	0.62791816	-1.215	0.2253
BCINTGOV	1	-1.79440159	0.65385682	-2.744	0.0064
BCHLHOSX	1	-1.26078468	0.98410935	-1.281	0.2010
BCHWYEX	1	1.31713773	0.74380816	1.771	0.0774
BCLOCEDX	1	-0.20062943	0.79224261	-0.253	0.8002
BCHIEDEX	1	-1.05779678	1.05431125	-1.003	0.3164
BCOTHEX	1	-1.11441607	0.70361433	-1.584	0.1141
BCMFGWGE	1	0.11377785	0.04322497	2.632	0.0088
POPDEN	1	1.06970026	0.34994095	3.057	0.0024
DODINV	1	0.08948592	0.12658627	0.707	0.4801
DODEXP	1	-0.07290489	0.25898902	-0.281	0.7785
YR3	1	0.01865128	0.003987978	4.677	0.0001
YR4	1	-0.001428576	0.004618163	-0.309	0.7572
YR5	1	-0.01460042	0.005344543	-2.732	0.0066
YR6	1	-0.005305146	0.005928548	-0.895	0.3715
YR7	1	-0.03555899	0.006914078	-5.143	0.0001
YR8	1	0.01192689	0.007128474	1.673	0.0952
YR9	1	0.02093350	0.007833774	2.672	0.0079
YR10	1	0.009717156	0.008388436	1.158	0.2475
ST2	1	0.01638094	0.02621236	0.625	0.5324
ST3	1	-0.12858273	0.02027940	-6.341	0.0001
ST4	1	0.46274372	0.05216876	8.870	0.0001
ST5	1	0.02828410	0.02460247	1.150	0.2511
ST6	1	-0.61619824	0.19540593	-3.153	0.0017
ST7	1	-0.66317347	0.11396098	-5.819	0.0001
ST8	1	0.16195354	0.03774269	4.291	0.0001
ST9	1	0.10450367	0.01716533	6.088	0.0001
ST10	1	-0.30659419	0.03976973	-7.709	0.0001
ST11	1	0.14251909	0.04382722	3.254	0.0012
ST12	1	-0.05300091	0.02772302	-1.912	0.0567
ST13	1	-0.06636953	0.02493503	-2.662	0.0081
ST14	1	-0.06934790	0.02492963	-2.782	0.0057
ST15	1	-0.06407639	0.01759019	-3.643	0.0003
ST16	1	0.02094951	0.01517955	1.380	0.1684
ST17	1	-0.24888014	0.03651392	-6.816	0.0001
ST18	1	-0.29723571	0.12066935	-2.463	0.0142
ST19	1	-0.51947335	0.22375105	-2.322	0.0208
ST20	1	0.14102428	0.03656241	3.857	0.0001
ST21	1	0.10136526	0.02174915	4.661	0.0001
ST22	1	-0.08262411	0.01614630	-5.117	0.0001
ST23	1	0.03157492	0.02038858	1.549	0.1223
ST24	1	-0.31675205	0.04913343	-6.447	0.0001
ST25	1	-0.17085623	0.02890414	-5.911	0.0001
ST26	1	-0.24050212	0.04040124	-5.953	0.0001
ST27	1	-0.36892895	0.04430307	-8.327	0.0001
ST28	1	-0.75986158	0.30872043	-2.461	0.0143
ST29	1	-0.14953877	0.03017463	-4.956	0.0001
ST30	1	0.21687378	0.09412955	2.304	0.0218
ST31	1	0.07521105	0.02024979	3.714	0.0002
ST32	1	-0.33251823	0.04327814	-7.683	0.0001
ST33	1	0.03248548	0.05718360	0.568	0.5703
ST34	1	-0.02749275	0.01801313	-1.526	0.1278
ST35	1	0.004623293	0.03030994	0.153	0.8789

TABLE 18 - CONTINUED

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
ST36	1	0.07891441	0.05876914	1.343	0.1802
ST37	1	-1.14422207	0.30903799	-3.703	0.0002
ST38	1	-0.06846599	0.01748072	-3.917	0.0001
ST39	1	-0.34843546	0.04518603	-7.711	0.0001
ST40	1	-0.002902126	0.01621282	-0.179	0.8580
ST41	1	0.35772166	0.04802177	7.449	0.0001
ST42	1	-0.14803508	0.03022353	-4.898	0.0001
ST43	1	-0.42091865	0.05451514	-7.721	0.0001
ST44	1	0.04827327	0.02904799	1.662	0.0974
ST45	1	0.04962416	0.02513086	1.975	0.0491
ST46	1	-0.21862191	0.03249443	-6.728	0.0001
ST47	1	0.07232070	0.02214635	3.266	0.0012
ST48	1	-0.31793204	0.04956916	-6.414	0.0001

TABLE 19 - PARKS' ESTIMATION OF DOD LPERINC MODEL

SOURCE	B VALUES	T FOR H:B=0	PROB>|T|	STD ERR B
$INT	0.119360	3.0350	0.0026	0.039328
LLAGPI	1.00121	301.02	0.0	0.0033261
BCPRPTAX	-1.42866	-3.2189	0.0014	0.44383
BCOTHTAX	-1.68476	-4.5682	0.0000	0.36880
BCUSRFEE	-2.54163	-4.7036	0.0000	0.54035
BCDEFICT	-2.40303	-5.6087	0.0000	0.42844
BCINTGOV	-1.09004	-3.2673	0.0012	0.33362
BCHLHOSX	1.40750	2.5528	0.0110	0.55135
BCHWYEX	0.656684	0.84717	0.3974	0.77515
BCLOCEDX	0.570327	0.99173	0.3219	0.57508
BCHIEDEX	2.51082	4.8086	0.0000	0.52215
BCOTHEX	1.80271	4.0316	0.0001	0.44715
BCMFGWGE	-0.0129677	-0.39226	0.6951	0.033059
POPDEN	-0.0540060	-2.4739	0.0138	0.021831
DODINV	0.157702	1.6059	0.1091	0.098201
DODEXP	-0.0349090	-0.12484	0.9007	0.27964

DEGREES OF FREEDOM FOR T-STATISTICS = 416

TABLE 20 - OLS ESTIMATION OF DOD/NETFED LPERINC MODEL

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	16	455.20518	28.45032394	31644.446	0.0001
ERROR	415	0.37311080	0.000899062		
C TOTAL	431	455.57829			

ROOT MSE	0.02998437	R-SQUARE	0.9992
DEP MEAN	3.470105	ADJ R-SQ	0.9991
C.V.	0.8640767		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	0.08389550	0.02130556	3.938	0.0001
LLAGPI	1	0.99907217	0.002536454	393.885	0.0001
BCPRPTAX	1	-0.76247356	0.33658493	-2.265	0.0240
BCOTHTAX	1	-1.17889152	0.34154875	-3.452	0.0006
BCUSRFEE	1	-1.80639749	0.36010725	-5.016	0.0001
BCDEFICT	1	-1.90063183	0.34439711	-5.519	0.0001
BCINTGOV	1	-0.96235946	0.30828236	-3.122	0.0019
BCHLHOSX	1	0.95039773	0.45392977	2.094	0.0369
BCHWYEX	1	0.44431206	0.45096856	0.985	0.3251
BCLOCEDX	1	-0.06030113	0.46362221	-0.130	0.8966
BCHIEDEX	1	1.80764774	0.54815196	3.298	0.0011
BCOTHEX	1	1.42133039	0.37192870	3.822	0.0002
BCMFGWGE	1	-0.002949747	0.01468300	-0.201	0.8409
POPDEN	1	-0.01832551	0.009900798	-1.851	0.0649
DODINV	1	0.01591667	0.07330035	0.217	0.8282
DODEXP	1	0.18274158	0.09972657	1.832	0.0676
NETFED	1	0.11170420	0.04731142	2.361	0.0187

TABLE 21 - COVARIANCE ESTIMATION OF DOD/NETFED LPERINC MODEL

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	71	455.46651	6.41502128	20659.687	0.0001
ERROR	360	0.11178329	0.000310509		
C TOTAL	431	455.57829			

ROOT MSE	0.01762127	R-SQUARE	0.9998
DEP MEAN	3.470105	ADJ R-SQ	0.9997
C.V.	0.5078022		

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
INTERCEP	1	1.07615710	0.09367252	11.489	0.0001
LLAGPI	1	0.72875825	0.02823644	25.809	0.0001
BCPRPTAX	1	-0.80676429	0.66807385	-1.208	0.2280
BCOTHTAX	1	-0.83933683	0.64229672	-1.307	0.1921
BCUSRFEE	1	-0.07698986	0.64976623	-0.118	0.9057
BCDEFICT	1	-0.66937354	0.62542980	-1.070	0.2852
BCINTGOV	1	-1.81025198	0.64995349	-2.785	0.0056
BCHLHOSX	1	-1.34621694	0.97887253	-1.375	0.1699
BCHWYEX	1	1.27966127	0.73950327	1.730	0.0844
BCLOCEDX	1	-0.29370942	0.78848977	-0.372	0.7097
BCHIEDEX	1	-0.90286687	1.05008235	-0.860	0.3905
BCOTHEX	1	-1.06753312	0.69966688	-1.526	0.1279
BCMFGWGE	1	0.10882707	0.04301745	2.530	0.0118
POPDEN	1	1.18377599	0.35128652	3.370	0.0008
DODINV	1	0.09621295	0.12585701	0.764	0.4451
DODEXP	1	-0.02708596	0.25818422	-0.105	0.9165
NETFED	1	-0.14097353	0.06072525	-2.321	0.0208
YR3	1	0.01882150	0.003964630	4.747	0.0001
YR4	1	-0.003389926	0.004667443	-0.726	0.4681
YR5	1	-0.01682391	0.005397995	-3.117	0.0020
YR6	1	-0.008603215	0.006061662	-1.419	0.1567
YR7	1	-0.03764299	0.006930806	-5.431	0.0001
YR8	1	0.009993268	0.007134316	1.401	0.1622
YR9	1	0.01900976	0.007830640	2.428	0.0157
YR10	1	0.009619146	0.008338007	1.154	0.2494
ST2	1	0.01335700	0.02608699	0.512	0.6090
ST3	1	-0.13189401	0.02020763	-6.527	0.0001
ST4	1	0.48223898	0.05253006	9.180	0.0001
ST5	1	0.02769813	0.02445556	1.133	0.2581
ST6	1	-0.68618821	0.19655464	-3.491	0.0005
ST7	1	-0.73110652	0.11699313	-6.249	0.0001
ST8	1	0.16809643	0.03760851	4.470	0.0001
ST9	1	0.10582636	0.01707143	6.199	0.0001
ST10	1	-0.32014217	0.03995860	-8.012	0.0001
ST11	1	0.14723214	0.04360847	3.376	0.0008
ST12	1	-0.05854579	0.02765932	-2.117	0.0350
ST13	1	-0.07020724	0.02483987	-2.826	0.0050
ST14	1	-0.07393407	0.02485807	-2.974	0.0031
ST15	1	-0.06849192	0.01758737	-3.894	0.0001
ST16	1	0.01669463	0.01519902	1.098	0.2728
ST17	1	-0.26834314	0.03724968	-7.204	0.0001
ST18	1	-0.33194700	0.12087075	-2.746	0.0063
ST19	1	-0.58790081	0.22434778	-2.620	0.0092
ST20	1	0.14323416	0.03635460	3.940	0.0001
ST21	1	0.10190291	0.02161936	4.714	0.0001
ST22	1	-0.08932342	0.01630641	-5.478	0.0001
ST23	1	0.04062358	0.02063718	1.968	0.0498
ST24	1	-0.33222812	0.04929382	-6.741	0.0001
ST25	1	-0.17880581	0.02893336	-6.180	0.0001
ST26	1	-0.25908162	0.04094757	-6.327	0.0001
ST27	1	-0.40201645	0.04628522	-8.686	0.0001
ST28	1	-0.85576075	0.30962854	-2.764	0.0060
ST29	1	-0.14786799	0.03000148	-4.929	0.0001
ST30	1	0.20772955	0.09364534	2.218	0.0272
ST31	1	0.06977677	0.02026345	3.443	0.0006
ST32	1	-0.35541463	0.04413356	-8.053	0.0001
ST33	1	0.02817678	0.05686939	0.495	0.6206
ST34	1	-0.02949371	0.01792534	-1.645	0.1008

TABLE 21 - CONTINUED

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
ST35	1	0.001470621	0.03015793	0.049	0.9611
ST36	1	0.08001125	0.05841699	1.370	0.1716
ST37	1	-1.26802687	0.31177117	-4.067	0.0001
ST38	1	-0.07987879	0.01805749	-4.424	0.0001
ST39	1	-0.36850680	0.04573839	-8.057	0.0001
ST40	1	0.003308420	0.01633569	0.203	0.8396
ST41	1	0.37881747	0.04858976	7.796	0.0001
ST42	1	-0.16590988	0.03101248	-5.350	0.0001
ST43	1	-0.45988226	0.05672650	-8.107	0.0001
ST44	1	0.04457374	0.02891694	1.541	0.1241
ST45	1	0.05295095	0.02502053	2.116	0.0350
ST46	1	-0.22680495	0.03249044	-6.981	0.0001
ST47	1	0.06988942	0.02203782	3.171	0.0016
ST48	1	-0.34896311	0.05105151	-6.836	0.0001

TABLE 22 - PARKS' ESTIMATION OF DOD/NETFED LPERINC MODEL

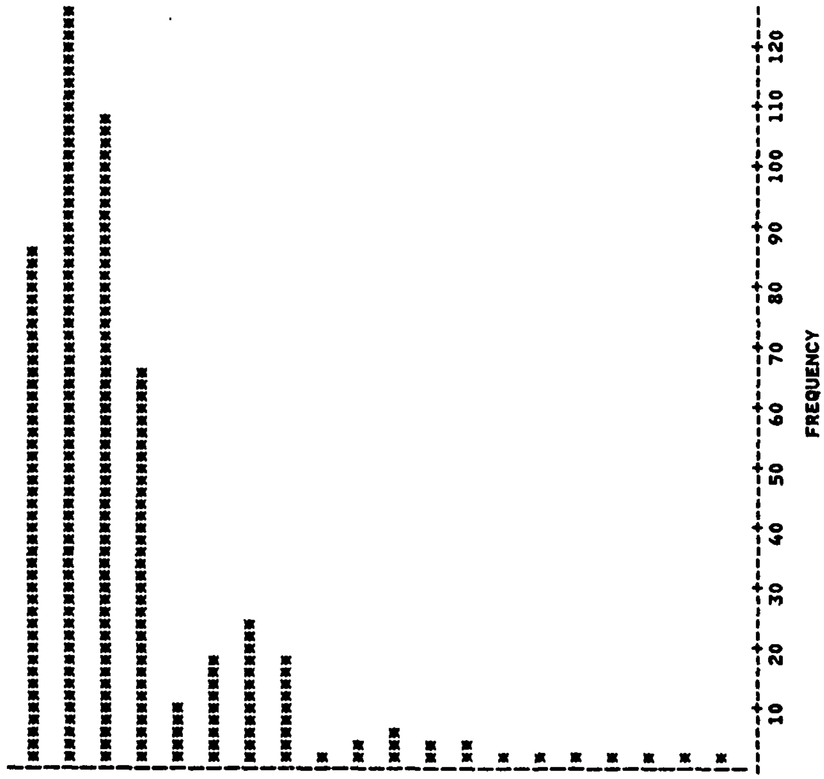
SOURCE	B VALUES	T FOR H:B=0	PROB>|T|	STD ERR B
$INT	0.108107	2.5258	0.0119	0.042802
LLAGPI	1.00262	310.25	0.0	0.0032316
BCPRPTAX	-1.72287	-3.2611	0.0012	0.52830
BCOTHTAX	-1.78380	-4.3304	0.0000	0.41193
BCUSRFEE	-2.91769	-4.9892	0.0000	0.58481
BCDEFICT	-2.70167	-5.9641	0.0000	0.45299
BCINTGOV	-1.52621	-3.9964	0.0001	0.38190
BCHLHOSX	1.81073	2.2698	0.0237	0.79776
BCHWYEX	1.08204	1.3232	0.1865	0.81774
BCLOCEDX	0.705016	1.1396	0.2551	0.61863
BCHIEDEX	2.48422	4.0228	0.0001	0.61754
BCOTHEX	2.15124	4.3778	0.0000	0.49140
BCMFGWGE	0.00478786	0.12084	0.9039	0.039622
POPDEN	-0.0596475	-2.6764	0.0077	0.022287
DODINV	0.114849	1.2057	0.2286	0.095258
DODEXP	-0.121776	-0.38412	0.7011	0.31703
NETFED	0.00679104	0.089328	0.9289	0.076024

DEGREES OF FREEDOM FOR T-STATISTICS = 415

TABLE 23 - DURBIN H-STATISTICS

	PERINC MODELS		**LPERINC MODELS**	
	Estimation Method		**Estimation Method**	
Model	**OLS**	**Covar.**	**OLS**	**Covar.**
Basic	4.869	1.851	2.352	-2.682
DoD	4.641	1.697	2.144	-2.726
DoD/NETFED	4.620	1.576	1.686	-2.027

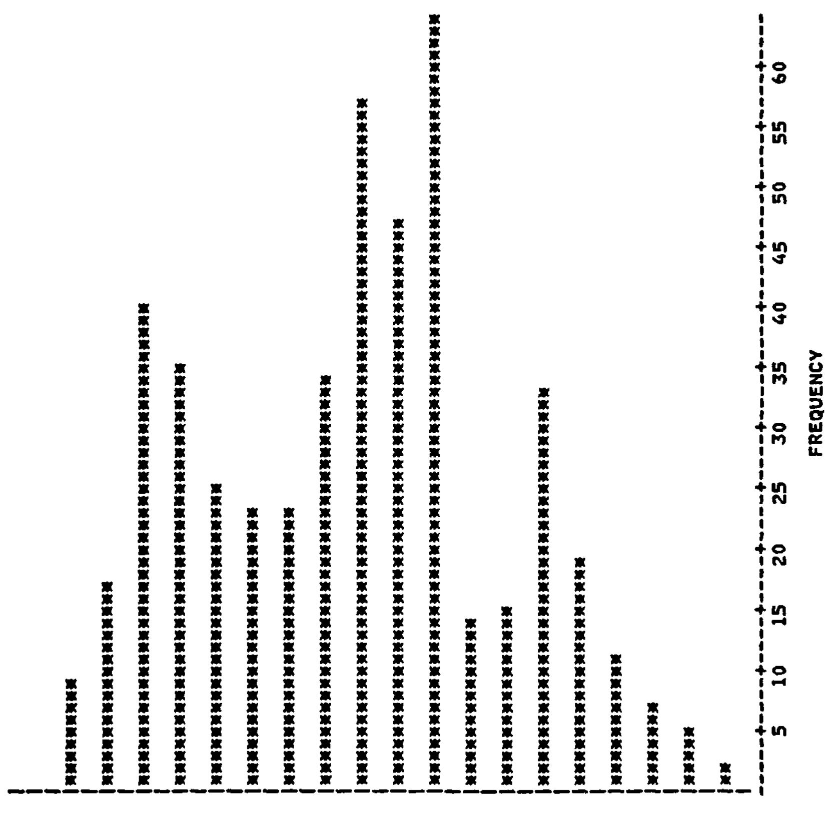
FREQUENCY BAR CHART



MIDPOINT PERINC	FREQ	CUM. FREQ	PERCENT	CUM. PERCENT
0	86	86	17.92	17.92
20	126	212	26.25	44.17
40	107	319	22.29	66.46
60	66	385	13.75	80.21
80	10	395	2.08	82.29
100	17	412	3.54	85.83
120	23	435	4.79	90.63
140	18	453	3.75	94.38
160	2	455	0.42	94.79
180	3	458	0.63	95.42
200	6	464	1.25	96.67
220	3	467	0.63	97.29
240	3	470	0.63	97.92
260	2	472	0.42	98.33
280	1	473	0.21	98.54
300	2	475	0.42	98.96
320	2	477	0.42	99.38
340	1	478	0.21	99.58
360	1	479	0.21	99.79
380	1	480	0.21	100.00

EXHIBIT 1 - Frequency Distribution of PERINC

FREQUENCY BAR CHART



MIDPOINT LPERINC	FREQ	CUM. FREQ	PERCENT	CUM. PERCENT
1.25	0	0	0.00	0.00
1.50	9	9	1.88	1.88
1.75	17	26	3.54	5.42
2.00	40	66	8.33	13.75
2.25	35	101	7.29	21.04
2.50	25	126	5.21	26.25
2.75	23	149	4.79	31.04
3.00	23	172	4.79	35.83
3.25	34	206	7.08	42.92
3.50	57	263	11.88	54.79
3.75	47	310	9.79	64.58
4.00	64	374	13.33	77.92
4.25	14	388	2.92	80.83
4.50	15	403	3.13	83.96
4.75	33	436	6.88	90.83
5.00	19	455	3.96	94.79
5.25	11	466	2.29	97.08
5.50	7	473	1.46	98.54
5.75	5	478	1.04	99.58
6.00	2	480	0.42	100.00

EXHIBIT 2 - Frequency Distribution of LPERINC

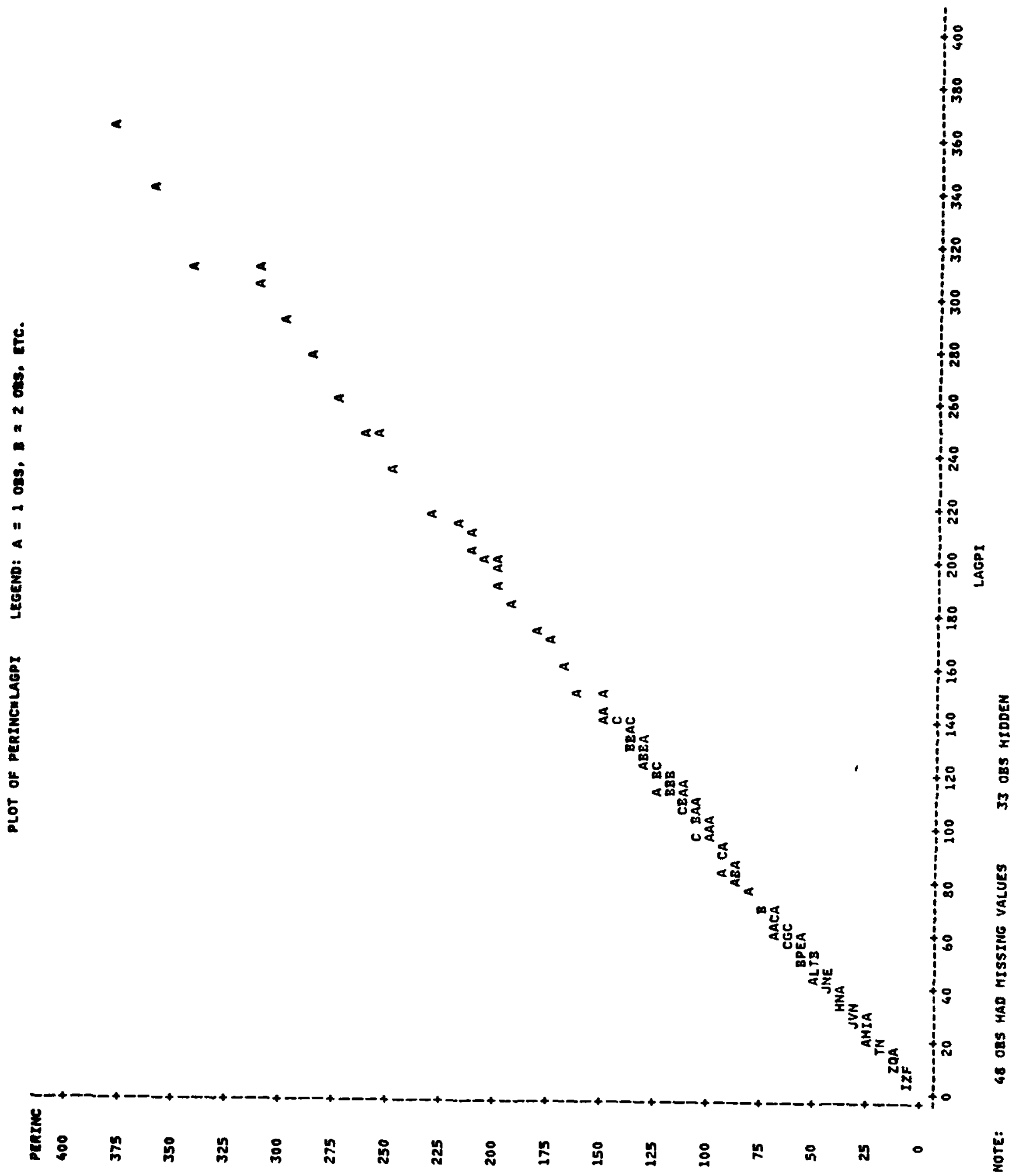


EXHIBIT 3 - Plot of PERINC versus LAGPI

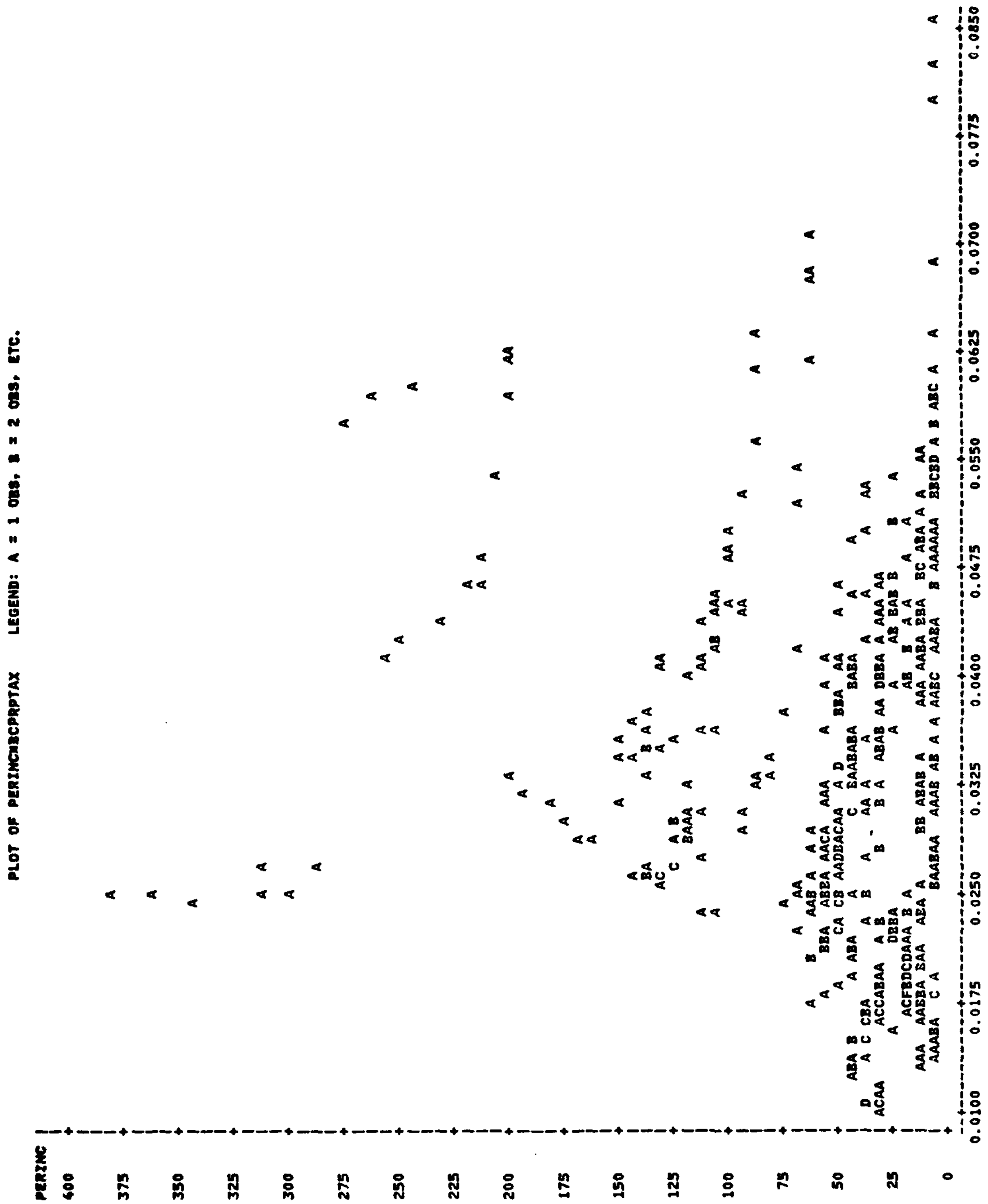


EXHIBIT 4 - Plot of PERINC versus BCPRPTAX

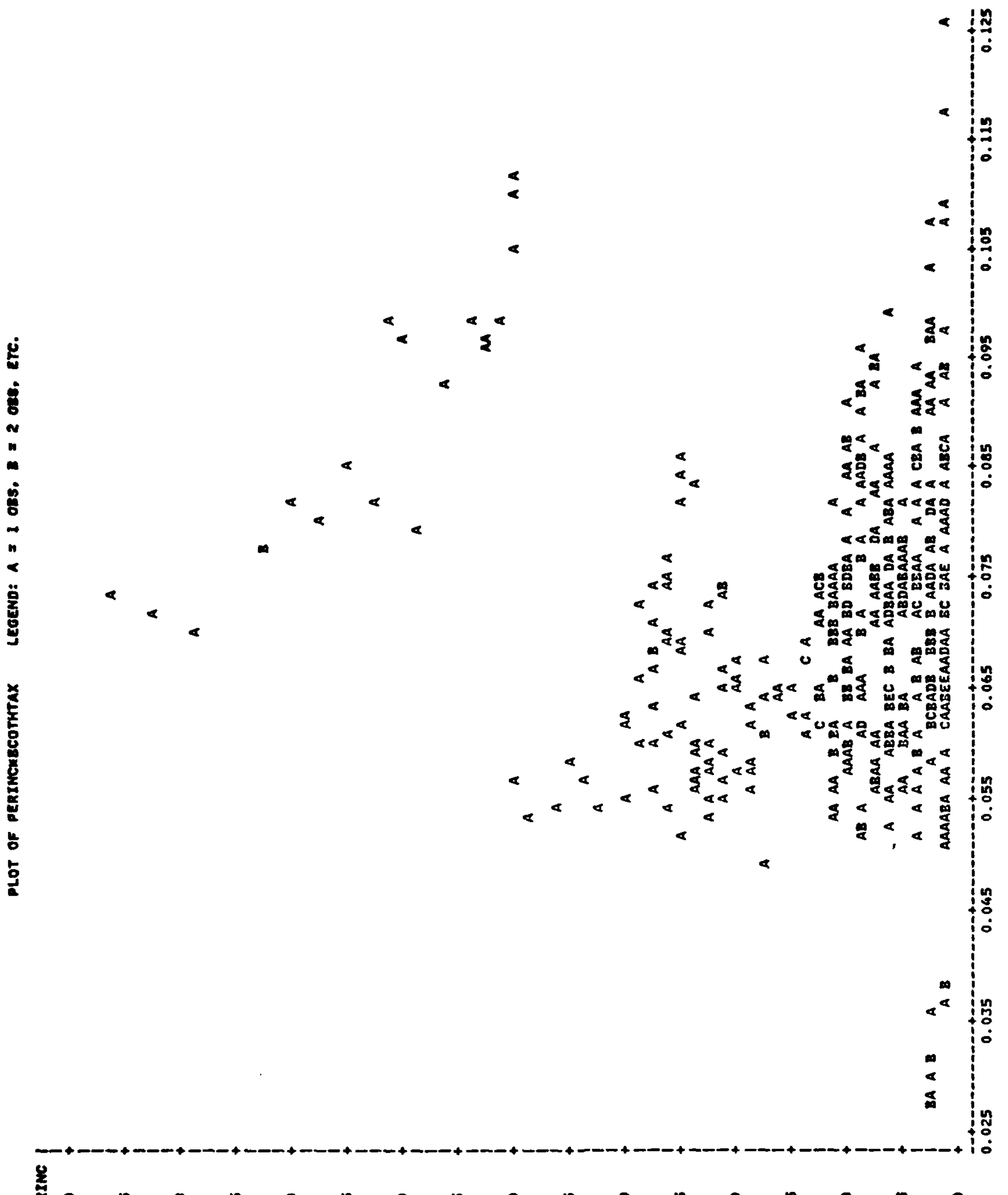


EXHIBIT 5 - Plot of PERINC versus BCOTHTAX

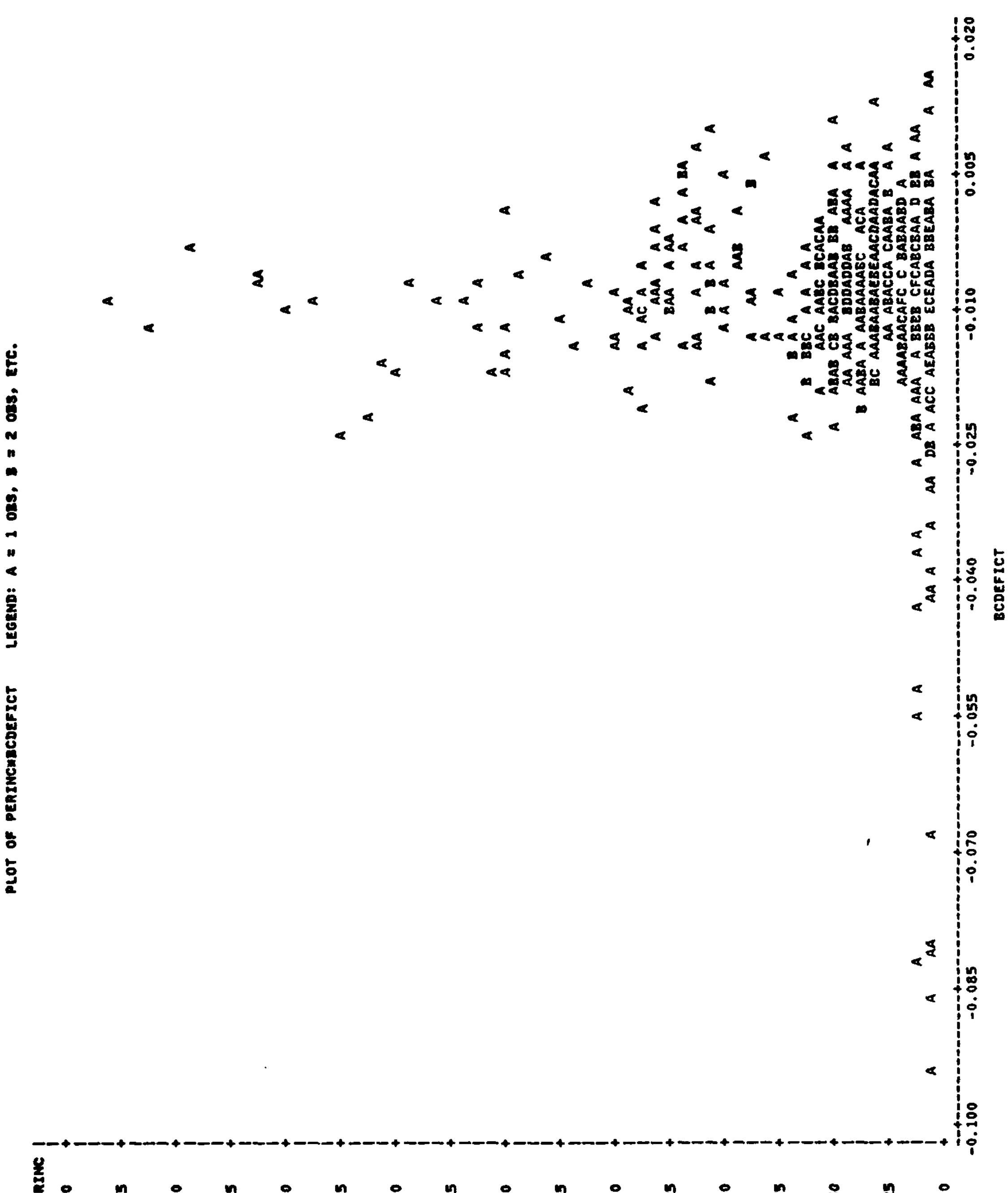


EXHIBIT 6 - Plot of PERINC versus BCDEFICT

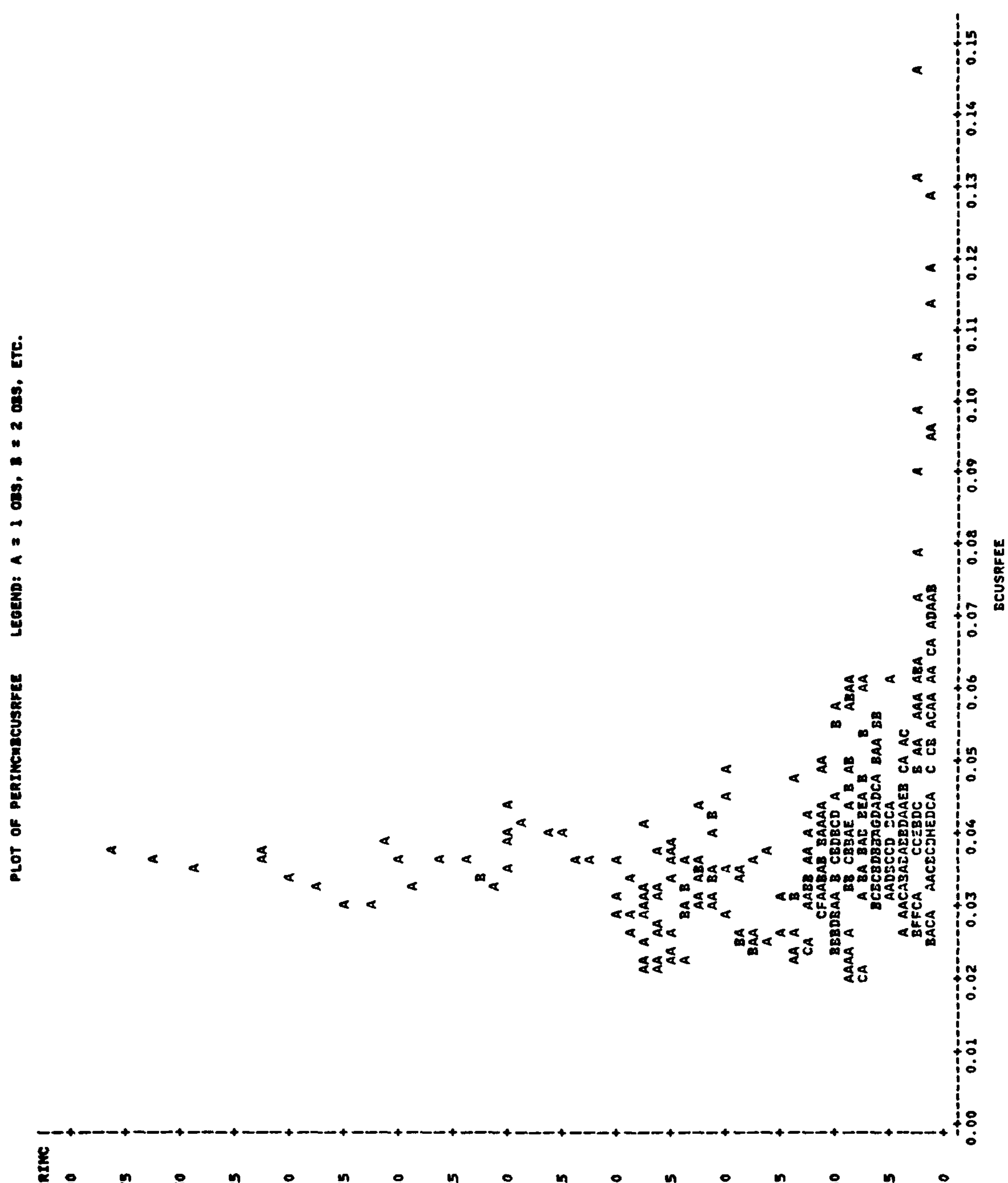


EXHIBIT 7 - Plot of PERINC versus BCUSRFEE

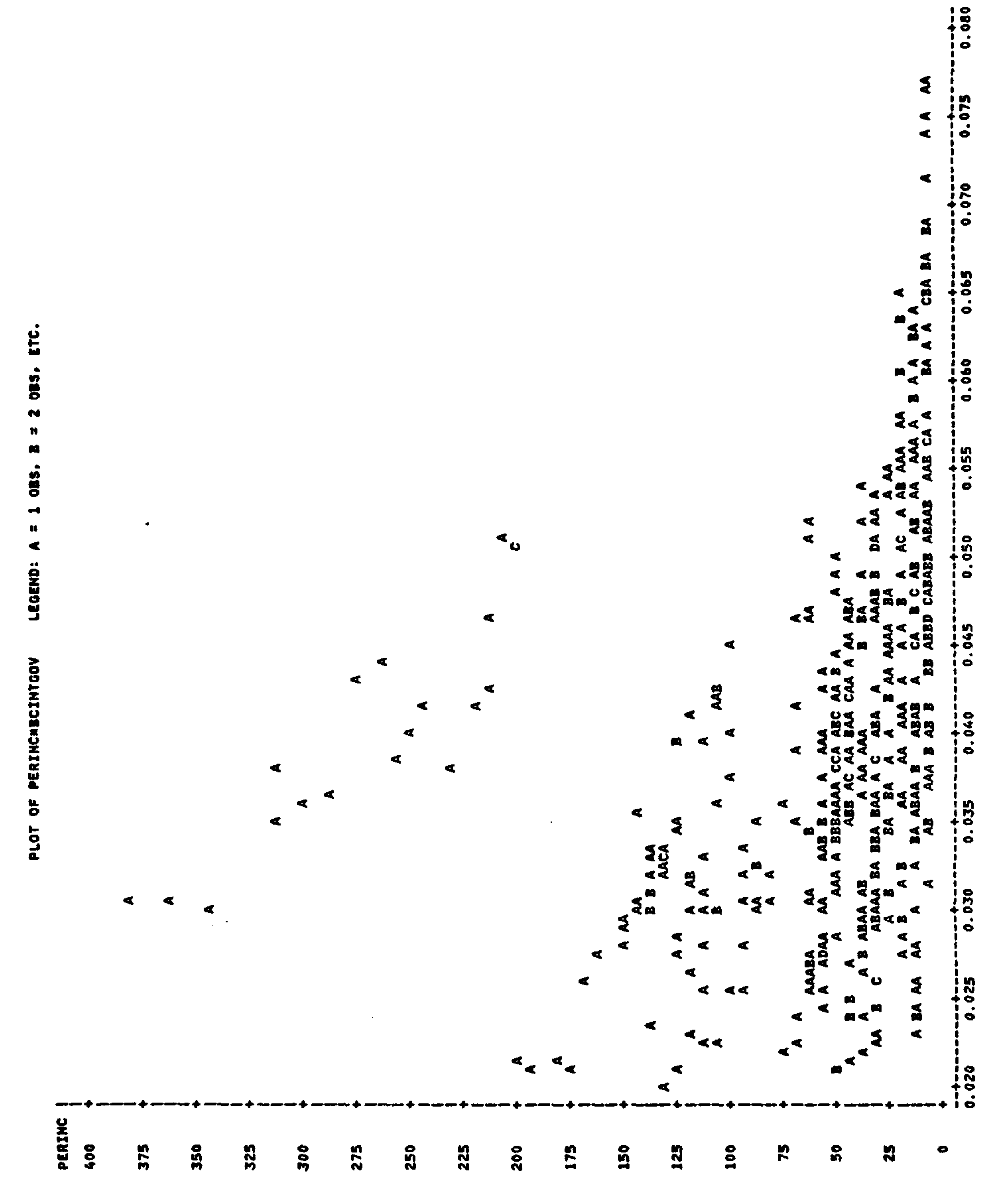


EXHIBIT 8 - Plot of PERINC versus BCINTGOV

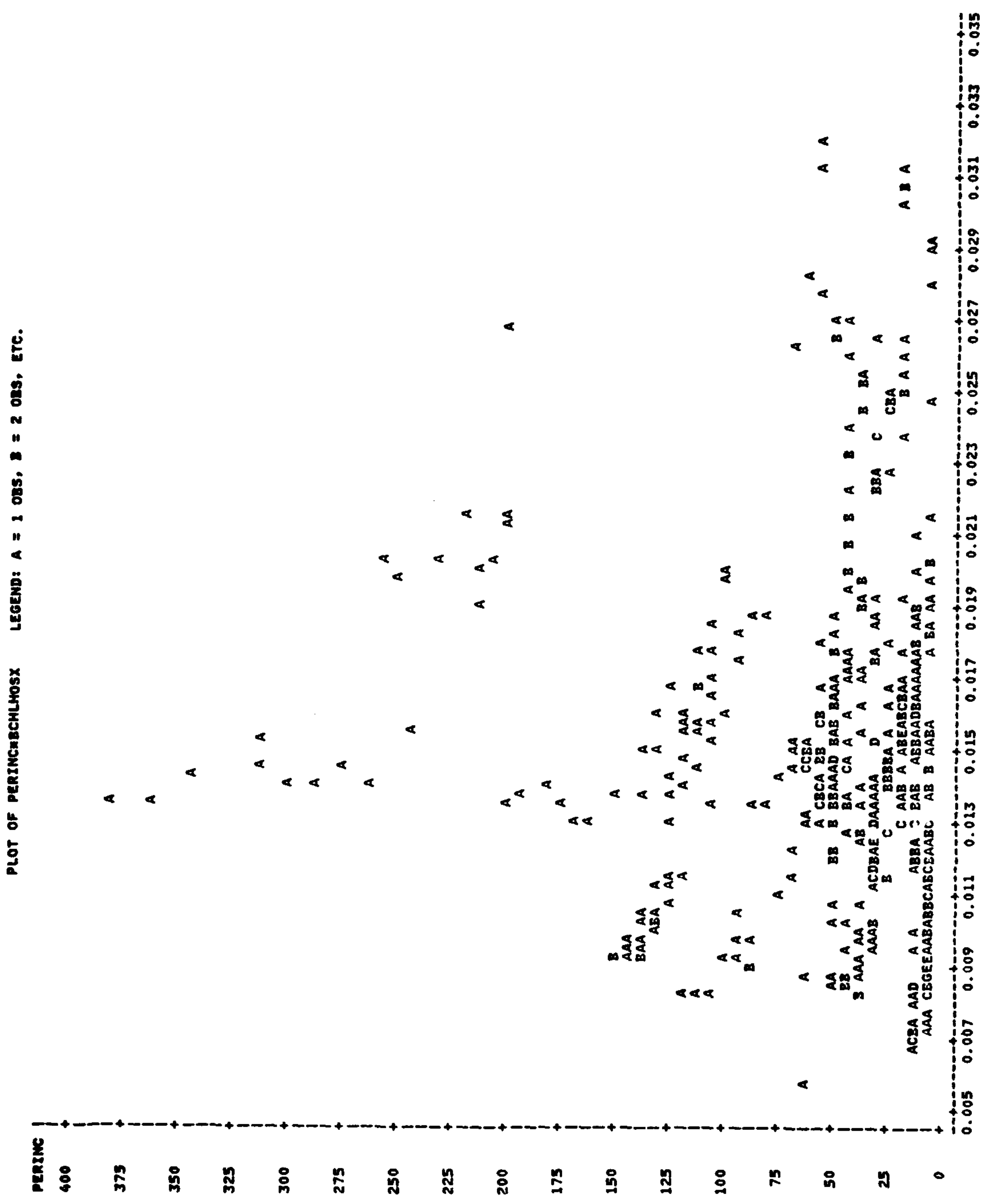


EXHIBIT 9 - Plot of PERINC versus BCHLHOSX

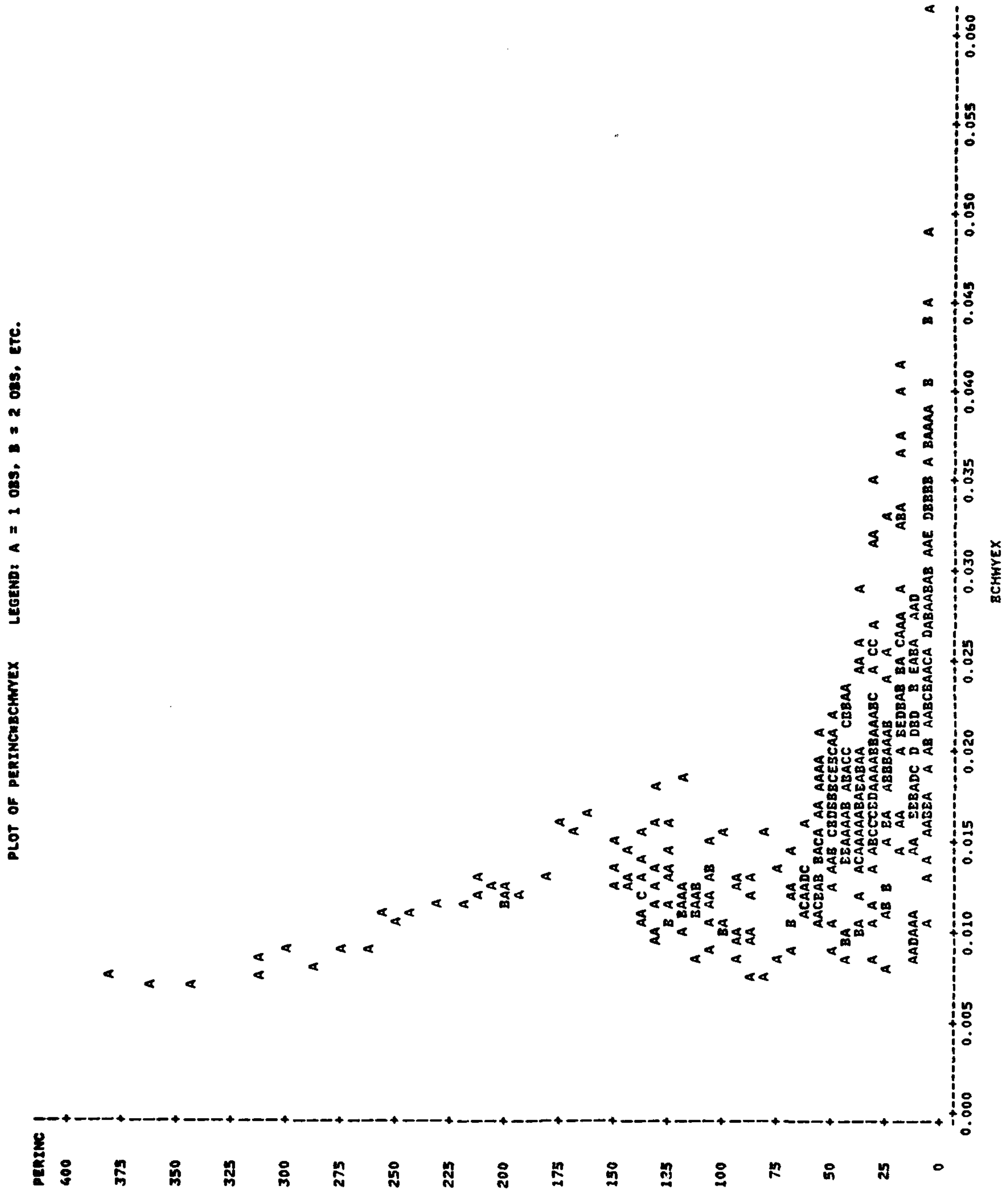


EXHIBIT 10 - Plot of PERINC versus BCHWYEX

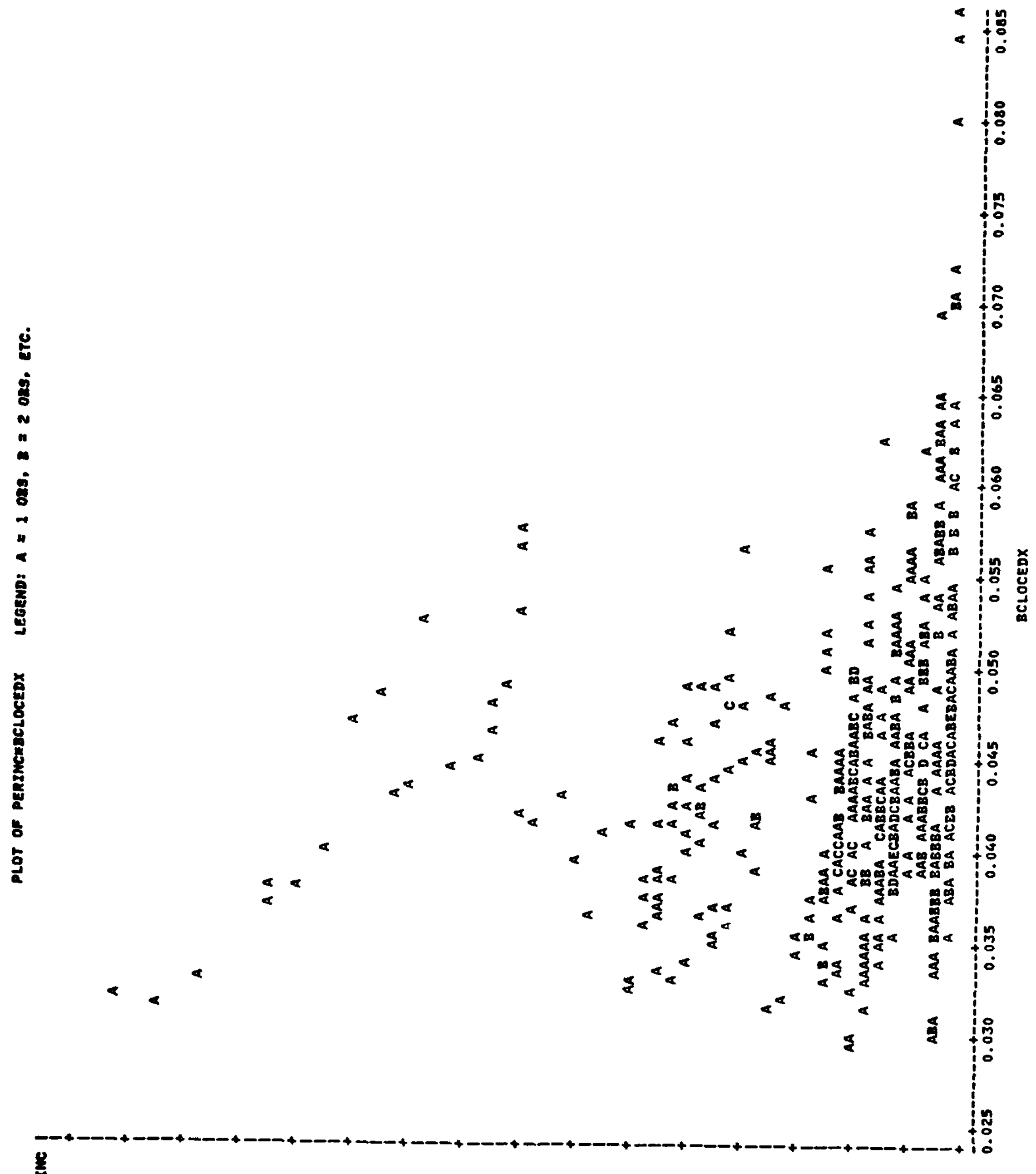


EXHIBIT 11 - Plot of PERINC versus BCLOCEDX

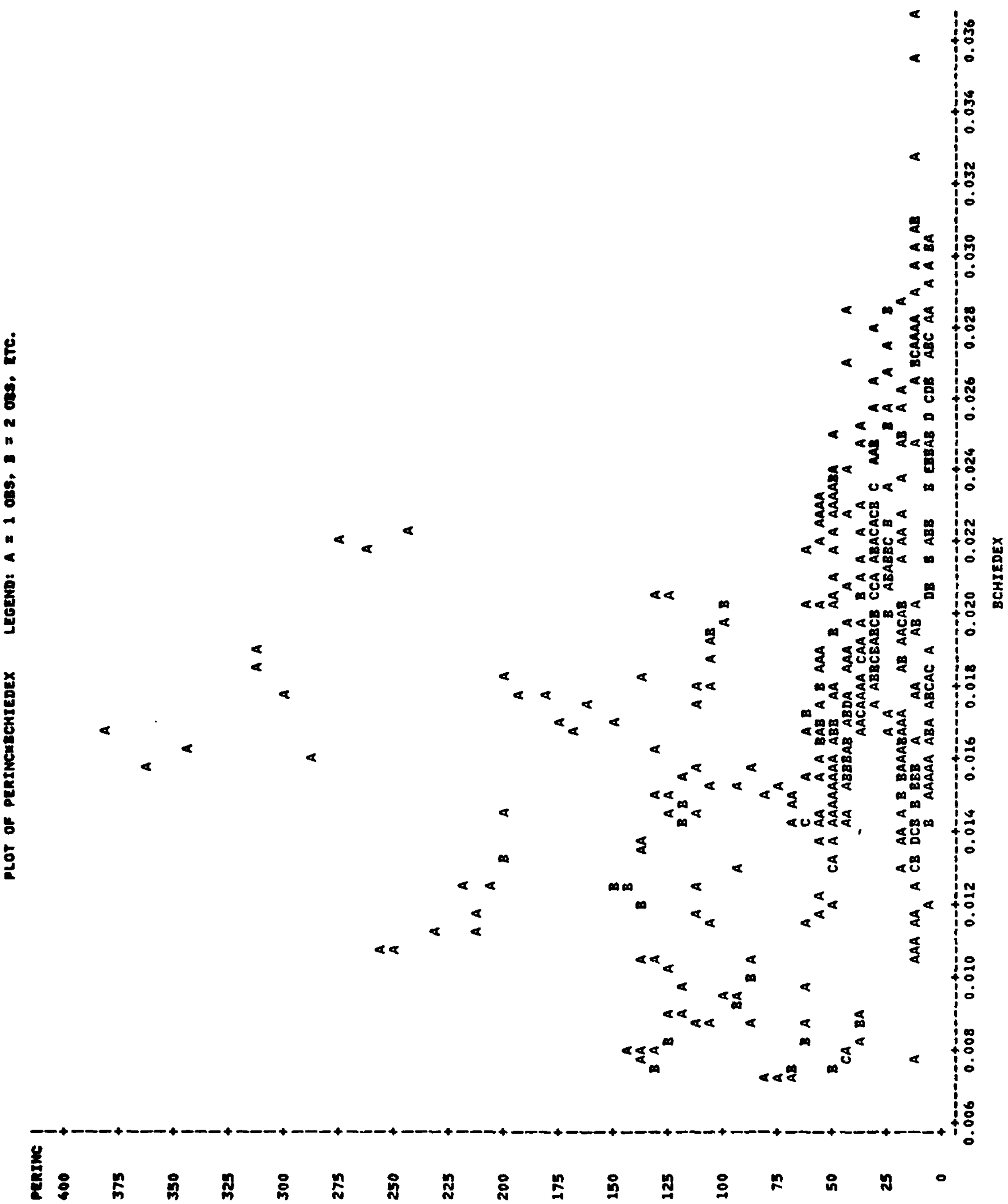


EXHIBIT 12 - Plot of PERINC versus BCHIEDEX

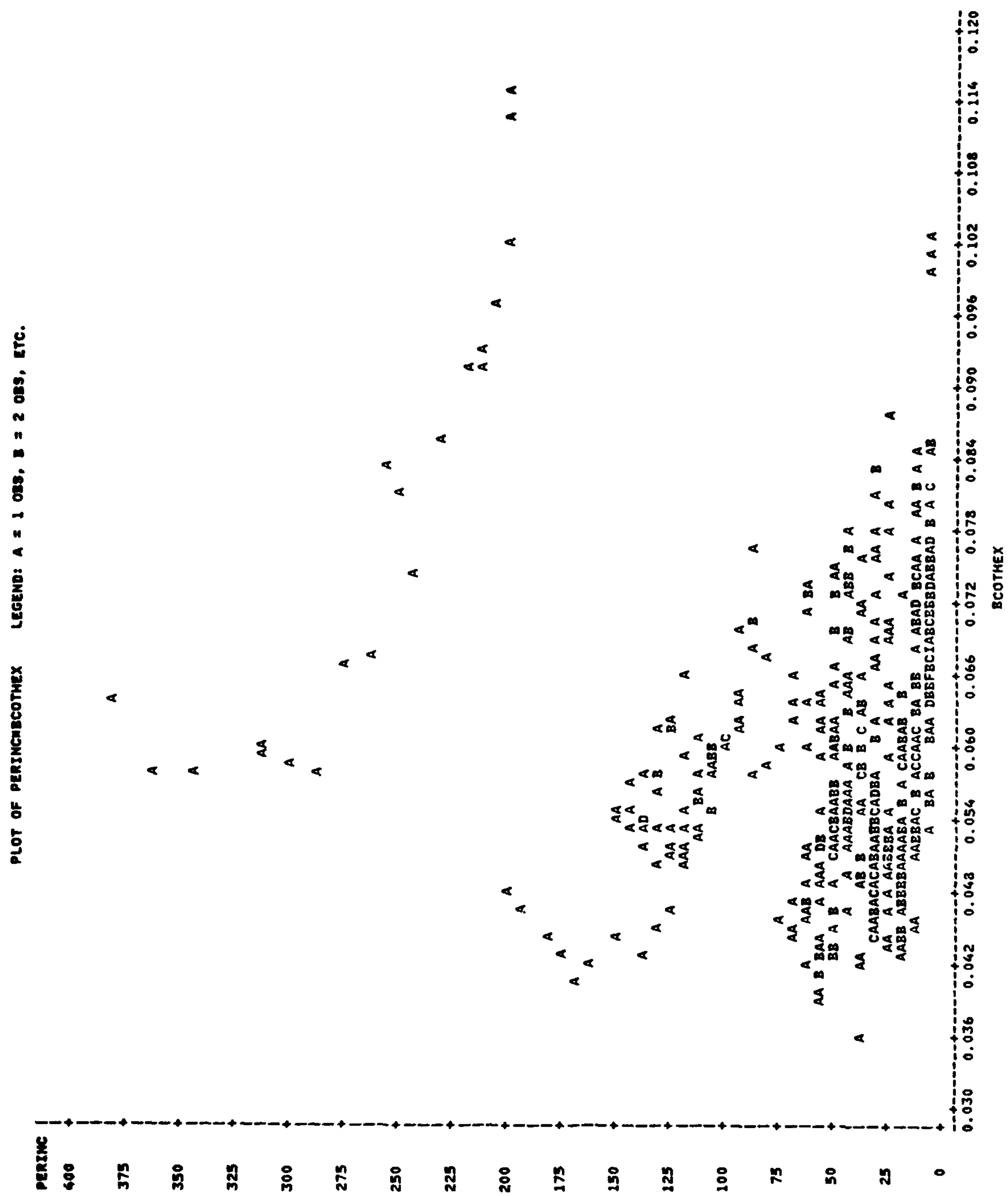


EXHIBIT 13 - Plot of PERINC versus BCOTHEX

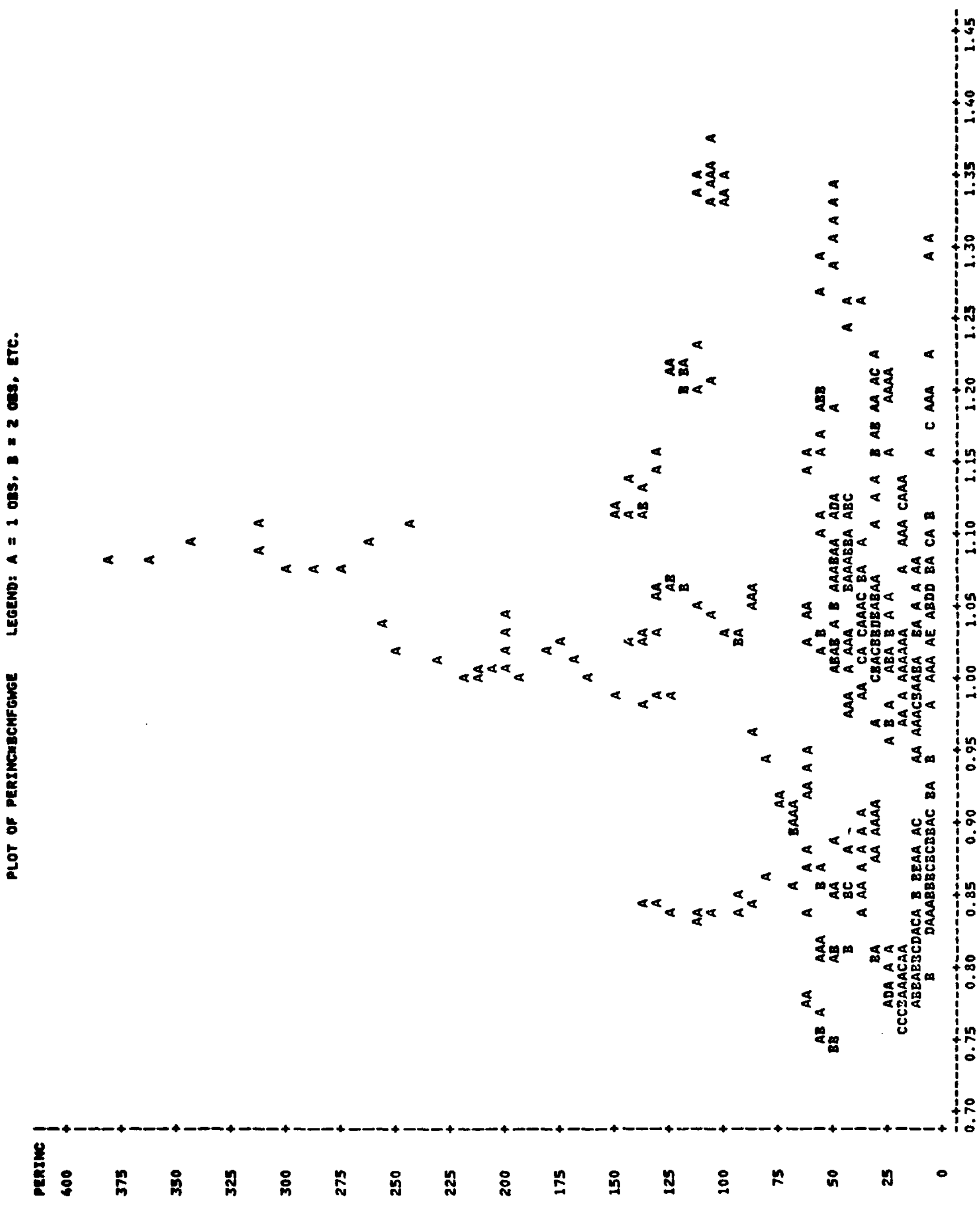


EXHIBIT 14 - Plot of PERINC versus BCMFGWGE

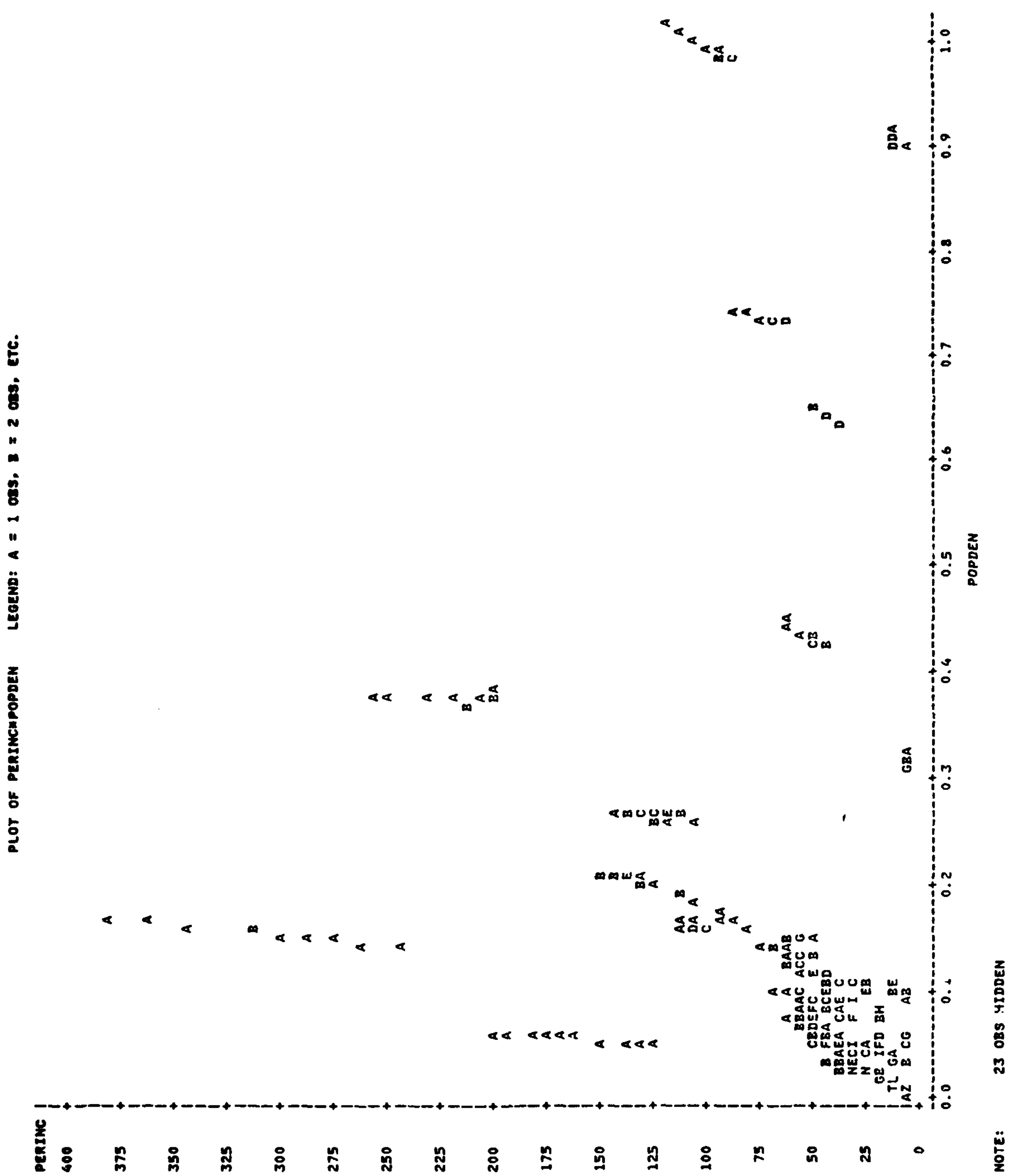


EXHIBIT 15 - Plot of PERINC versus POPDEN

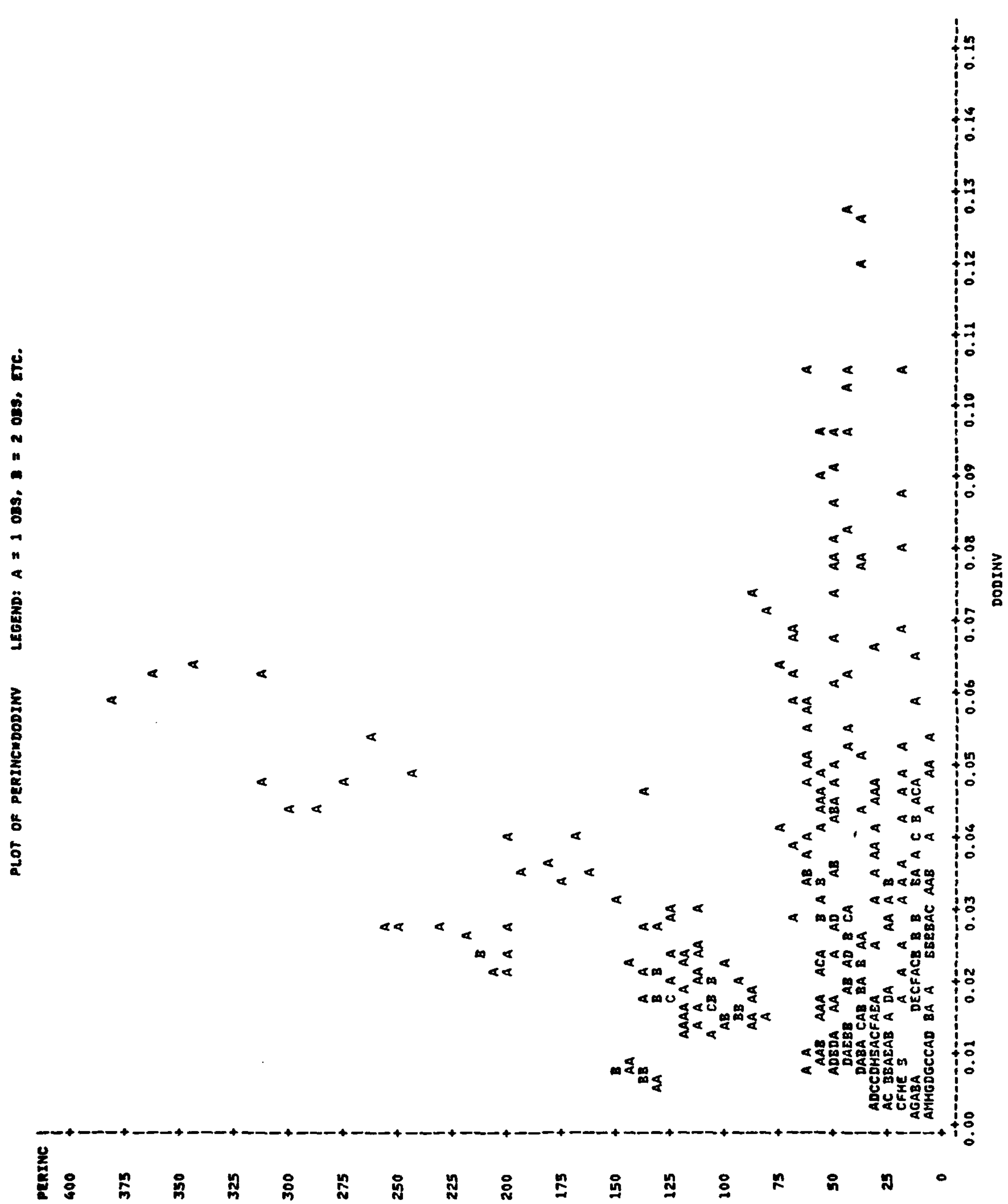


EXHIBIT 16 - Plot of PERINC versus DODINV

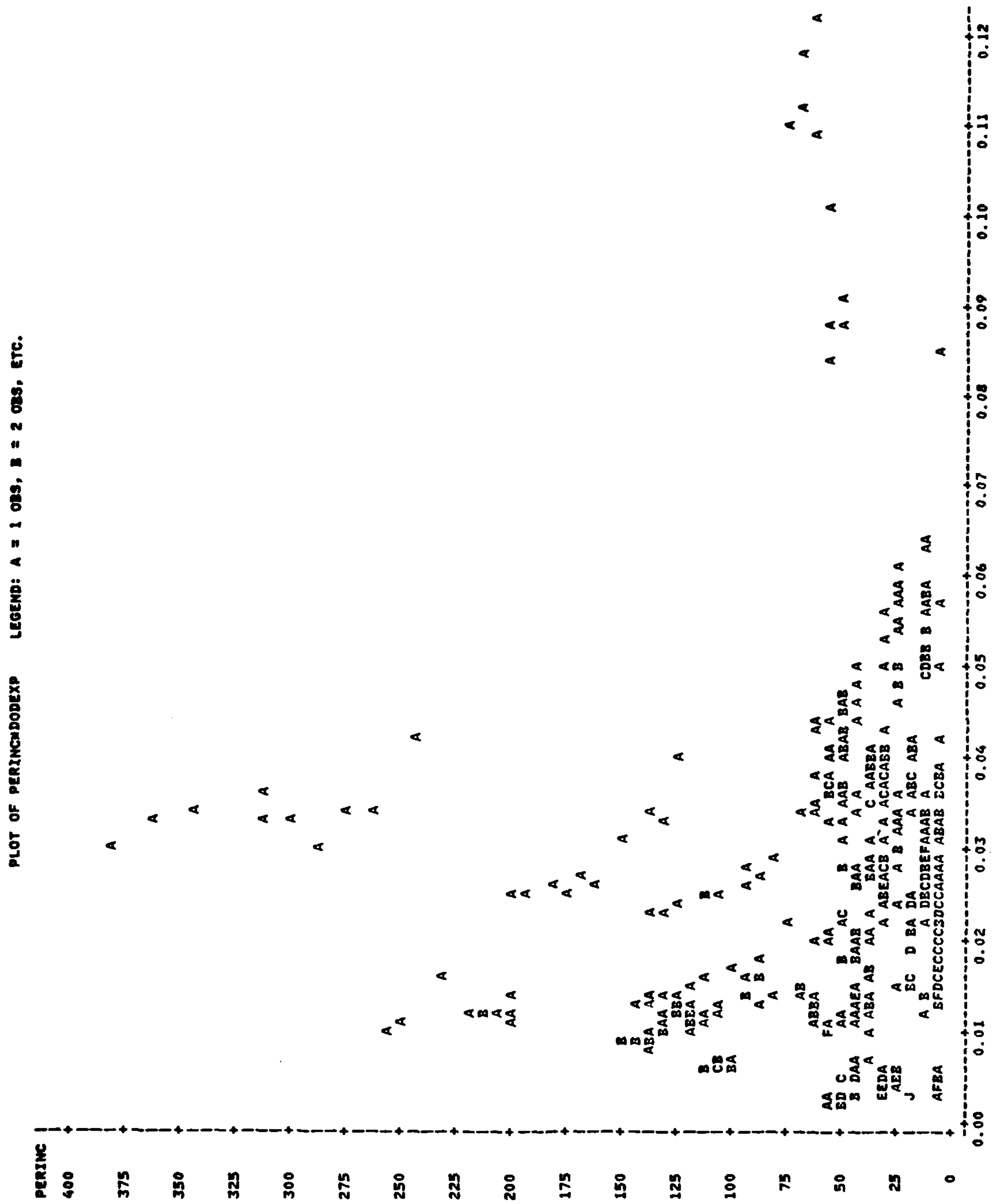


EXHIBIT 17 - Plot of PERINC versus DODEXP

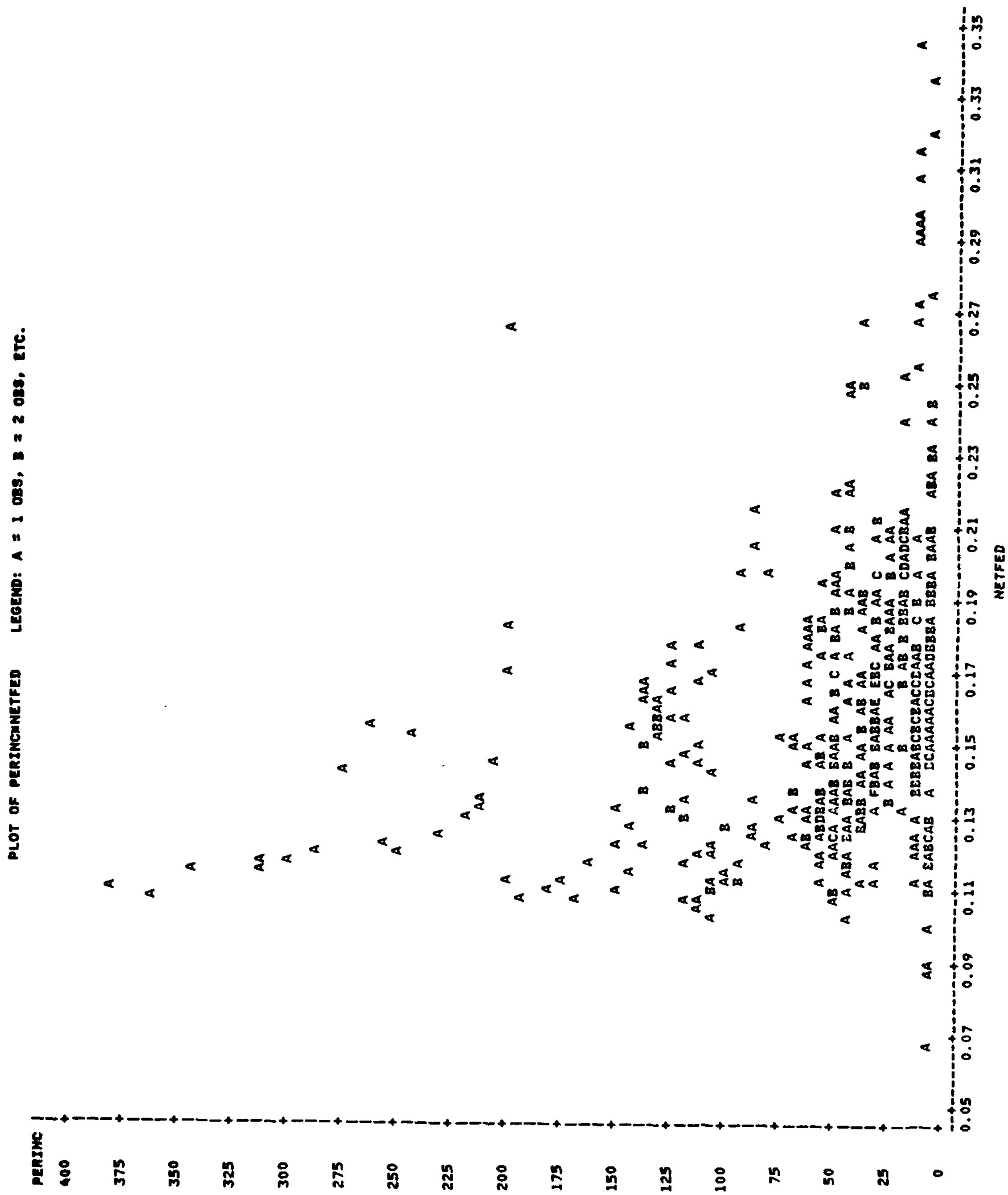


EXHIBIT 18 - Plot of PERINC versus NETFED

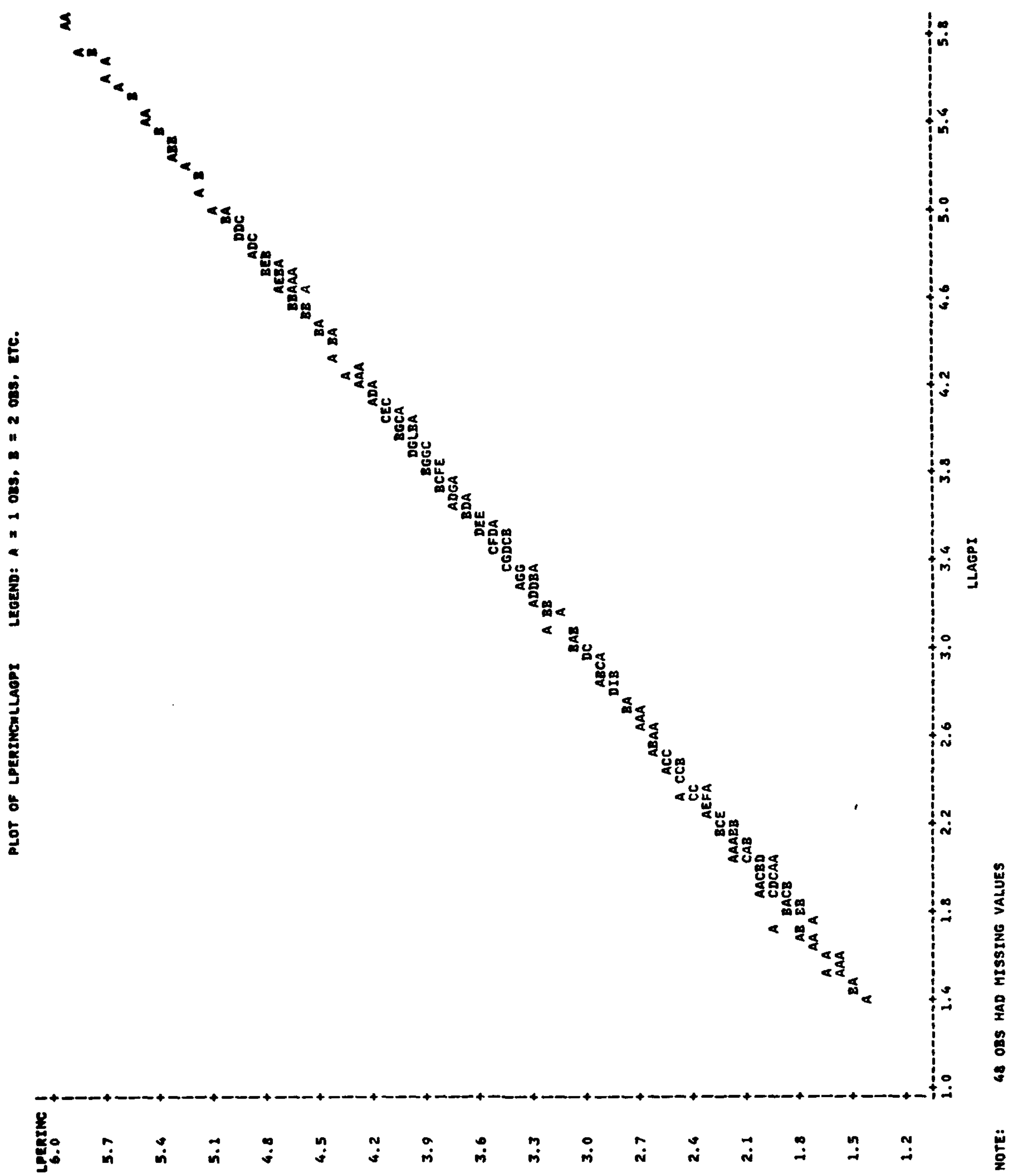


EXHIBIT 19 - Plot of LPERINC versus LLAGPI

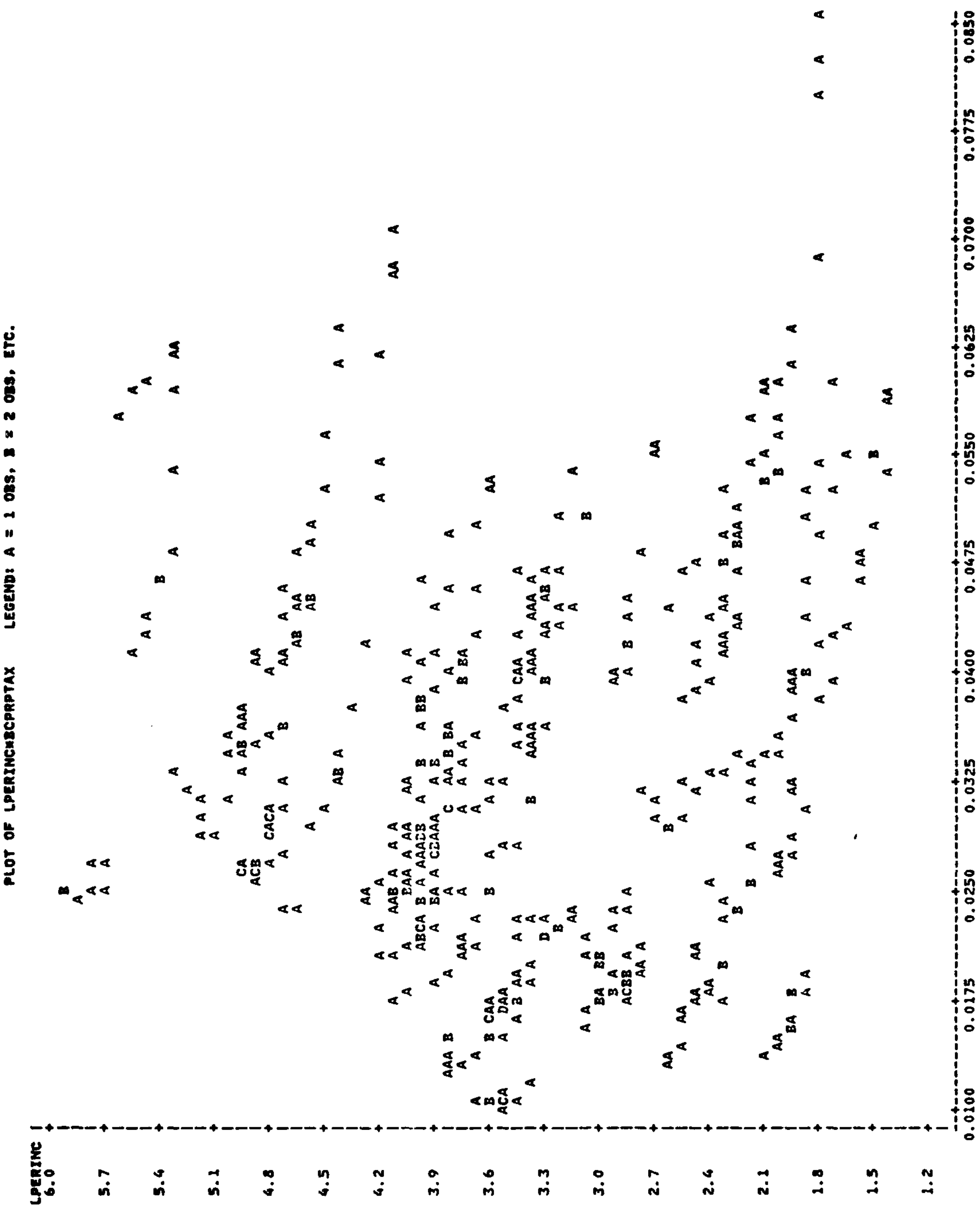


EXHIBIT 20 - Plot of LPERINC versus BCPRPTAX

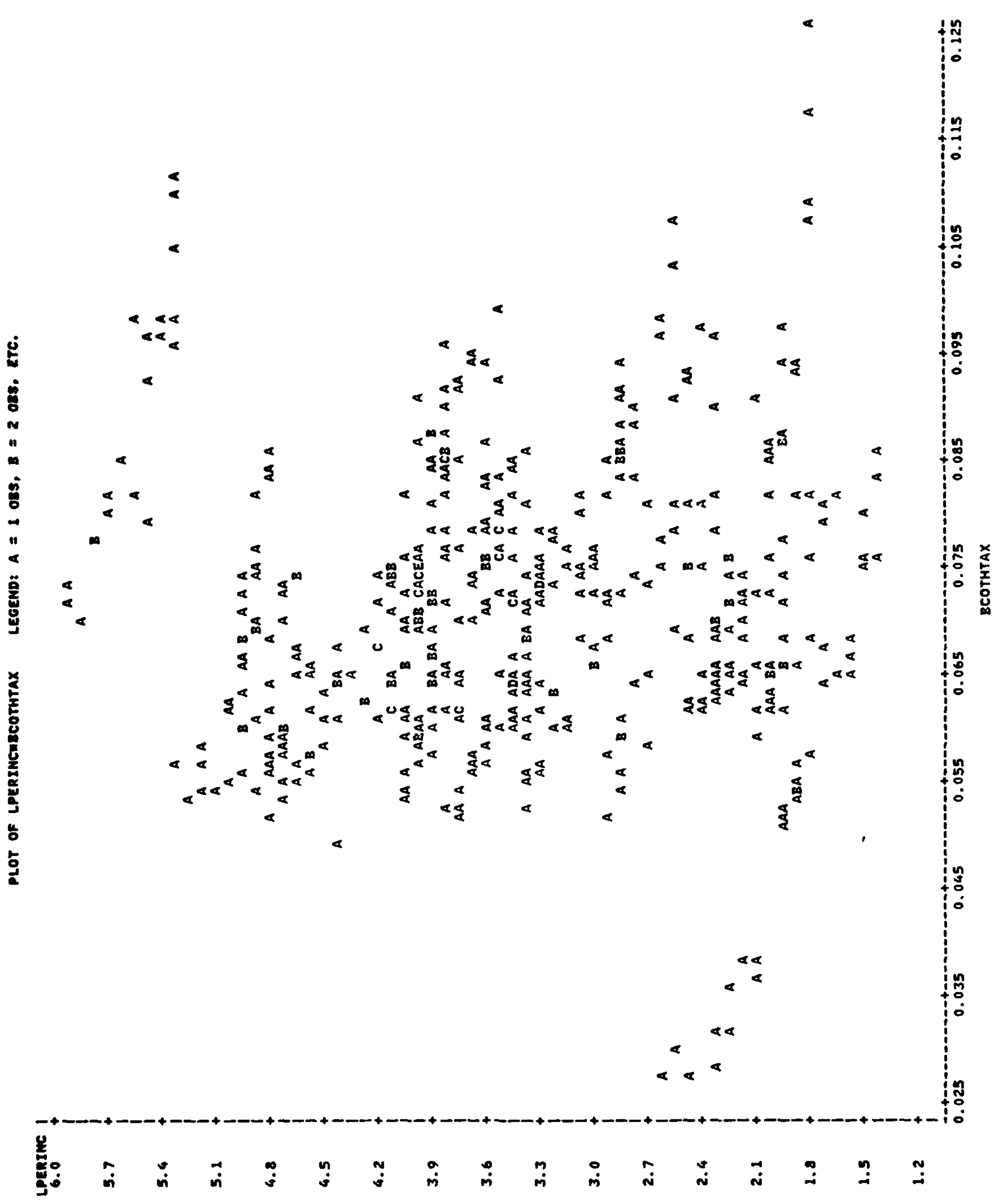


EXHIBIT 21 - Plot of LPERINC versus BCOTHTAX

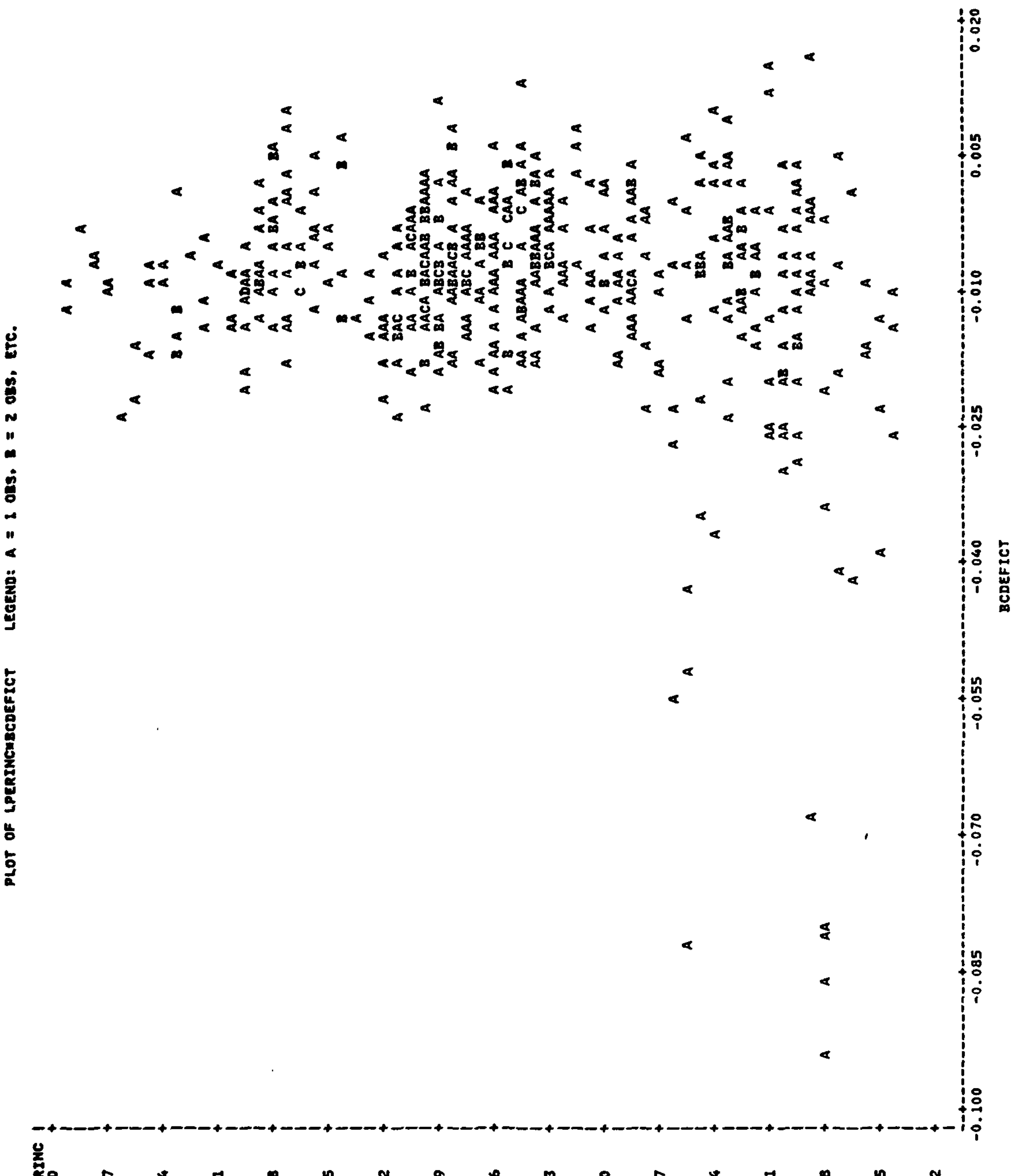


EXHIBIT 22 - Plot of LPERINC versus BCDEFICT

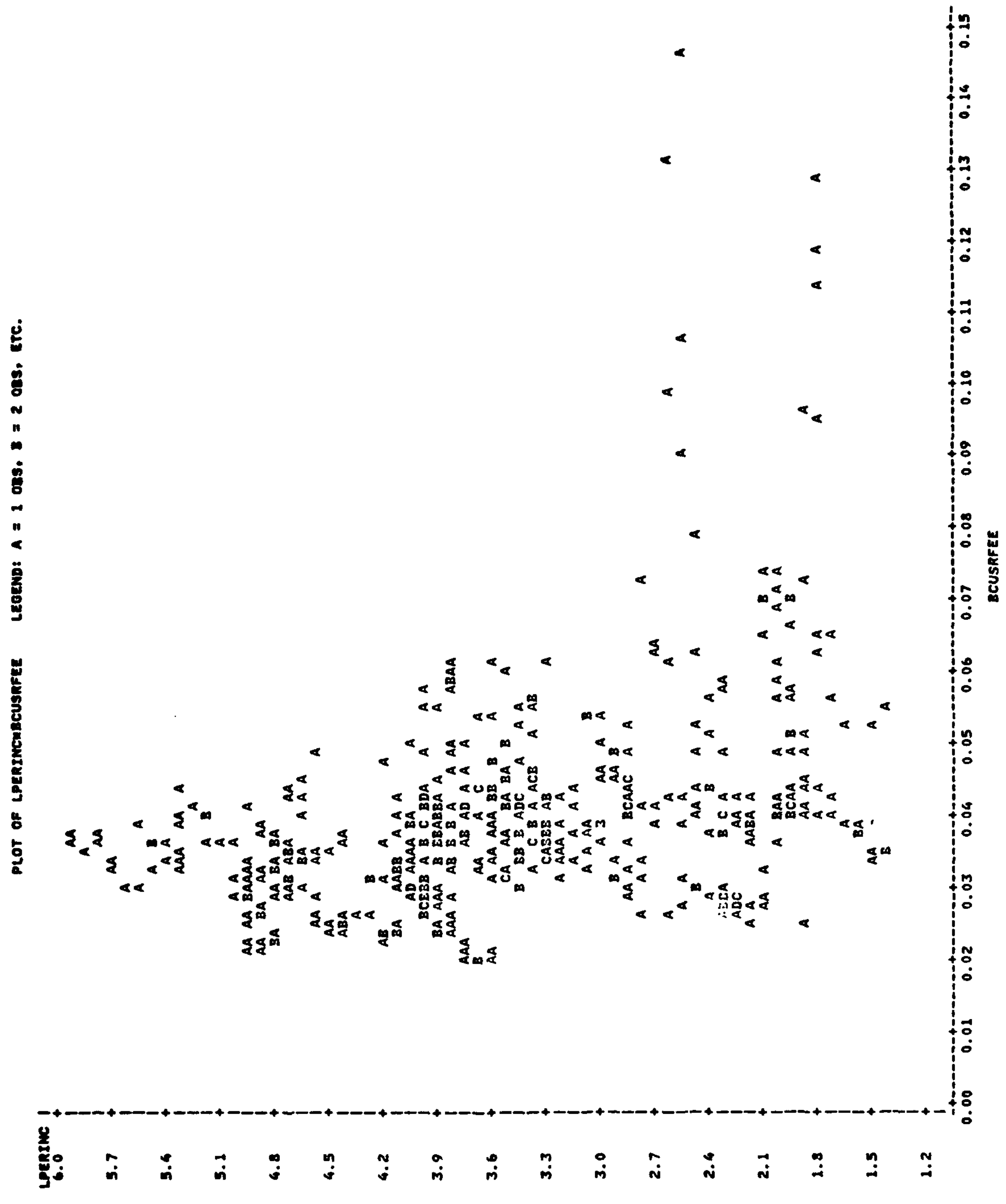


EXHIBIT 23 - Plot of LPERINC versus BCUSRFEE

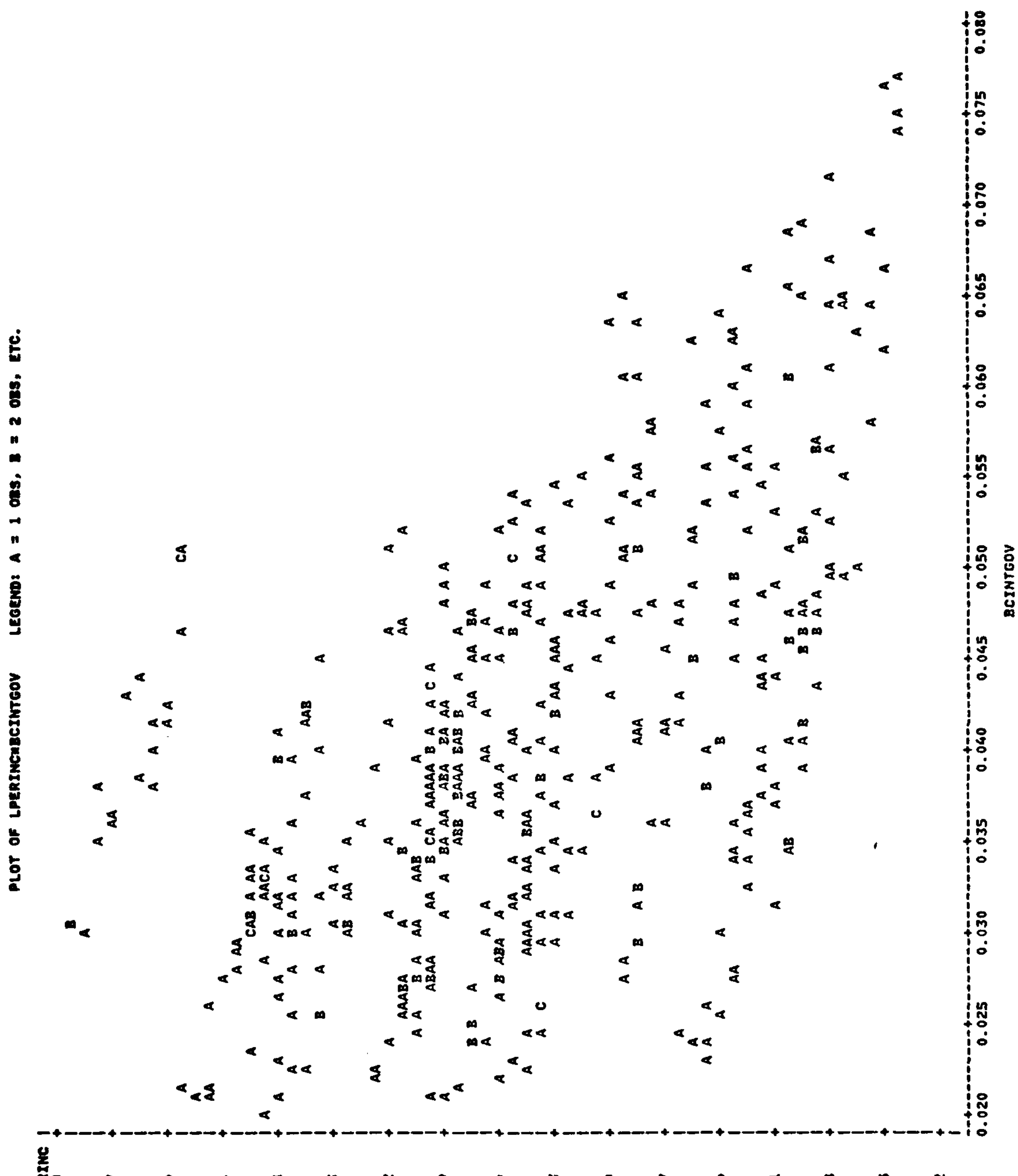


EXHIBIT 24 - Plot of LPERINC versus BCINTGOV

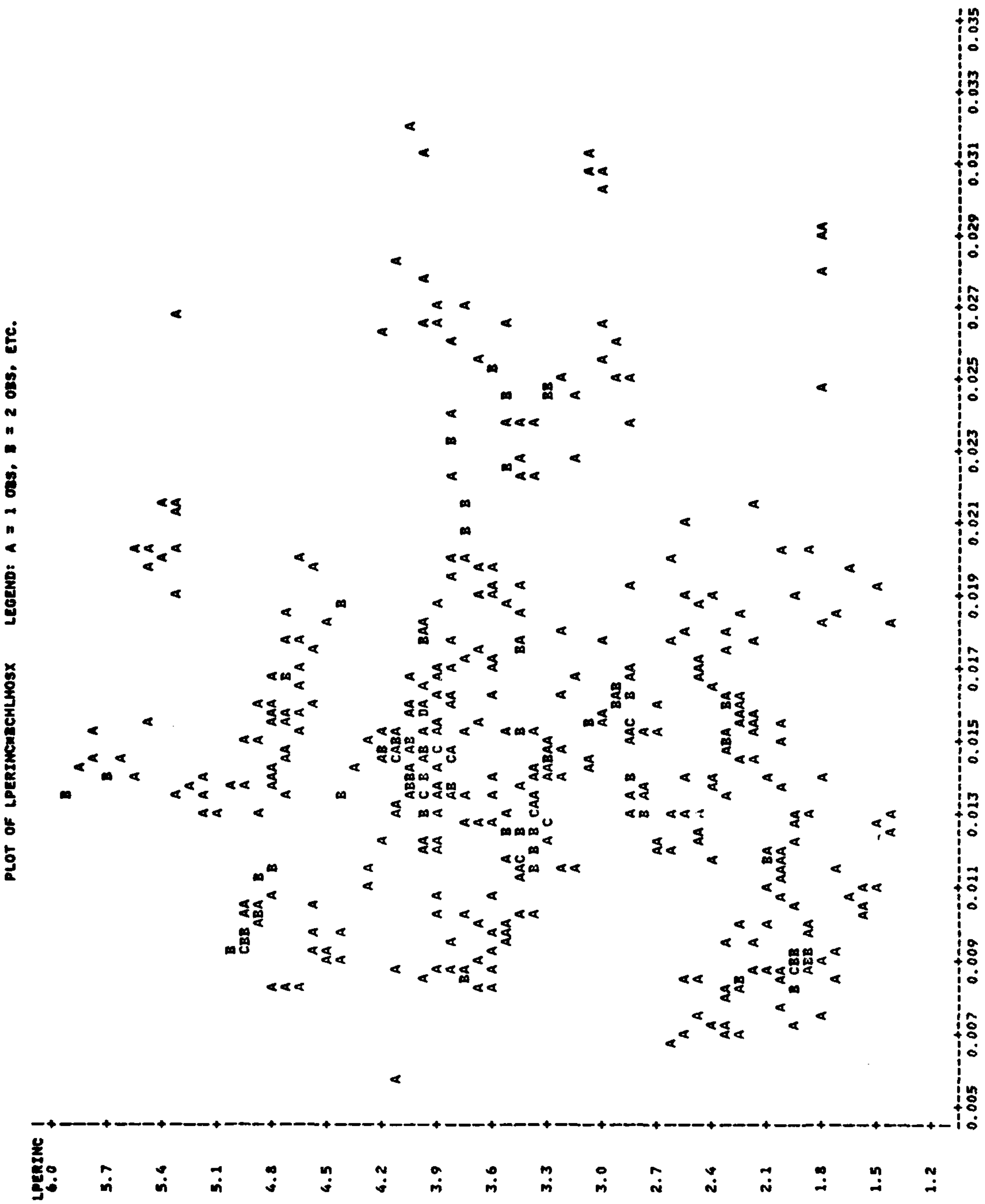


EXHIBIT 25 - Plot of LPERINC versus BCHLHOSX

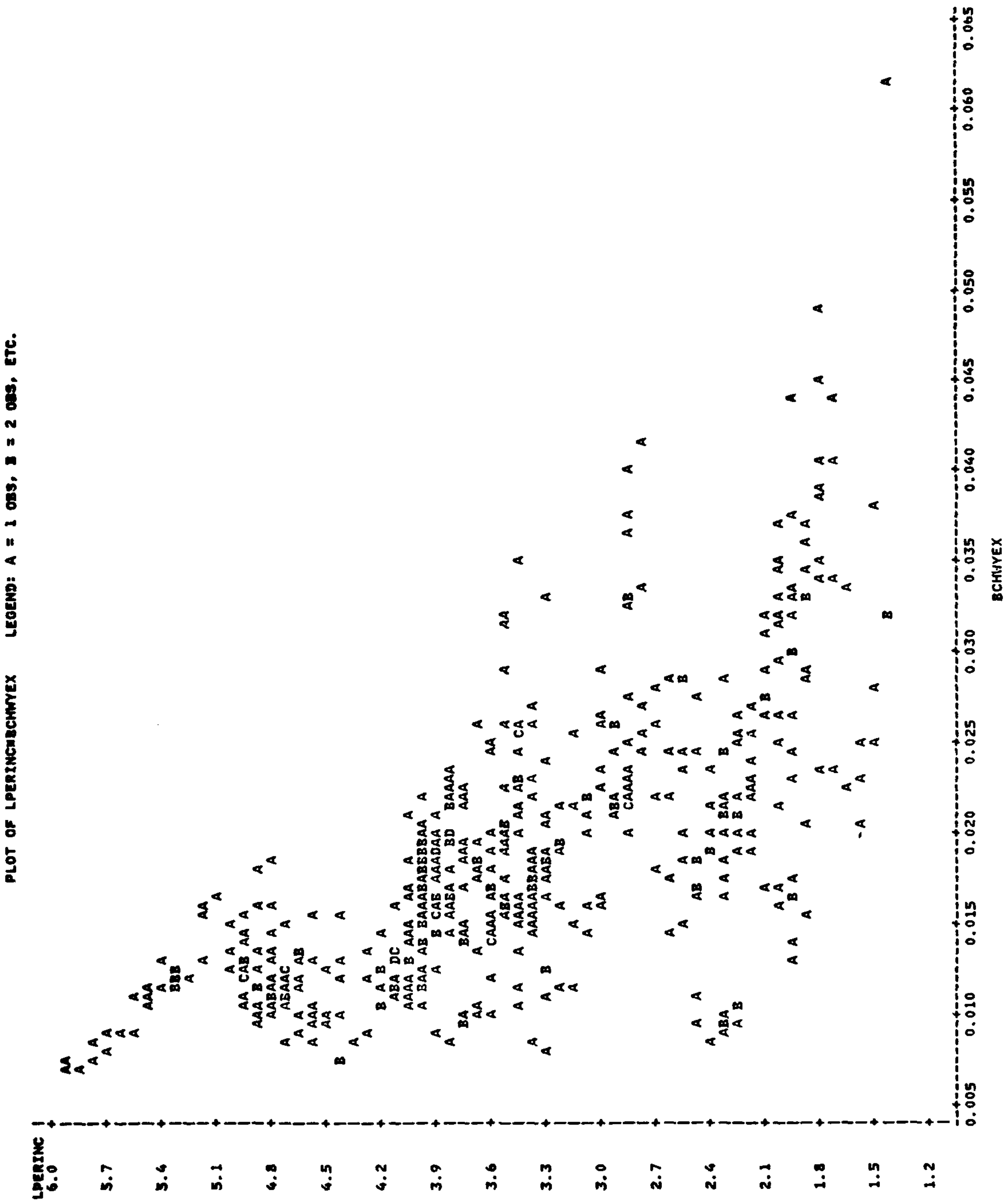


EXHIBIT 26 - Plot of LPERINC versus BCHWYEX

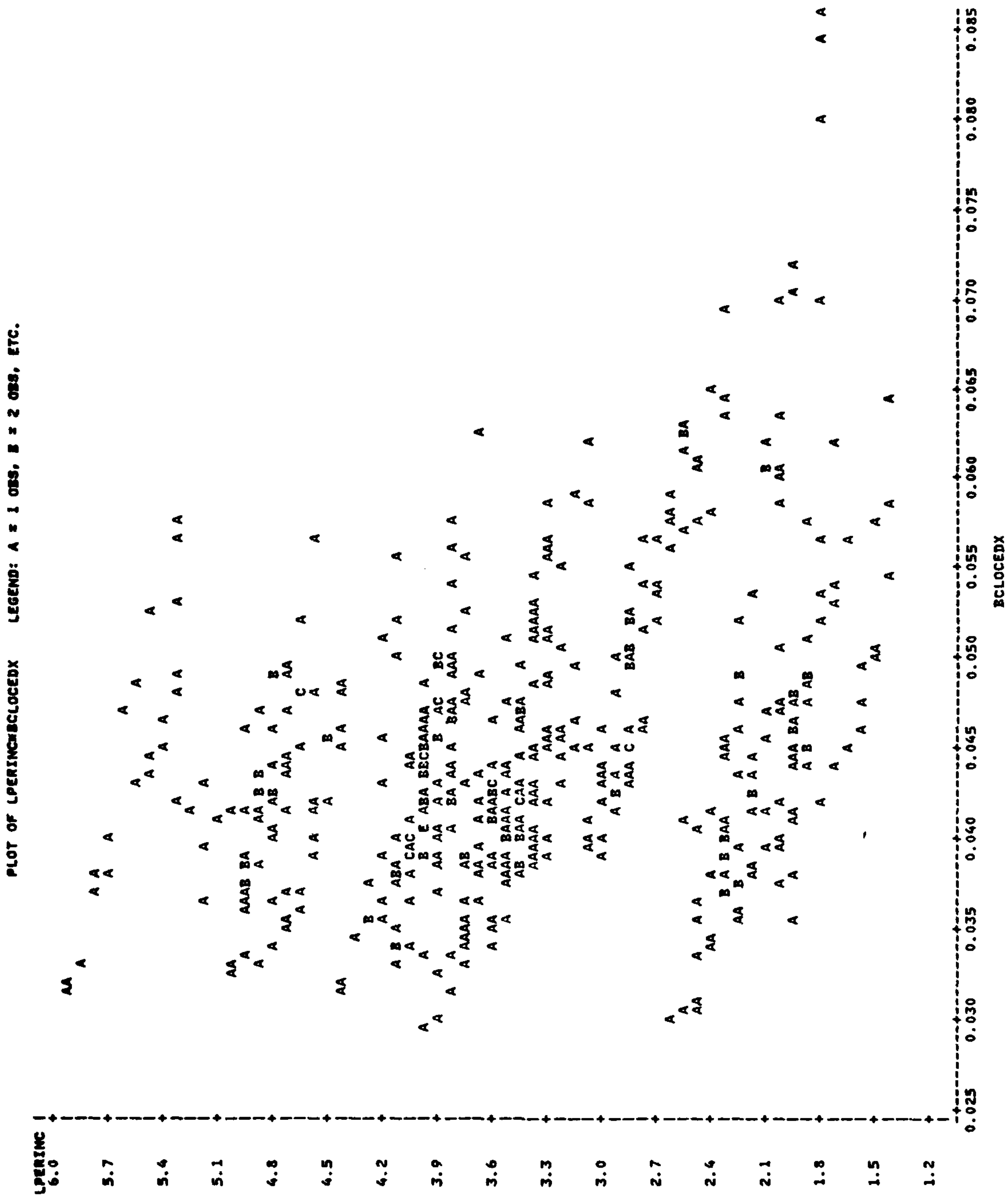


EXHIBIT 27 - Plot of LPERINC versus BCLOCEDX

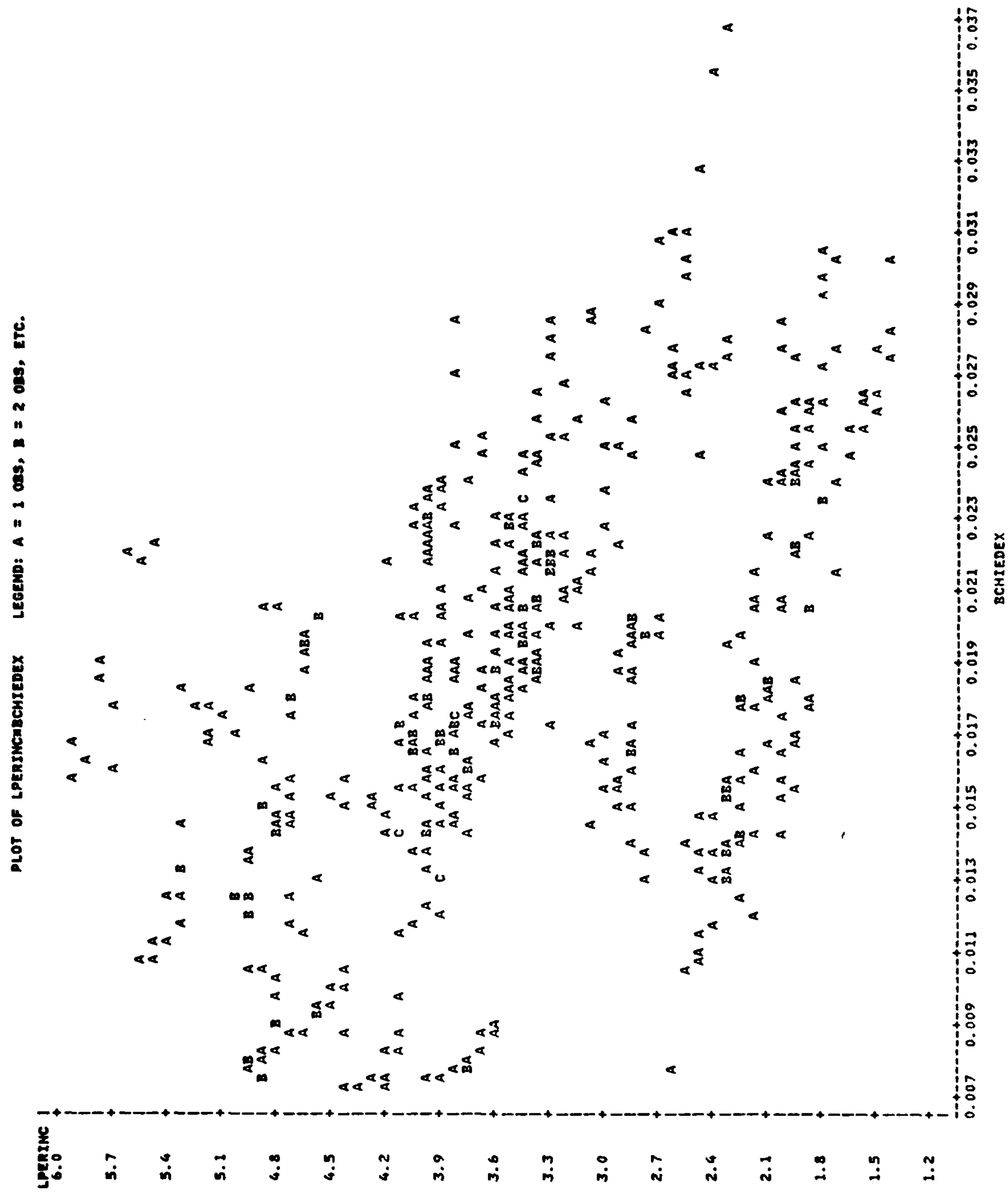


EXHIBIT 28 - Plot of LPERINC versus BCHIEDEX

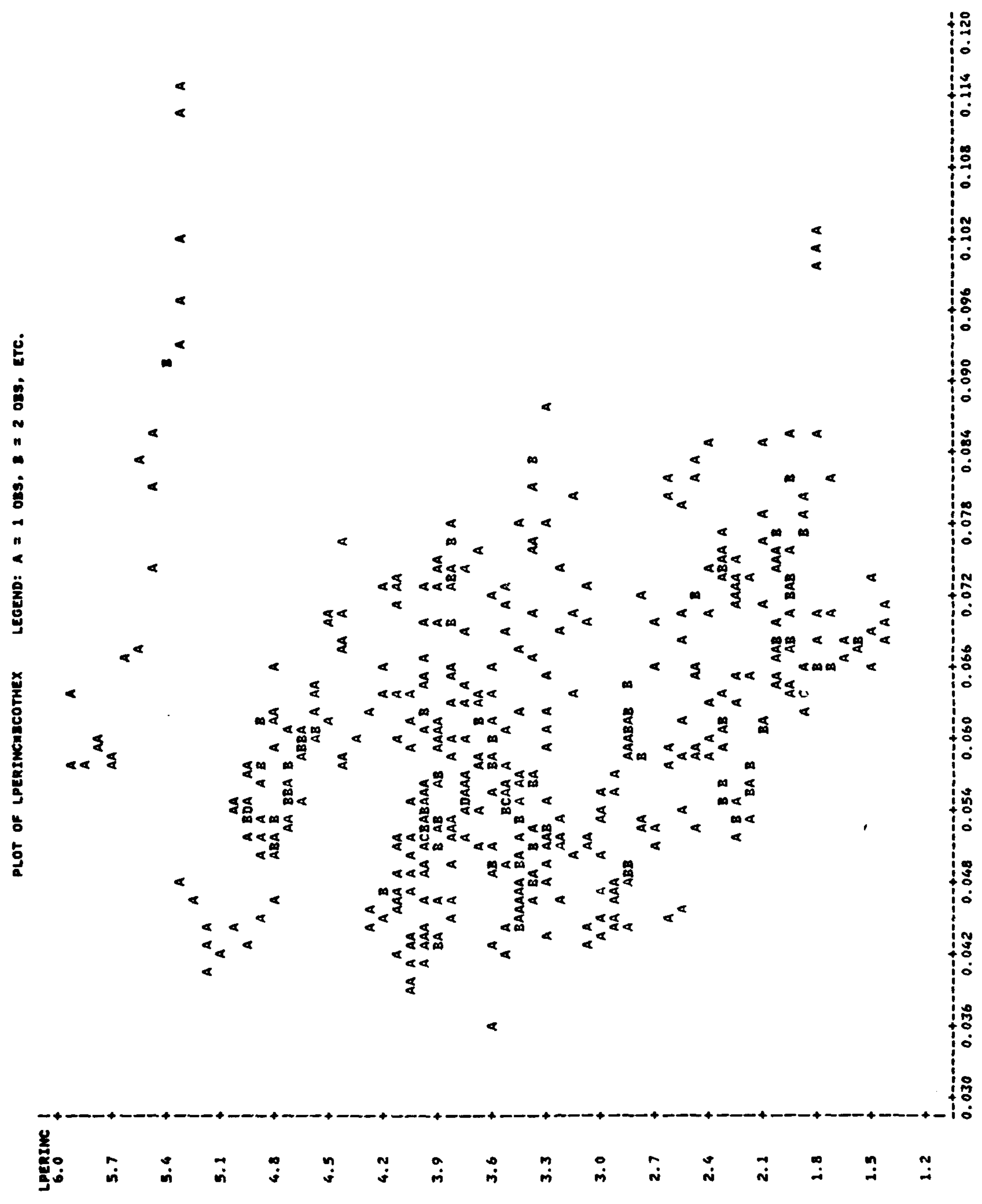


EXHIBIT 29 - Plot of LPFRINC versus BCOTHEX

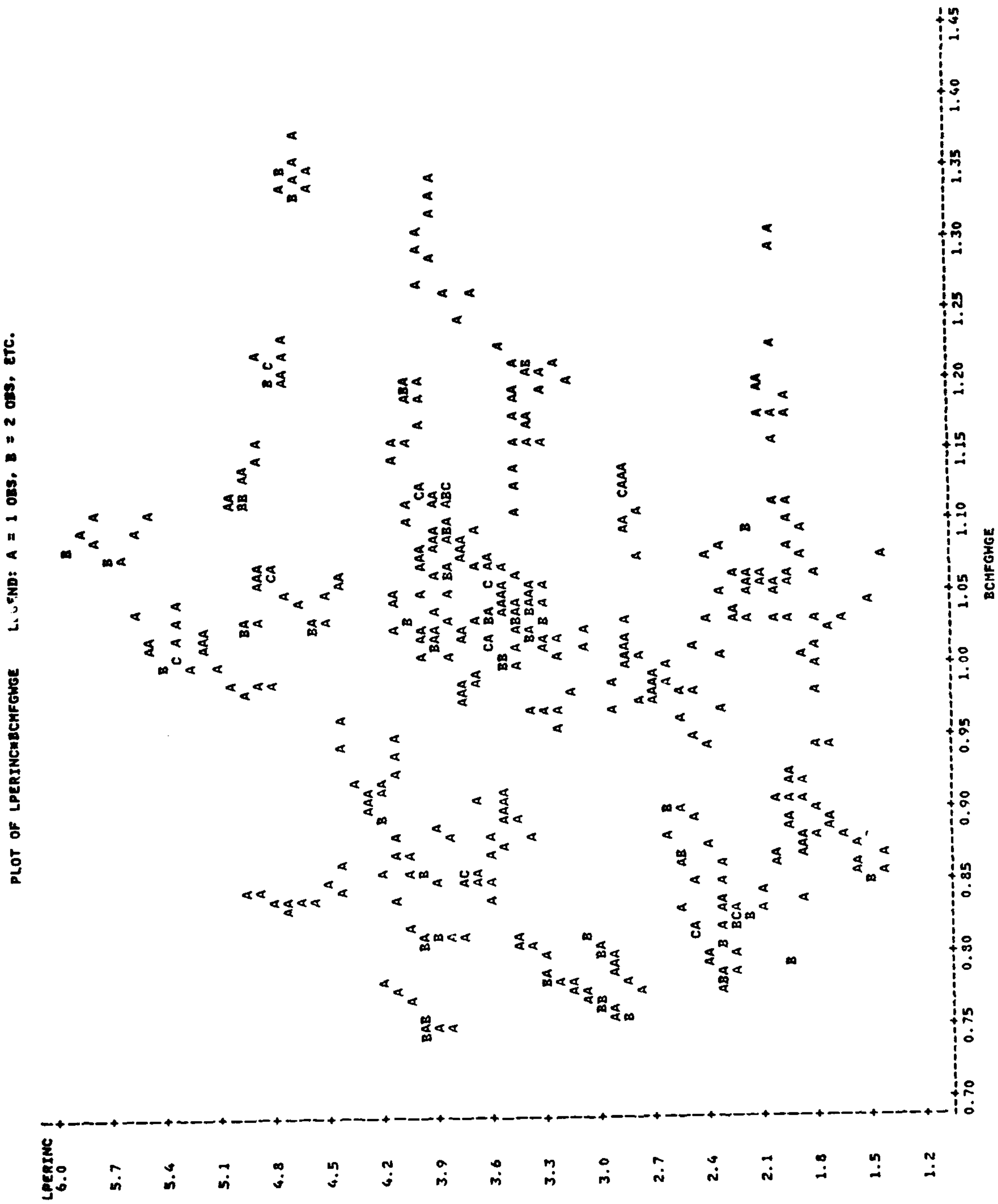


EXHIBIT 30 - Plot of LPERINC versus BCMFGWGE

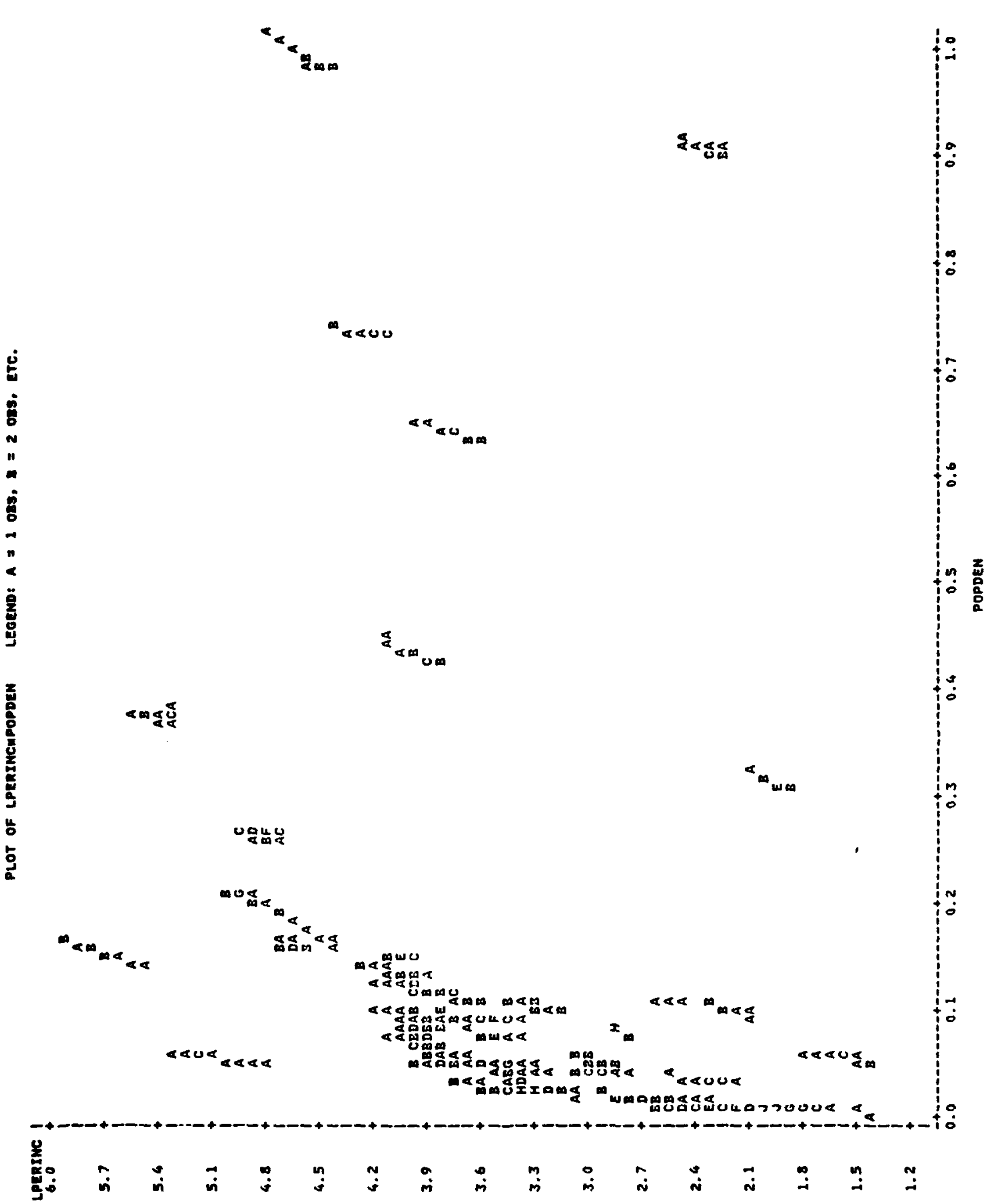


EXHIBIT 31 - Plot of LPERINC versus POPDEN

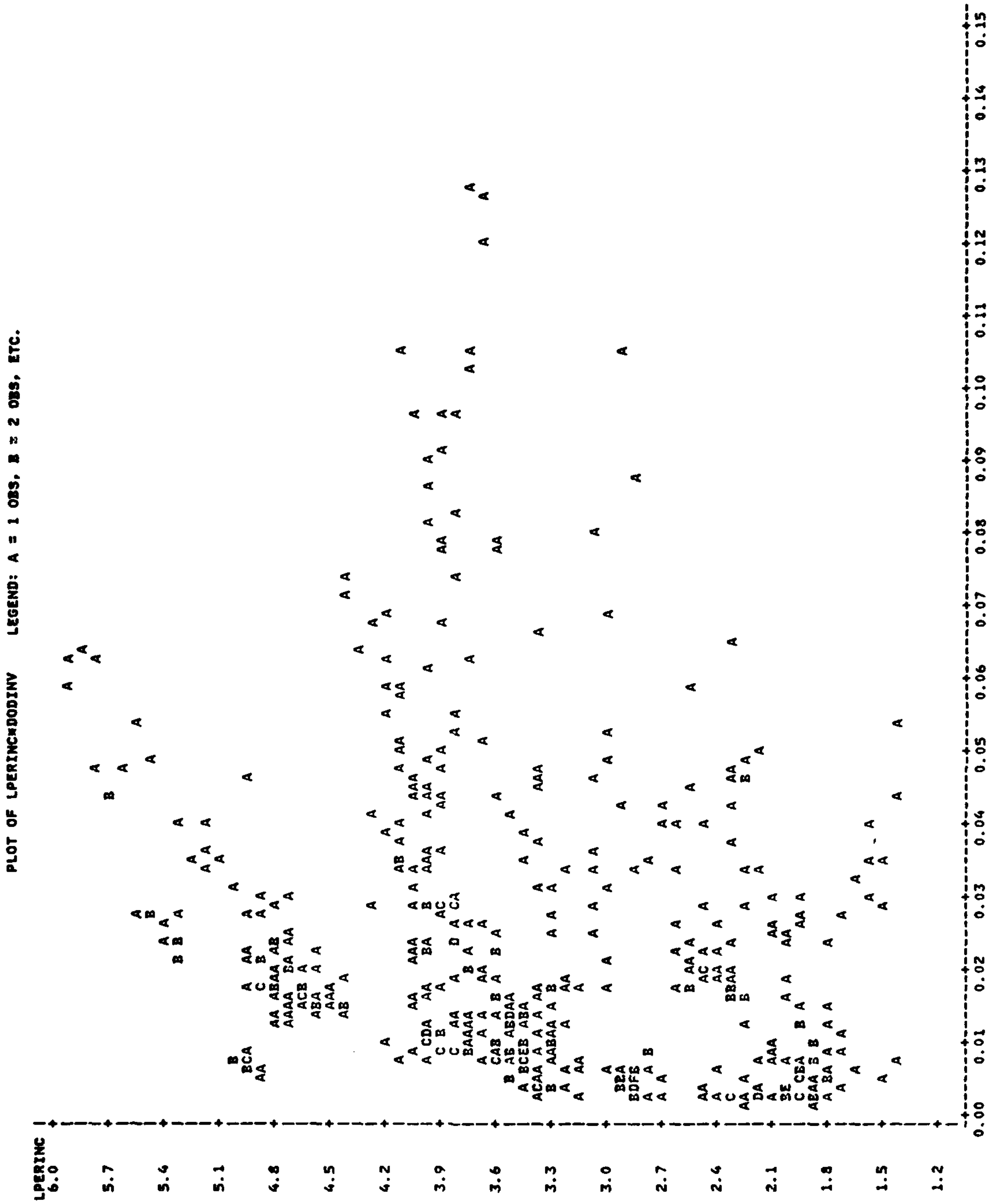


EXHIBIT 32 - Plot of LPERINC versus DODINV

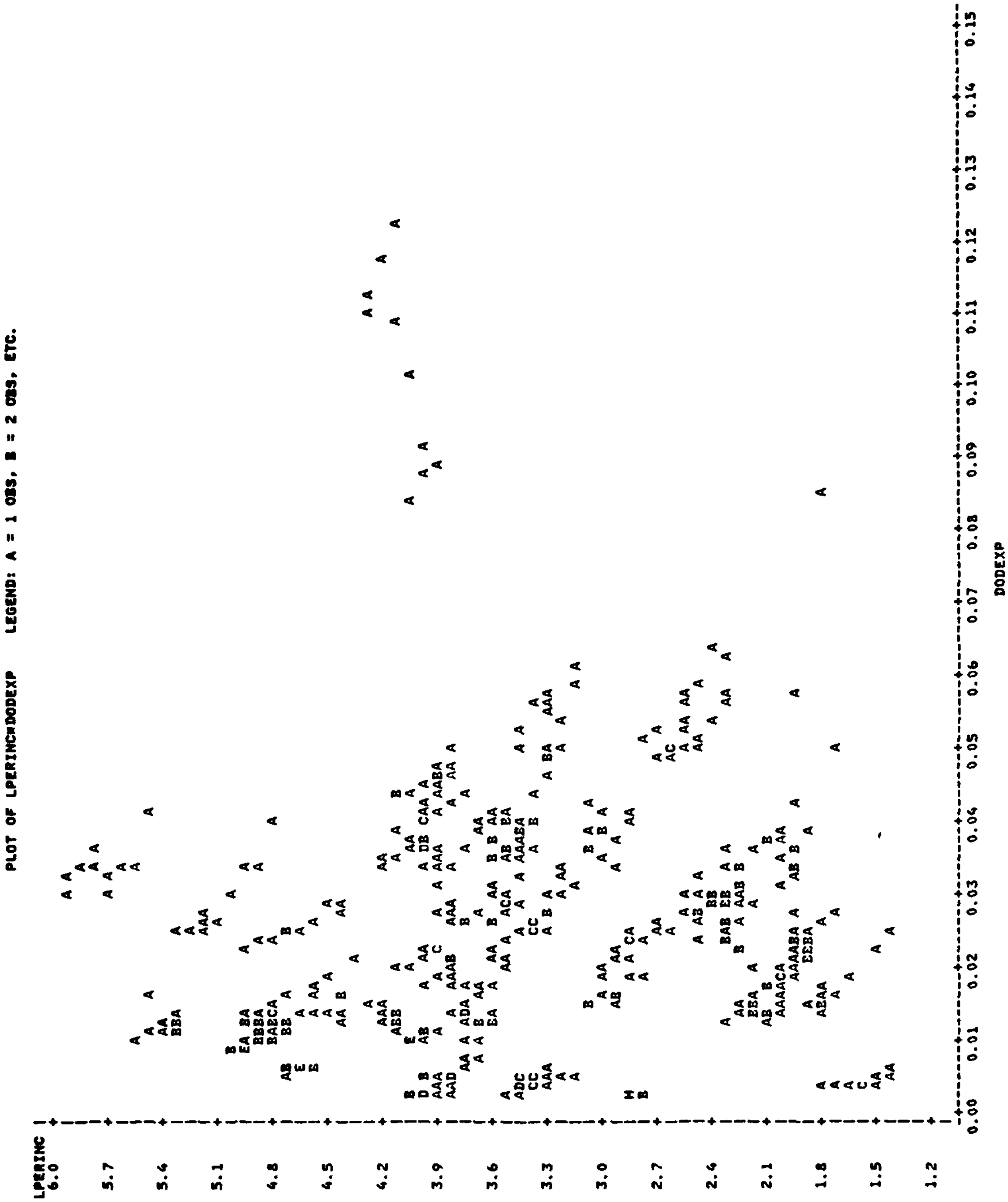


EXHIBIT 33 - Plot of LPERINC versus DODEXP

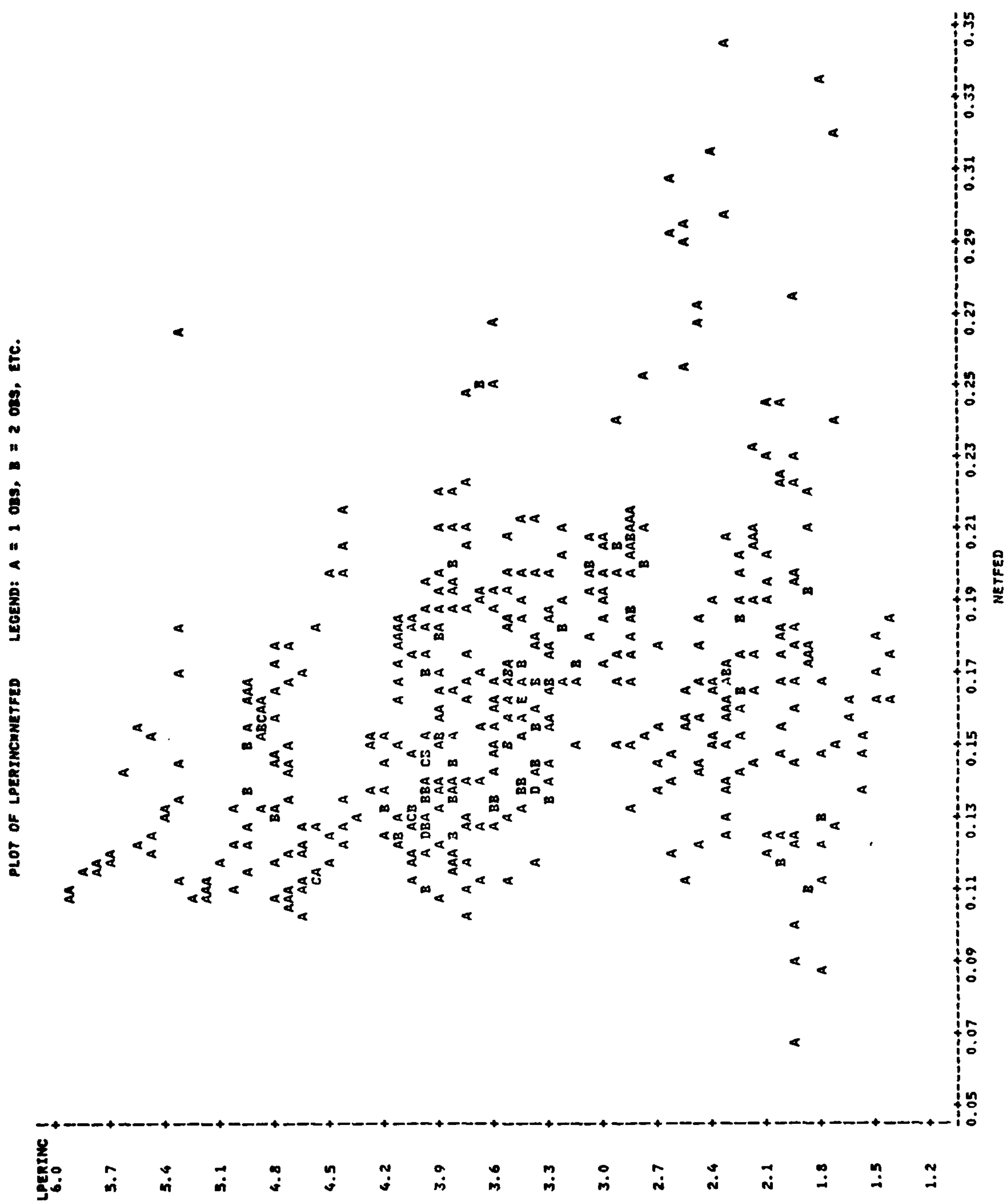


EXHIBIT 34 - Plot of LPERINC versus NETFED

FREQUENCY BAR CHART

MIDPOINT RESID	FREQ	CUM. FREQ	PERCENT
-12.8	1	1	0.23
-11.2	0	1	0.00
-9.6	0	1	0.00
-8.0	1	2	0.23
-6.4	5	7	1.16
-4.8	9	16	2.08
-3.2	13	29	3.01
-1.6	66	95	15.28
0.0	232	327	53.70
1.6	81	408	18.75
3.2	13	421	3.01
4.8	7	428	1.62
6.4	1	429	0.23
8.0	2	431	0.46
9.6	0	431	0.00
11.2	0	431	0.00
12.8	0	431	0.00
14.4	0	431	0.00
16.0	1	432	0.23
17.6	0	432	0.00

RESIDUALS

FREQUENCY (axis: 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230)

EXHIBIT 35 - Error Distrib. - PERINC DOD OLS Model

FREQUENCY BAR CHART

RESIDUALS

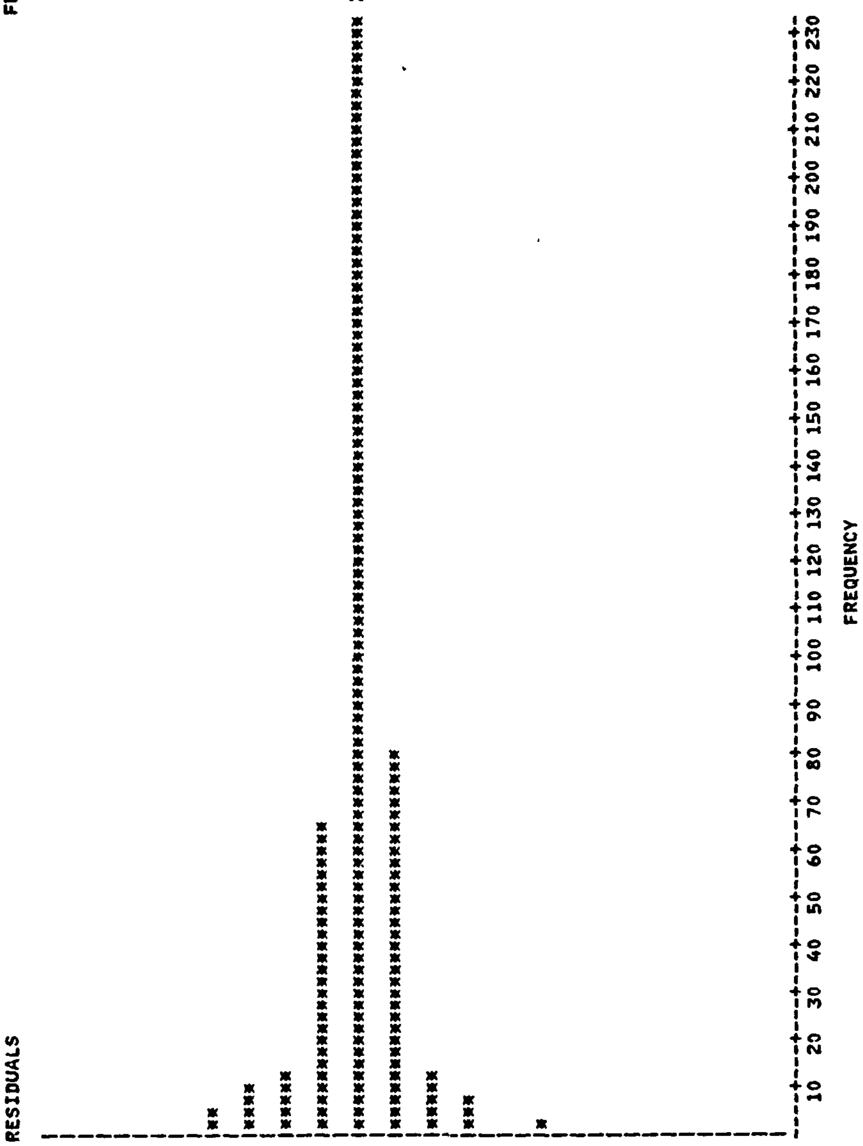
MIDPOINT RESID	FREQ	CUM. FREQ	PERCENT
-16.0	0	0	0.00
-14.4	0	0	0.00
-12.8	1	1	0.23
-11.2	0	1	0.00
-9.6	0	1	0.00
-8.0	0	1	0.00
-6.4	1	2	0.23
-4.8	2	4	0.46
-3.2	13	17	3.01
-1.6	61	78	14.12
0.0	264	342	61.11
1.6	77	419	17.82
3.2	8	427	1.85
4.8	3	430	0.69
6.4	1	431	0.23
8.0	0	431	0.00
9.6	0	431	0.00
11.2	0	431	0.00
12.8	1	432	0.23
14.4	0	432	0.00

20 40 60 80 100 120 140 160 180 200 220 240 260

FREQUENCY

EXHIBIT 36 - Error Distrib. - PERINC DOD COVARIANCE Model

FREQUENCY BAR CHART



MIDPOINT RESID	FREQ	CUM. FREQ	PERCENT
-12.8	1	1	0.23
-11.2	0	1	0.00
-9.6	0	1	0.00
-8.0	1	2	0.23
-6.4	5	7	1.16
-4.8	9	16	2.08
-3.2	13	29	3.01
-1.6	65	94	15.05
0.0	233	327	53.94
1.6	81	408	18.75
3.2	13	421	3.01
4.8	7	428	1.62
6.4	1	429	0.23
8.0	2	431	0.46
9.6	0	431	0.00
11.2	0	431	0.00
12.8	0	431	0.00
14.4	0	431	0.00
16.0	1	432	0.23
17.6	0	432	0.00

EXHIBIT 37 - Error Distrib. - PERINC NETFED OLS Model

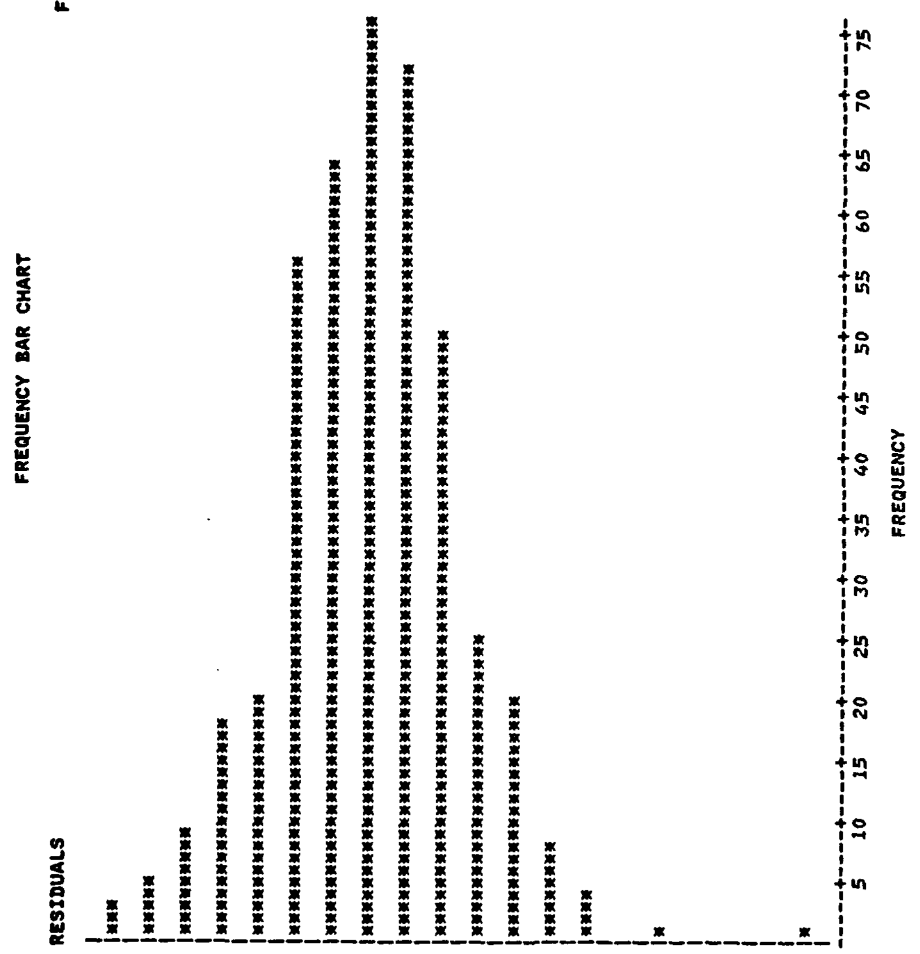
FREQUENCY BAR CHART

MIDPOINT RESID	RESIDUALS	FREQ	CUM. FREQ	PERCENT
-16.0		0	0	0.00
-14.4		0	0	0.00
-12.8		1	1	0.23
-11.2		0	1	0.00
-9.6		0	1	0.00
-8.0		0	1	0.00
-6.4		1	2	0.23
-4.8		2	4	0.46
-3.2	**	10	14	2.31
-1.6	*************	66	80	15.28
0.0	***	265	345	61.34
1.6	***************	74	419	17.13
3.2	**	9	428	2.08
4.8		2	430	0.46
6.4		1	431	0.23
8.0		0	431	0.00
9.6		0	431	0.00
11.2		0	431	0.00
12.8		1	432	0.23
14.4		0	432	0.00

20 40 60 80 100 120 140 160 180 200 220 240 260

FREQUENCY

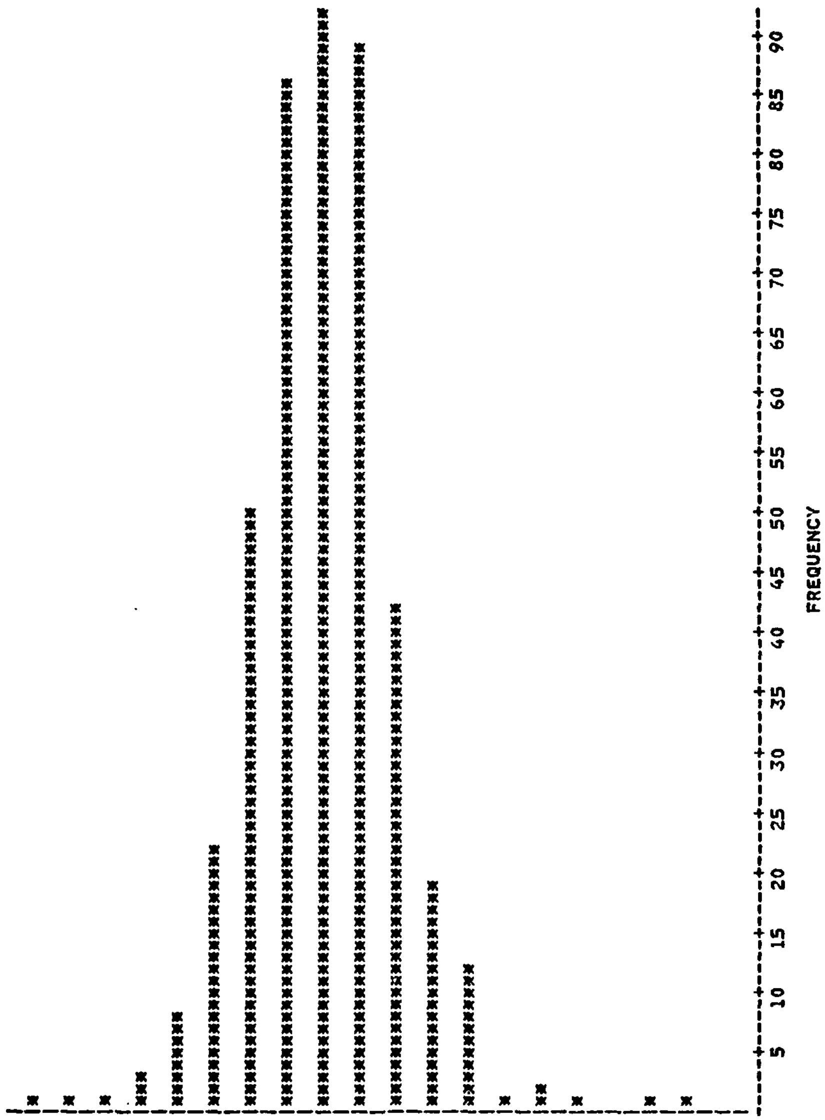
EXHIBIT 38 - Error Distrib. - PERINC NETFED COVARIANCE Model



MIDPOINT RESID	FREQ	CUM. FREQ	PERCENT
-0.084	3	3	0.69
-0.072	5	8	1.16
-0.060	9	17	2.08
-0.048	18	35	4.17
-0.036	20	55	4.63
-0.024	56	111	12.96
-0.012	64	175	14.81
0.000	76	251	17.59
0.012	72	323	16.67
0.024	50	373	11.57
0.036	25	398	5.79
0.048	20	418	4.63
0.060	8	426	1.85
0.072	4	430	0.93
0.084	0	430	0.00
0.096	1	431	0.23
0.108	0	431	0.00
0.120	0	431	0.00
0.132	0	431	0.00
0.144	1	432	0.23

EXHIBIT 39 - Error Distrib. - LPERINC DOD OLS Model

FREQUENCY BAR CHART



MIDPOINT RESID	FREQ	CUM. FREQ	PERCENT
-0.064	1	1	0.23
-0.056	1	2	0.23
-0.048	1	3	0.23
-0.040	3	6	0.69
-0.032	8	14	1.85
-0.024	22	36	5.09
-0.016	50	86	11.57
-0.008	86	172	19.91
0.000	92	264	21.30
0.008	89	353	20.60
0.016	42	395	9.72
0.024	19	414	4.40
0.032	12	426	2.78
0.040	1	427	0.23
0.048	2	429	0.46
0.056	1	430	0.23
0.064	0	430	0.00
0.072	1	431	0.23
0.080	1	432	0.23
0.088	0	432	0.00

EXHIBIT 40 - Error Distrib. - LPERINC DOD COVARIANCE Model

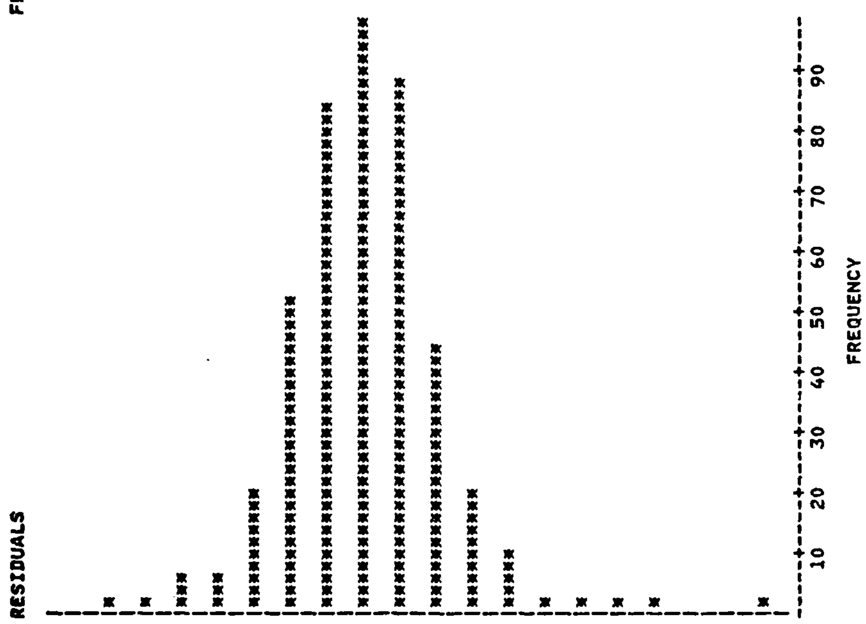
FREQUENCY BAR CHART

MIDPOINT RESID	FREQ	CUM. FREQ	PERCENT
-0.096	0	0	0.00
-0.084	3	3	0.69
-0.072	4	7	0.93
-0.060	11	18	2.55
-0.048	17	35	3.94
-0.036	20	55	4.63
-0.024	53	108	12.27
-0.012	73	181	16.90
0.000	73	254	16.90
0.012	72	326	16.67
0.024	49	375	11.34
0.036	24	399	5.56
0.048	20	419	4.63
0.060	7	426	1.62
0.072	3	429	0.69
0.084	1	430	0.23
0.096	1	431	0.23
0.108	0	431	0.00
0.120	0	431	0.00
0.132	1	432	0.23

RESIDUALS — FREQUENCY (axis: 5 10 15 20 25 30 35 40 45 50 55 60 65 70)

EXHIBIT 41 - Error Distrib. - LPERINC NETFED OLS Model

FREQUENCY BAR CHART



MIDPOINT RESID	FREQ	CUM. FREQ	PERCENT
-0.064	0	0	0.00
-0.056	1	1	0.23
-0.048	2	3	0.46
-0.040	5	8	1.16
-0.032	6	14	1.39
-0.024	20	34	4.63
-0.016	52	86	12.04
-0.008	83	169	19.21
0.000	97	266	22.45
0.008	88	354	20.37
0.016	43	397	9.95
0.024	19	416	4.40
0.032	10	426	2.31
0.040	1	427	0.23
0.048	1	428	0.23
0.056	1	429	0.23
0.064	2	431	0.46
0.072	0	431	0.00
0.080	0	431	0.00
0.088	1	432	0.23

EXHIBIT 42 - Error Distrib. - LPERINC NETFED COVARIANCE Model

EXHIBIT 43 - Residual Variances by State - PERINC Models

	DoD Models		DoD/NETFED Models	
	Estimation Method		Estimation Method	
STATE	OLS	Covar.	OLS	Covar.
1	.39262	.36826	.38694	.40985
2	.83403	.23375	.83109	.22214
3	.29639	.52616	.29575	.47298
4	64.970	49.960	64.931	49.690
5	.33541	.54503	.32873	.57164
6	.69355	.16716	.69087	.15033
7	.17988	1.9498	.19016	1.9452
8	7.7635	3.6842	7.7843	3.6643
9	1.5641	.42101	1.5736	.30351
10	.11878	.72784	.11687	.75557
11	9.6510	5.0401	9.6137	4.8402
12	3.8087	1.4799	3.7997	1.4254
13	2.0870	.81825	2.1048	.70201
14	.78435	.85633	.75884	.88051
15	1.3032	.58117	1.2972	.55824
16	1.2303	1.0395	1.2547	1.1523
17	.27980	.45312	.27756	.49102
18	1.5829	.32534	1.5683	.35140
19	2.5511	.58019	2.5626	.57284
20	16.416	8.3954	16.390	8.1278
21	1.4845	.83751	1.4464	.80258
22	.06720	1.6188	.07299	1.4386
23	2.7072	.59362	2.6692	.65897
24	.22011	1.0214	.19993	1.3002
25	.38259	.69817	.38683	.68946
26	.12617	.38465	.13357	.47412
27	.15977	1.2514	.16383	1.2371
28	4.9884	1.6460	4.9864	1.6899
29	.12181	.83047	.11740	.96886
30	23.646	12.385	23.771	12.111
31	2.0859	.35287	2.0726	.39147
32	.20175	.66509	.21635	.62895
33	7.9115	3.1907	7.8934	2.9862
34	.84893	2.1058	.84239	2.1518
35	1.0430	.75866	1.0152	.70183
36	4.3694	1.7533	4.3574	1.7185

EXHIBIT 43 - CONTINUED

37	.04190	1.4179	.03988	1.5664
38	.24977	.66039	.24562	.54284
39	.07679	1.0493	.06143	1.0870
40	1.0067	.12403	1.0013	.11610
41	8.7460	5.4565	8.7302	5.5029
42	.20506	.44600	.20783	.48820
43	.12036	1.0395	.12015	1.0138
44	1.8953	.30787	1.9008	.27371
45	1.8239	.88757	1.8065	.90121
46	.14383	.50770	.13212	.63156
47	.93437	.85200	.92187	.73121
48	.20189	1.3701	.21126	1.0798

EXHIBIT 44 - Residual Variances by State - LPERINC Models

	DoD Models		DoD/NETFED Models	
	Estimation Method		Estimation Method	
STATE	OLS	Covar.	OLS	Covar.
1	.00038	.00008	.00036	.00008
2	.00083	.00034	.00081	.00036
3	.00078	.00004	.00077	.00003
4	.00053	.00012	.00055	.00011
5	.00021	.00010	.00019	.00010
6	.00029	.00012	.00029	.00012
7	.00039	.00022	.00036	.00021
8	.00057	.00018	.00059	.00018
9	.00046	.00038	.00049	.00031
10	.00133	.00029	.00129	.00029
11	.00047	.00007	.00044	.00006
12	.00101	.00034	.00099	.00032
13	.00215	.00065	.00220	.00059
14	.00079	.00036	.00074	.00036
15	.00105	.00031	.00105	.00030
16	.00067	.00051	.00074	.00053
17	.00098	.00020	.00097	.00019
18	.00059	.00021	.00056	.00022
19	.00050	.00018	.00053	.00018
20	.00127	.00027	.00126	.00024
21	.00060	.00026	.00053	.00025
22	.00025	.00026	.00025	.00023
23	.00098	.00015	.00091	.00018
24	.00159	.00041	.00151	.00047
25	.00125	.00051	.00124	.00050
26	.00107	.00025	.00110	.00031
27	.00109	.00047	.00109	.00044
28	.00052	.00013	.00052	.00013
29	.00040	.00013	.00041	.00012
30	.00059	.00014	.00066	.00013
31	.00060	.00004	.00058	.00004
32	.00573	.00249	.00570	.00241
33	.00054	.00007	.00052	.00006
34	.00082	.00055	.00080	.00054
35	.00111	.00027	.00101	.00026
36	.00023	.00013	.00022	.00013

EXHIBIT 44 - CONTINUED

37	.00060	.00015	.00060	.00016
38	.00036	.00004	.00034	.00002
39	.00177	.00101	.00157	.00115
40	.00057	.00004	.00056	.00004
41	.00028	.00022	.00027	.00024
42	.00038	.00013	.00037	.00013
43	.00061	.00013	.00060	.00013
44	.00045	.00015	.00047	.00014
45	.00076	.00021	.00073	.00020
46	.00035	.00010	.00033	.00010
47	.00028	.00020	.00027	.00017
48	.00248	.00059	.00233	.00053

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