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AN
ECONOMIC
IMPACT
OF
THE
TFX
CONTRACT
AWARD
ON
THE
FORT
WORTH
TRADING
AREA



A STUDENT THESIS BY:

Mr. Raymond W. Harrison
Major Richard E. Smith, USAF

SCHOOL OF SYSTEMS AND LOGISTICS
AIR FORCE INSTITUTE OF TECHNOLOGY

WRIGHT-PATTERSON AIR FORCE BASE, OHIO

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AN ECONOMIC IMPACT OF THE TFX CONTRACT AWARD
ON THE FORT WORTH TRADING AREA

THESIS

Presented to the Faculty of the School
of Systems and Logistics
of the Air Force Institute of Technology
Air University
in Partial Fulfillment of the
Requirements for the Degree
of Master of Science
in Logistics Management

10

By

Richard E. Smith, ~~B.S.~~ Raymond W. Harrison, ~~B.S.~~
Major USAF Civilian CIA

Graduate Logistics

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PREFACE

Economic change in small areas is subject to a complex of forces. Technology creates new product and service demands and undermines old ones. Specialized resources attract industries. Major decisions by national or state authorities, or the vagaries of international markets, spur or stifle growth. Populations grow in numbers, in incomes, and in skills; or perhaps decline as outmigrants seek better economic alternatives. Initiative on the part of local promotion groups may attract activities that represent net additions to the national product or perhaps mere relocations away from other small and less favored areas.¹

A small area has a characteristic economic feature. Besides responding to the broad, general forces that make for development and fluctuation, such an area is more often than not peculiarly subject to stimuli or slowdown by outside forces. Its growth or decline in a modern market economy is likely to be

¹C.P.Blair, Economic Growth Projections for the Dallas, Fort Worth, and Houston Trading Areas (Austin: Bureau of Business Research, The University of Texas, 1961), p. 1.

a somewhat erratic and typically unbalanced response to global, national, regional, and state patterns of which it is a minute and often specialized subpart.²

Such an economic entity is the Fort Worth trading area. Such will be the affect and impact to be felt by that community and most probably the entire southwest region of the United States as a result of the TFX contract award.

The writers of this thesis are indebted to James S. Hall, General Dynamics Corporation representative for the Dayton, Ohio office, for providing employment estimates and wage statistics without which the thesis could not have been prepared.

For criticism and suggestions, we are indebted to our advisor, Dr. Herbert R. Kroeker of The Ohio State University, and Mr. Lewis J. Williams of The Ohio State University and Major Roy R. Wood, Jr., Air Force Institute of Technology, as members of the reading committee.

We also wish to convey our appreciation to Mrs. Bette Switalski for her typing of the final manuscript.

²Ibid.

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CHAPTER I

INTRODUCTION

The Problem and its Delimitation

The purpose of this economic base study is to show the economic impact and anticipated effects on the Fort Worth, Texas trading area as a result of the TFX (Tactical Fighter Experimental) military aircraft contract award to the General Dynamics and Grumman aircraft corporations. In order to accomplish worth while results in the limited time available, however, it was necessary to restrict the problem to measurable economic factors directly related to General Dynamics projected TFX employment and income. Many factors, which by nature effect the economy of an area, could not be considered as they either were not measurable or could not be realistically related to a single isolated industrial segment of the economic area without including all basic industries in the trading area. While economic base studies normally attempt to forecast the potential expansion and growth of an entire economic area based on all conceivable economic impact factors, the study conducted here was designed

to forecast expansion and growth in the Fort Worth trading area only insofar as the economy would be influenced and effected by the TFX contract award.

No single geographic area is necessarily more appropriate for a base study than another. Generally speaking, however, the larger the area considered, the more diverse are the characteristics of the area. In order to conduct a study of the economic impact to be realized by a community as a result of a large military contract the size of the TFX award, it was determined that a metropolitan area would be too small to adequately reflect the total impact, which is anticipated to effect more than the immediate Fort Worth metropolitan community. A trading area is larger than a metropolitan area which is limited primarily by commuting and shopping patterns only. The trading area can be formally and more broadly defined as a district whose boundaries are usually determined by the economical buying or selling which can be accomplished from a given point of distribution.¹ In addition to the above, pertinent information and statistics which had been previously compiled in Blair's 1959 economic projection study of the Fort Worth trading area were available upon which to base

¹2001 Business Terms and What They Mean (New York: Alexander Hamilton Institute, 1962), p. 282.

an economic base study. For these two major reasons the trading area was selected as the economic base upon which impact conclusions were to be developed.

In delimiting the study to the Fort Worth trading area, it was felt that a more complete economic impact analysis could be made in the limited research time available. It is true, that the proximity of the Dallas trading area will undoubtedly exert some influence on the conclusions reached in this paper. Where possible, these interconnected Fort Worth - Dallas relationships will be examined and determinations made with respect to economic effects on the Fort Worth community. In some instances, therefore, it may be desirable to treat the Fort Worth and Dallas trading areas as a single, combined unit. Primarily, however, this study will be limited to the Fort Worth trading area. All discussions contained in the paper concerning economic impact factors and effects can be assumed to refer only to the Fort Worth trading area unless other trading areas or metropolitan areas are specifically mentioned and included in the discourse.

The TFX contract period selected for analysis and review has been restricted to the years 1960-1970. The years 1960 through 1962 are prior to the contract award but years in which competitive preparation of

aircraft design, cost estimates, etc. were being submitted by the General Dynamics Corporation and other aircraft companies interested in making proposals. For the years 1963-1970, projections of General Dynamics employment and income at Fort Worth were made in order to determine what, if any, impact the TFX contract would have on the Fort Worth trading area. Since estimates become less accurate when projecting for a long period of time, it was determined that no purpose would be served by projecting figures beyond 1970.

A further delimitation of the study is that which binds measurement of the economic impact of the TFX contract award on the Fort Worth trading area to General Dynamics TFX basic employment, income and local procurement. All previous employment projections evolved in 1959 from the Blair study for the 1960-1970 period have been accepted as valid projection estimates.² However, it is the subsequently revised General Dynamics employment estimates developed as a result of the TFX contract award that now increases previous employment projections for the aircraft and parts basic industry in the Fort Worth trading area.³ The projected increase to

²Blair, pp. 74-75.

³Interview with James S. Hall, General Dynamics representative, Dayton, Ohio, June 24, 1963.

General Dynamics employment and employment income by year as a result of the award is the basis upon which the TFX economic impact on the Fort Worth economy is to be determined. All employment projections for all other basic industry in the trading area will remain as previously provided, but General Dynamics projected employment figures will be increased and varied in accordance with estimated yearly TFX production schedules. This will be explained in greater detail in chapters to follow.

Assumptions

In the conduct of any study of projected area growth, certain basic assumptions must be made. In this study of the Fort Worth trading area, various specific assumptions determined necessary were also made from time to time relative to the specific data or subject matter under discussion. The various specific assumptions will be identified as such in the body of the paper when applicable and appropriate for mention or consideration. However, basic assumptions applicable to this study in its entirety are as follows:

1. That national economic conditions will prevail as in the immediate past during the projection period.

2. That no major war will break out and that the present cold war status will continue indefinitely.

3. That the General Dynamics TFX contract award will remain in effect as currently planned for the entire period of this economic impact projection study (until 1970).

4. That General Dynamics TFX research and development and production will remain in the Fort Worth area at the currently estimated volume for the entire period of the study (until 1970).

5. That no other substantial government or commercial contract is awarded to General Dynamics for performance in the Fort Worth trading area.

6. That all General Dynamic/Fort Worth TFX aircraft and aircraft parts production is considered "basic" employment.

7. That for the purposes of this study, any expansion to Fort Worth economic growth is derived from General Dynamics expansion in "basic" employment as a result of the TFX contract award.

The Economic Base Study

The economic base of a community consists of those activities which provide the basic employment and income on which the rest of the local economy depends. An economic base study identifies the basic sources of employment and income and provides

an understanding of the source and level of all employment and income in a community. The primary objective of an economic base study is to develop information which will help a community solve local problems, make better decisions about matters that will enlarge economic opportunities for its citizens, improve their welfare, and make it possible for them to increase their contributions to community and national growth.

Economic base studies divide the local economy into two segments:

1. Firms and individuals serving markets outside the community.

2. Firms and individuals serving markets within the community.

The goods and services which the community sells outside its boundaries are considered exports. Exports include all sales made outside the community, not just trade with foreign nations. The remaining goods and services go to the local market. Local is defined to mean the geographic region being studied, such as the Fort Worth trading area.

Implicit in this division of markets is the cause and effect relationship. Export markets are considered the prime mover of the local economy. If employment serving this market rises or falls, employment serving the local market is presumed to move in the

same direction. When the factory (export) closes, retail merchants (local) feel the impact as laid-off factory workers have less to spend. Because of this prime mover role, export employment is considered as "basic". Employment which serves the local market is considered adaptive and is titled "dependent" or "service" employment.

One important use of a base study is in making some kind of forecast, although a forecast is not necessarily part of a base study. When the economic forces which have made the community what it is are understood, it is easier to project how these and other economic forces will effect the community in the future. First, the growth or decline of employment in basic industries is forecast for some time period. Then associated non-basic employment growth or decline can be determined. These projections can help greatly in forecasting changes in population, income, and the tax base. Forecasts of trends in these fields, in turn, can be used in planning to meet a wide range of public and private needs of the area, such as planning and zoning, capital budgeting, taxes and expenditures, housing, transportation, electricity, gas, telephone, and other services.⁴

⁴Charles M. Tiebout, The Community Economic Base Study (New York: Committee for Economic Development, 1962), pp. 9 and 13.

Methodology: The Economic Base or Export Model

The model used in this study for projecting employment and population growth in the Fort Worth trading area is one of a type known as an "economic base" or "export" model. It rests on two basic assumptions:

1. That population change in small areas is primarily a function of economic activity, with natural population change (births and deaths) playing a role secondary to the effects of net migration. If employment opportunities continue to be created, an area may contain its natural population increase and draw-in additional people from the outside, while emigration and population decline will occur if better opportunities exist elsewhere.

2. That a meaningful distinction can be drawn between those activities located in a small area but oriented toward outside markets, e. g. military aircraft production and those activities strictly serving local demand. The former are presumed to be the dynamic element in economic change within the area. They bring in outside income, which when respent produces a multiplier effect supporting incomes and employment in other activities.

Military aircraft production is considered an "export" activity and is termed "basic" industry in

this study, in contrast to the "dependent" business activities which serve local area markets only. The term "export" model is appropriate since sales outside of the area are considered to be the originating force in expansions or contractions within the area. The "dependent" business activities are viewed as changes in response to net changes in income derived from "basic" business activity. Thus, the "exports" of the market area provide the clue to growth or decline.⁵

The growth model employed depends upon the development of direct relationships between levels of dependent and basic activities, expressed in terms of employment. Employment is normally chosen as the data media for the model because it is relatively easy to obtain, while on the other hand, detailed income data by industrial origin, which is perhaps more desirable for multiplier analysis, is not always available for small areas.⁶ In this study an attempt has been made to weight General Dynamics current employment figures with current wage rates, and to apply estimated wage rates toward projected future employment totals. In other words, by estimating employment totals and wage rates by job classification at General Dynamics/Fort

⁵Blair, p. 9.

⁶Ibid., p. 10.

Worth for yearly periods up to the year 1970, it is anticipated that gross income and, thence, disposable income figures can be derived. If realistically estimated, the number of General Dynamics workers and their average wage can indicate how many new dependent-type jobs could be created and supported through application of the service-basic ratio and, coupled with the multiplier effect principle, an indication of the economic impact resulting from the TFX contract award on the Fort Worth economy can be shown. Because of the service-basic ratio, the most critical part of any procedure is the accurate identification and projection of future basic employment. In this study, this means an accurate projection of General Dynamics/Fort Worth employment. Increased basic employment tends to expand dependent employment by a multiple of the amount of basic employment change as indicated by the service-basic industry ratio comparison. In some high-income industries each basic employee may support three or four dependent employees in local-market service (dependent) activities.⁷

History and Economic Characteristics of the Fort Worth Trading Area

Fort Worth, which is the hub of the entire trading area, is in North Central Texas, only 30 miles

⁷Alfred G. Dale, An Economic Method for Small Areas (Austin: Bureau of Business Research, The University of Texas, 1955), pp. 33-34.

west of Dallas. The distance between the spreading outskirts of the two cities is much shorter. The 1960 census shows a population of 538,495 for Fort Worth. This is an increase over the 1950 census of some 49 percent.⁸ The estimated population for the entire Fort Worth trading area for 1960 is 710,900.⁹ In its century of existence, the city has passed through several stages of growth to become the currently diversified metropolis that it is. In the 19th century, Fort Worth was a railhead and market center for the cattle country of West Texas. In 1903, the city successfully subsidized the establishment of two large meat packing houses. With these facilities, it rapidly became one of the nation's largest cattle and sheep markets, and remains so today.¹⁰

Beginning in the First World War, major oil discoveries were made in nearby counties. As the nearest urban center of any size, Fort Worth became the focus for the resulting rapid development. Much of the financing, administration, and supplying of the West Texas fields emanated from Fort Worth. In return, oil flowed to the city for refining. Fort

⁸Donald J. Bogue and Calvin L. Beale, Economic Areas of the United States (New York: The Free Press of Glencoe, Inc., 1961), p. 1057.

⁹Blair, p. 75.

¹⁰Bogue and Beale, p. 1057.

Worth lost some of its importance in the industry subsequently as the closest fields were depleted and as West Texas created cities of its own. There is still one sizeable refinery, however, and certain items of oil industry equipment are manufactured in the city. Moreover, the oil boom brought in wealth and capital that stimulated other business ventures.¹¹

In 1941, the industry of the area took a new direction when a huge military aircraft plant was acquired by the General Dynamics Corporation. Since that date, aircraft manufacture has been the major payroll in the area, for the plant proved to be permanent and has been joined more recently by a helicopter factory. In the same period, the growing city and its newly skilled labor force attracted producers of automobiles (assembly), air conditioners, containers, and clothing. In short, the manufacturing base of the economy has been greatly expanded.¹²

Twelve counties comprise the Fort Worth trading area, as shown in Figure 1. These twelve counties have been determined through a series of surveys conducted by the Texas State Employment Commission and other state agencies, to be dependent mostly on the

¹¹Ibid., p. 1058

¹²Ibid.

city of Fort Worth for their spending and buying of needed goods and services.¹³ The economy of the trading area is obviously dominated by the industrial and commercial development of Fort Worth and Tarrant County, where the bulk of industrial expansion has occurred. Much of the evolution of the rest of the trading area has occurred in response to changes within the Fort Worth metropolitan area. It is expected that industrial expansion will continue to concentrate on the Tarrant County complex, with subsidiary developments in the remainder of the trading area.¹⁴

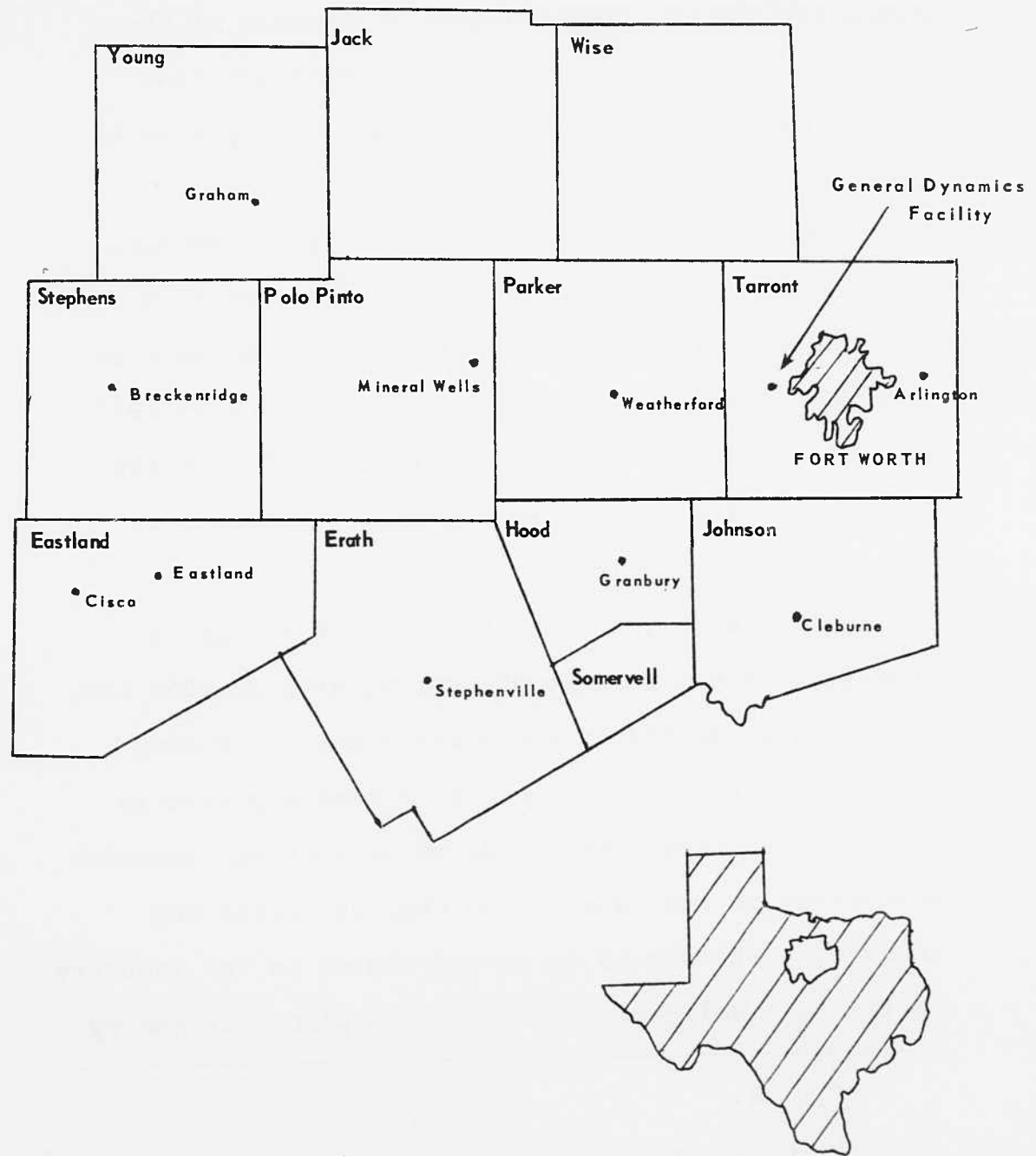
In spite of the rapid industrialization of the eastern section of the Fort Worth trading area, agriculture and petroleum production are still important elements in the economic base. It is probable that significant declines in agriculture employment will occur during the 1960-1970 period under study, particularly in the western counties of the trading area. However, dairying and production of truck crops and specialized crops should increase in response to the growth of urban markets in the trading area. Petroleum industry employment, meanwhile, is expected to decline gradually during this period.¹⁵

¹³Blair, p. 56

¹⁴Ibid.

¹⁵Ibid.

Figure 1
FORT WORTH TRADING AREA



Employment in manufacturing has a good growth potential, and basic services should expand rapidly. Prior to the TFX contract award, the traditional airframe industry was expected to offer drastically reduced employment opportunities.¹⁶ Because of the contract award, however, projected manufacturing growth rates will be larger than would otherwise be the case.

The population of the trading area grew substantially from 416,000 in 1940 to approximately 711,000 in 1960.¹⁷ It is projected on the basis of economic growth potentials to reach 778,000 by 1970, 857,000 by 1980, and 1,090,000 by 2020.¹⁸ The 1960 Fort Worth trading area population, by county, is shown in Table 1 below.

Total employment in the aircraft and parts industry for the Fort Worth trading area in 1959 was estimated at 22,962 in the Blair study. The same study also reveals that General Dynamics presently accounts for approximately 80 percent of all aircraft employment in Fort Worth, and thus dominates the industry. The second largest producer in the industry is the Bell Helicopter Company with plants at nearby

¹⁶Ibid.

¹⁷Ibid., pp. 74-75.

¹⁸Ibid., pp. 75 and 77.

Hurst and Saginaw. Other important firms are Menasco Manufacturing Company, makers of aircraft landing gear and missile components, and Aero-affiliates and Stratoflex, each of whom devotes part of its employment to the manufacture of aircraft parts. Nine other small firms in and around Fort Worth, and one each at nearby Cleburne and Olney also manufacture aircraft parts.¹⁹

TABLE 1

1960 POPULATION BY COUNTY
IN THE FORT WORTH TRADING AREA^a

County	Population
Eastland	19,500
Erath	16,200
Hood	5,400
Jack	7,400
Johnson	34,700
Parker	22,900
Palo Pinto	20,500
Somervell	2,600
Stephens	8,900
Tarrant	538,500
Wise	17,000
Young	17,300
Fort Worth trading area (total)	710,900

^aFigures obtained from The World Almanac and Book of Facts for 1963. U. S. Population by States and Counties, pp. 294-295.

Prior to the TFX contract award, employment in the aircraft and parts industry for the Fort Worth trading area had been projected downward to 19,000 by

¹⁹Ibid., p. 64.

1970, to 15,000 by 1980, and to 10,000 by 2020.²⁰ Revised estimates now place potential aircraft and parts employment at a high of 28,900 for 1968; only slightly lower at 26,700 for 1970.²¹

Had it not been for the TFX contract award, the decline in projected aircraft industry employment would have had an adverse effect on the Fort Worth economy. This is especially obvious when it is noted that in 1959 employment in aircraft and parts manufacturing was approximately 43 percent of all manufacturing industry and 24 percent of all basic industry employment for the entire Fort Worth trading area. In other words, almost half of all persons engaged in manufacturing type employment were working in the aircraft and parts industry. One out of every four basic industry workers was employed in the aircraft and parts industry.²²

Summary

This introductory chapter has delimited the TFX impact problem to be researched, and touched on the economic base or export model approach to be used to project Fort Worth TFX employment and income for the

²⁰Ibid., pp. 75 and 77.

²¹Interview with James S. Hall, General Dynamics representative, Dayton, Ohio, June 24, 1963.

²²Blair, p. 65.

1960-1970 period to be studied. A definition has been given of what a trading area is and why it was selected as the geographic limitation to the study. A further limitation is that which restricts the study to General Dynamics employment, employment income, and General Dynamics local procurement, since it is assumed that General Dynamics will perform the only substantial or measurable portion of the TFX contract in the Fort Worth area. The several assumptions made in order to establish a static economic and political climate for the projected 1960-1970 study period, limits further those possible economic variables that might otherwise be considered in the study.

A description was given of what an economic base study is and how it is expected to develop information which will help a community solve local problems and forecast private and public needs of the area. To give the reader a feel for the Fort Worth trading area, some of its history and its current and projected economic characteristics were provided. A better understanding of the Fort Worth trading area can be had from the geographic and population figures and data given.

Following chapters will go into detail to describe the significance of the service-basic ratio,

differentiate between basic and dependent (service) employment, and explain the multiplier doctrine, accelerator principle, and income leakage factors, all of which will effect the economic impact to be felt by the Fort Worth trading area as a result of the TFX contract award.

CHAPTER II

GENERAL DYNAMICS CORPORATION AND THE TFX CONTRACT

Business Position

General Dynamics is one of the leading contractors of modern weapon systems and is also well represented in such varied fields as nuclear submarines and other atomic power activities, the space sciences, electronics, and construction materials. Huge write-offs against commercial jet transport programs produced heavy deficits in 1960 and 1961, and lower sales and profits were indicated for 1963 as a result of the termination of the B58 supersonic aircraft project and the completion of the Atlas missile base activation programs during the latter part of 1962. However, the company's successful bid to develop the advanced TFX aircraft should become a major asset in the years ahead.¹

Plant and Property

General Dynamics/Fort Worth is located on 600 acres of land and has buildings containing 4,700,000

¹Standard Listed Stock Reports (New York: Standard and Poor's Corporation, 1963), XXX, No. 109, Sec. 13.

square feet of floor space. Of this figure 19,000 square feet of space is used for engineering offices. The plant, including machinery and equipment, is leased from the United States Government. Plant facilities are designed for production of long range multiple engine aircraft as well as lighter aircraft. Because General Dynamics/Fort Worth occupies a U. S. Government owned plant it has, since 1957, not been subject to local taxes.²

Financial Condition

Revenues for 1962 were down 8 percent from the previous year reflecting the phase out of the B58 bomber program and lower commercial plane sales. Margins were restored, however, as virtually all expenses related to the jet transport projects were absorbed in prior years. Operating income for 1962 was \$103,018,241 compared with an operating deficit of \$126,046,162 in the previous year. Pretax profits were \$58,843,460 as against a pretax loss of \$168,066,854 the year before. After taxes at 9.6 percent, net income was \$52,858,645 in contrast to the huge final deficit of \$143,203,459 sustained in 1961.³

²Moody's Industrial Manual (New York: Moody's Investment Service, Inc., 1962), p. 1802.

³Standard Listed Stock Reports, XXX, No. 109, Sec. 13.

Employment

General Dynamics/Fort Worth employment figures have been dropping since 1957 due to the completion and phase out of the B58 bomber program. From a recent 1957 high of 25,399, employment was down to less than 16,000 by 1962. With the TFX contract award General Dynamics expects that employment will gradually increase until a peak is reached of approximately 25,000 by 1968.⁴

The Origin and Purpose of the TFX Contract

The idea of a new fighter plane for the U. S. Air Force came into being in 1959 when General F. F. Everest, the incoming commander of the Air Force's Tactical Air Command, determined the need for a new fighter-bomber that would meet the demanding requirements for the next decade.

The type of plane that General Everest had in mind was entirely different from those presently in the Air Force inventory. The best fighter that the Air Force had at the time was the F-105, which was in a vulnerable position with only forty-four suitable take-off and landing fields, and these fields were well known by the Soviets. General Everest had in mind

⁴Interview with James S. Hall, General Dynamics representative, Dayton, Ohio, June 24, 1963.

a new fighter, an aircraft with the capability to use shorter runways and any type of landing field. He also wanted the capability of long range for ferrying purposes in order to arrive at trouble spots in a minimum of time. The new plane, according to Richard Smith writing for Fortune Magazine, should also have the capability of low-level attack at supersonic speeds, be able to loiter at subsonic speeds for reconnaissance purposes, and participate in aerial combat at speeds up to 1,700 miles per hour.⁵ This radical approach requiring multi-operational characteristics in one airplane was to have a profound effect in future aircraft production and procurement.

The Department of Defense Views on Procurement Policies

When Secretary of Defense Robert S. McNamara came into office in 1961, he began to place more emphasis on "value engineering" in the procurement system of all military services. He felt that inter-service rivalry and procurement by single services should be carefully considered. It was his firm belief that the Department of Defense should review all procurement from an objective point of view and thereby make sound decisions unencumbered by service bias or prejudice. He felt that by looking at defense

⁵Richard Austin Smith, "The \$7-Billion Contract That Changed the Rules," Fortune, LXVII, No. 3 (March 1963), p. 97.

spending from top-level echelons in the Department of Defense, civilian specialists could view competitive bidding on a more objective basis than could the individual services. Under this concept, Secretary McNamara felt that his department could save the nation millions of dollars by coordinating its procurement.

With the advent of the TFX, he felt that this was the opportunity to which he could apply the various approaches which he believed would save the nation a vast amount of money and at the same time streamline the procurement system for all military departments. The TFX would be the biggest fighter-plane program since World War II, involving most of the major aircraft industries in the bidding phase, requiring a radical departure from previous concepts of production and design, and creating a multi-purpose airplane for both the Air Force and the Navy.

Extent of the Contract

In April, 1960, according to Smith, a joint conference of the Air Research and Development Command, the Tactical Air Command, and NASA had agreed on a program for the TFX. Assuming that a contract would be let in October, 1960, sixteen test aircraft would be produced for \$338 million, first flight test in May, 1963, date of operational availability in October, 1965,

and total cost of contract would be approximately \$2.2 billion.⁶

Due to the forthcoming Presidential election in November, 1960, the Department of Defense temporarily postponed all procurement action concerning the awarding of the TFX contract since the incumbent administration did not want to commit the incoming administration to costly, far-reaching new military programs.

After Robert S. McNamara took over as the Secretary of Defense, it was months before he got around to reviewing the TFX, but when he did, he saw the opportunity to apply his ideas about "controlled response," i.e., that our arsenal should contain a number of options to all-out nuclear war, one of which was the selective, tactical use of atomic weapons. The TFX, as he saw it, would be able to fly under enemy radar at speeds too great for foreseeable ground-to-air missiles. Second, with a plane of such versatility, McNamara decided that this weapon could fill the needs of all the military services and, as the first fighter designed for multi-service requirements, it would thus become the cornerstone of his efforts to cut costs.

⁶Ibid., p. 182.

Richard Smith described McNamara's first official action concerning the TFX in the following manner:

McNamara's October 1, 1961 Request for Proposal and the accompanying Work Statement signaled the official start of the great race. The finish line for TFX designs was set for December 6, nine and a half weeks away. Crammed into 250 pages of the Work Statement were the rigorous requirements: the expected performance, the logistics and support demands, and the type of environment the aircraft would have to function in. Each contractor was required to specify how he intended to make the plane, which of the three eligible engines he would use, the costs involved, the dates on which he would guarantee to reach such milestones as first flight and operational availability, how much subcontracting there would be and to whom, and so on ad infinitum, even to the names of the top people to be assigned to the job.⁷

After receipt of initial bids, Secretary McNamara was concerned about the low-cost estimates in the bid proposals. He felt that both General Dynamics and Boeing had submitted bids that were extremely low with the idea that they would raise the costs after the contract had been awarded. In view of the fact that a cost overrun on a \$7-billion program would involve a huge sum of money, he felt this would have to be borne by the taxpayers and the total amount could have been used toward a different weapon system.⁸ As

⁷Ibid.

⁸Interview with Deputy Director, SPO for the TFX, June 11, 1963, revealed that no cost figures, numbers of aircraft, production schedules, or conditions of the TFX contract would be released. The data used in this thesis were obtained from magazine sources and are not considered official.

previously mentioned, the original program called for the building of sixteen test TFX aircraft at a cost of \$338 million and an undisclosed number of operational aircraft at a total cost of around \$2.2 billion. Under McNamara's plan, the new revised bid proposals called for a larger number of TFX aircraft than originally planned for when the Air Force would have been the sole user. The total cost of this new program would cost approximately \$7-billion since the plane was now for multi-service use.

Besides cost considerations, McNamara was keenly concerned about the commonality of parts for the new weapon system that was to be used jointly by the Air Force and Navy. Past experience had shown that the aircraft industries were service-oriented and had previously built their planes to please the individual services. Other than General Dynamics, the other major aircraft companies still felt this would be the concept for TFX production. This idea proved to be a stumbling block for Boeing when it came to making a final decision on contract award, since McNamara had decidedly emphasized his desire for more commonality in the new weapon system.

When the Source Selection Board met in December, 1961, to consider the Requests for Proposal from the bidders, it took them a month to evaluate and make their recommendation to award the contract to Boeing.

Upon review by the Department of Defense, it was decided that both Boeing and General Dynamics should refine their designs and resubmit their proposals.

In May, 1962, the Source Selection Board made their second evaluation and again recommended Boeing. This time the Navy expressed fears that the designs would not fulfill its needs. Both contractors were directed to rework their designs again.

The third evaluation was made by the Source Selection Board on June 20, 1962, and again Boeing was recommended. By this time an estimated 200,000 manhours had been put into the three evaluations on the proposals for the F-111 (TFX) tactical fighter. In June, 1962, Secretary of the Air Force Zuckert wrote the Source Selection Board directing them to hold a fourth evaluation and reconsider design and cost estimates. On November 2, 1962, the fourth evaluation was completed by the Source Selection Board and, again, Boeing was recommended.⁹

The decision to award the TFX contract to General Dynamics/Fort Worth was made in November, 1962, by the Department of Defense. Design was no longer a factor in deciding the contract award.

⁹George C. Wilson, "TFX Board Selected Boeing Four Times," Aviation Week & Space Technology, Vol 78, No. 9 (March 4, 1963), p. 24.

Secretaries McNamara, Gilpatric, Zuckert, and Air Force Under Secretary Joseph Charynk evaluated the proposals on the basis of commonality, schedule, and cost estimates. Under this criteria, all Secretaries agreed that the award should go to the General Dynamics combine.

The world of defense procurement, according to Smith, has only begun to feel the impact of the TFX contract. Nine airframe companies and three engine manufacturers were initially involved in bidding on the multi-service airplane, before Boeing and General Dynamics/Fort Worth were selected for final competition of the contract award. When it was over, General Dynamics/Fort Worth had won the contract for producing the airframe (expected to reach a total of \$4.2 billion by 1970). Pratt & Whitney had a potential billion-dollar contract for the engines, and a new concept of weapon procurement evolved from the Department of Defense.¹⁰

¹⁰Smith, Fortune, LXVII, p. 96.

CHAPTER III

BASIC - DEPENDENT INDUSTRY RELATIONSHIP

Perspective

It is necessary at this point to make some simplifying assumptions and observations in order to clearly identify and differentiate between basic and dependent (service) industry. Much of the following to be discussed and covered in this research study will involve basic and/or dependent employment and income, and for this reason a definitive identification should be made between the two.

In order to interpret assembled data and to arrive at concrete conclusions regarding the relative importance of various economic factors, it is essential to establish a clear frame of reference. It is apparent that some types of economic activity are more important than others, so far as the viability of the local economy is concerned. Under certain circumstances the size of an industry or activity, measured in terms of employment or in the money values of the product or services it offers,

may not necessarily correlate with its ability to influence total economic development.¹

If well defined economic trends are present within the trading area, it is possible to make some assumptions regarding their future impact on the local economy. Any type of developing economic activity is apt to generate its own impetus for continued development. Its localization in an area or region carries some expectation of further development and of activities subsidiary to it. In Texas a good example of this principle is to be found in the development of the aircraft and automobile assembly industries in the Dallas - Fort Worth areas. The creation of a trained labor force in this combined trading area, together with its strategic marketing advantages, has made it increasingly attractive as a site for similar industries. At the same time, a series of subsidiary activities (e.g. sub-contracting) have developed in response to the marketing opportunities offered by the major industries. There is also, of course, the resultant subsidiary growth of the supporting service industries.²

Basic Industry

The purpose of an economic analysis which is directed to finding how a community may grow, or

¹Dale, p. 8.

²Ibid., p. 10.

whether it can grow, must primarily consider those activities with a growth potential deriving from factors external to purely local influences. Such types of activity, which are based primarily on the sale of goods and services outside the local area or which are supported from non-local revenue sources, are considered to be "basic" industry.³ In this context the TFX aircraft can be considered wholly as an "export" product - a product produced for external consumption and supported from non-local revenue. The aircraft and aircraft parts industry can therefore be thought of as "basic" industry.

Unlike service activities, the capacity for growth of basic industry is not restricted by local demand or income levels. This characteristic gives basic industry a dual importance in the local economy. Its capacity for expansion is not limited by the local economy, and yet this expansion also generates concomitant secondary growth in the local service industries.⁴

Expanded opportunities in basic activities attract labor to a community. Augmented population

³Ibid., p. 9.

⁴Ibid.

and wealth in turn support expansion in the service industries. As employment in the basic industries increases, there will invariably be increases in employment in the service industries. In a very real sense, therefore, basic industry should be regarded as the foundation of community and area growth and prosperity.⁵

In order to isolate basic from service activities, it is necessary to adhere to the following basic industry criteria:

1. That the goods and services produced, or at least part of the production, are exported from the area or are bought by non-local users.⁶
2. That the revenue received is from non-local sources of income. This will apply to locally situated enterprises whose revenue is received from non-local sources.
3. That local residents who work outside the study area should be considered as basic workers, since they are responsible for bringing outside income into the area.⁷

⁵Ibid.

⁶Ibid.

⁷Ibid., p. 31.

Dependent (Service) Industry

To accurately define or identify dependent (service) industry is to determine whether or not the output of business is primarily for service to other businesses or for consumption by the local population. Two characteristics are distinctive of dependent (service) industry are that:

1. The level of activity in business geared to serving the needs of the local population is related to the total amount of wealth available in the community.⁸

2. Increasing the scope of this type of business will not augment the total wealth of the community. It might create different internal economic relationships, but it cannot create more wealth since it is dependent in the first instance upon the existing wealth in the area.⁹

It is entirely possible that the absolute importance of service type activity measured either in terms of employment or in dollar business volumes, will be dominant in the economic community. In fact, in many communities, a majority of the population relies upon opportunities in the service trades for employment. In the long run, however, service

⁸Ibid., p. 8.

⁹Ibid.

industry is essentially a dependent activity; dependent upon basic industry activity.

It is clear, for example, that the amount of laundry business which can be independently sustained in a community is closely related to the size of the local population, local income levels, and local social habits. Within fairly narrow limits there will be an upper level of laundry activity which can be economically supported. Any attempt to increase the amount of laundry business in a community which already has its needs adequately covered would result in a redistribution of the existing business, rather than an increase in the total amount.¹⁰

In this research study, activities will be termed and referred to as "service" and "dependent" industry interchangeably, and accordingly can be synonymously identified. Essentially, however, when related directly to basic industry, the term "dependent" industry will most likely be used. The term "service" industry will be more often used when referring to population and community activities apart from direct connection or reference to basic industry.

Basic-Dependent (Service) Industry Interrelationship

It is expected that some industries will always be partly basic and partly service in character to

¹⁰Ibid.

the extent that some of its products or services are exported and some retained for local consumption. When this is the case, it is necessary to determine the approximate proportions of the basic and service components.¹¹

The first step is to divide the employment in each of the basic industries in the ratio of the amount of non-local to local business, in order to arrive at an estimated figure representing the amount of "basic employment" within each industry. For the estimates to be realistic, it would be necessary to survey each individual establishment in the trading area, determine the proportions of output oriented to outside markets, and allocate an appropriate amount of employment as basic, with the remainder being regarded as dependent.¹²

In the conduct of this study of the TFX impact on the Fort Worth trading area, the suggested survey procedure is not practical or necessary since it has already been assumed that all TFX production is for export and supported from non-local revenue sources and therefore, no portion of production can be considered dependent or service employment.

¹¹Ibid., p. 31.

¹²Blair, pp. 10-11.

CHAPTER IV

PROJECTED FORT WORTH TRADING AREA TFX EMPLOYMENT AND INCOME

Prospective

In this chapter, attempts will be made to develop from historical data, projected General Dynamics TFX basic employment and from that, derive TFX dependent employment in the Fort Worth trading area. The projection period to which this study is limited begins in 1960 and extends through 1970. During this period, a year to year projection of TFX basic employment will be made and the service-basic ratio applied to determine dependent employment.

Estimated basic and dependent workers' wages for the years to be covered will also be projected on the basis of historical information. The total TFX basic and dependent employment derived from projected estimates will be multiplied, as applicable, by the projected Fort Worth average weighted workers' wage in the aircraft and parts industry on the one hand, or by Fort Worth dependent industry average weighted workers wage on the other hand, to arrive at TFX Fort Worth gross employment income.

The breakout of basic gross employment income and dependent gross employment income for each year covered by the study will be adjusted to account for personal Federal income and social security taxes in order to derive disposable income. Resulting basic and dependent disposable employment income figures will be determined by year and related to the TFX contract award. Chapters to follow will be concerned with determining what portion of disposable income will be spent in the Fort Worth trading area and what multiple effect will be exerted on the Fort Worth economy.

General Dynamics TFX Basic Employment

In order to estimate the amount of General Dynamics/Fort Worth TFX employment for the years 1960 through 1970, it was first necessary to make use of employment projections previously derived in a study conducted in 1959 by the Bureau of Business Research, The University of Texas.¹ In the study, projections

¹Blair, p. 74-75. There are many approaches to conducting a limited economic area base study. In this instance, it is not specifically known what methodology was followed by C. J. Blair and the Bureau of Business Research staff, but it is assumed that the pamphlet, An Economic Survey Method for Small Areas prepared previously by the Bureau of Business Research, was used as a guide. Much of the information obtained by the Business Research staff for their study came from the Texas Employment Commission, U. S. Census Bureau, other U. S. and State government agencies, and through correspondence and interviews with firms and persons engaged in, or concerned with, business and commerce in the Fort Worth trading area.

of total basic employment and projections of basic employment in the aircraft and parts industry for the Fort Worth area were made for the years 1960 and 1970, and beyond. Based on the figures provided for 1960 and 1970, an interpolation was made to arrive at projected employment totals for each of the intervening years. The interpolated results indicated in Table 2 show that total basic employment in the trading area was increasing while aircraft and parts employment was decreasing. This was mainly due to manufacturing and other basic industries increasing their employment more than the anticipated employment decline in aircraft and parts. These statistical projections were compiled, of course, prior to the TFX contract award.

In 1959, some 80 percent of all aircraft and parts industry production workers in the Fort Worth area were employed by the General Dynamics Corporation.² For the purpose of this research study, it has been assumed that prior to consideration of TFX impact factors, projected employment in the aircraft and parts industry would continue to be provided by General Dynamics at the 1959 prevailing rate of 80 percent for the projected 1960-1970 period. The remaining 20 percent would be aircraft and parts workers employed

²Blair, p. 64.

PROJECTED TFX BAS

Part A			
Projected employment prior to TFX contract	1960	1961	1962
Total basic employment ^a	99,377	99,687	99,997
Total AC & parts employees	22,583	22,204	21,825
Gen. Dynamics Employees (80%)	18,066	17,763	17,460
All other employees (20%)	4,517	4,441	4,365
Part B			
Projected employment subsequent to TFX contract			
Total basic employment	99,377	99,687	99,997
Total AC & parts employees	22,583	22,204	21,825
General Dynamics employees	18,066	17,763	17,460
(percentage)	80%	80%	80%
All other employees	4,517	4,441	4,365
(percentage)	20%	20%	20%
General Dynamics TFX Employment			
Percent of total General Dynamics employment	1%	2%	5%
Number of employees	181	355	873

^aTotal basic employment figures for the years between 1960

1

TABLE 2

ESTIMATED TFX BASIC EMPLOYMENT, FORT WORTH TRADING AREA

1962	1963	1964	1965	1966	1967	1968	1969	1970
99,997	100,307	100,617	100,927	101,237	101,547	101,857	102,167	102,479
21,825	21,446	21,067	20,688	20,309	19,930	19,551	19,172	18,791
17,460	17,157	16,853	16,550	16,247	15,994	15,640	15,338	15,033
4,365	4,289	4,214	4,138	4,062	3,986	3,911	3,834	3,758
99,997	101,150	103,764	106,377	107,990	109,553	111,217	110,829	110,446
21,825	22,289	24,214	26,138	27,062	27,986	28,911	27,834	26,758
17,460	18,000	20,000	22,000	23,000	24,000	25,000	24,000	23,000
80%	81%	83%	84%	85%	86%	86%	86%	86%
4,365	4,289	4,214	4,138	4,062	3,986	3,911	3,834	3,758
20%	19%	17%	16%	15%	14%	14%	14%	14%
5%	24%	52%	74%	76%	78%	80%	78%	76%
873	4,320	10,400	16,280	17,480	18,720	20,000	18,720	17,480

between 1960-1970 are interpolated on a straight line basis.

2

by all other aircraft and parts manufacturers in the area. As already explained, and as shown in Part A of Table 2, General Dynamics projected employment figures for the years 1960 through 1970 are based on data available prior to the TFX contract award.

Subsequent to the TFX contract award, information was obtained from General Dynamics in a series of discussions which indicated actual employment totals for 1960-1962, and estimated employment totals for their Fort Worth facility for the years 1963-1970.³ The rough employment estimates for 1963 through 1970 were based on the assumption that no drastic changes would be made to currently planned TFX production schedules. Based on these estimates it will be noted, in Part B of Table 2, that a peak employment figure of 25,000 is projected for General Dynamics in 1968. From the 1968 employment projection it will be further noted that General Dynamics will be credited with 86 percent of all projected Fort Worth aircraft and parts industry employment for that year.

Except for General Dynamics projected employment, all other aircraft and parts industry employment is assumed to continue to decline at the previously projected rates. The basis for this assumption is that

³Interview with James S. Hall, General Dynamics representative, Dayton, Ohio, June 24, 1963.

Bell Helicopter and the other smaller aircraft and parts manufacturers in the area have been primarily concerned with helicopter and missile work which is not readily conducive to conversion to TFX jet aircraft sub-assembly and part production. Further, indications are that the Fort Worth area in having received the rich TFX "plum" will not be favorably considered for additional TFX sub-contracting. Even if the above is incorrectly assumed, expansion of the smaller aircraft manufacturers due to TFX work would not be of a size to appreciably effect the economy of the trading area. Therefore in order to isolate the economic impact of the TFX contract award on the Fort Worth area, only General Dynamics employment projections have been considered in the study.

In further conversations with Mr. James Hall of General Dynamics, estimates were made as to what percentage of total General Dynamics employees for the years 1960 through 1962, and the percentage of projected employment for the years 1963 through 1970, were, or would be engaged in TFX aircraft development and production.⁴ These estimated projections are given in Table 2. From these figures it will be seen that 1968 is forecast as the highest projected year of TFX employment. From these employment figures

⁴Ibid.

will be determined TFX dependent employment. Dependent employment will be discussed at some length later in this chapter.

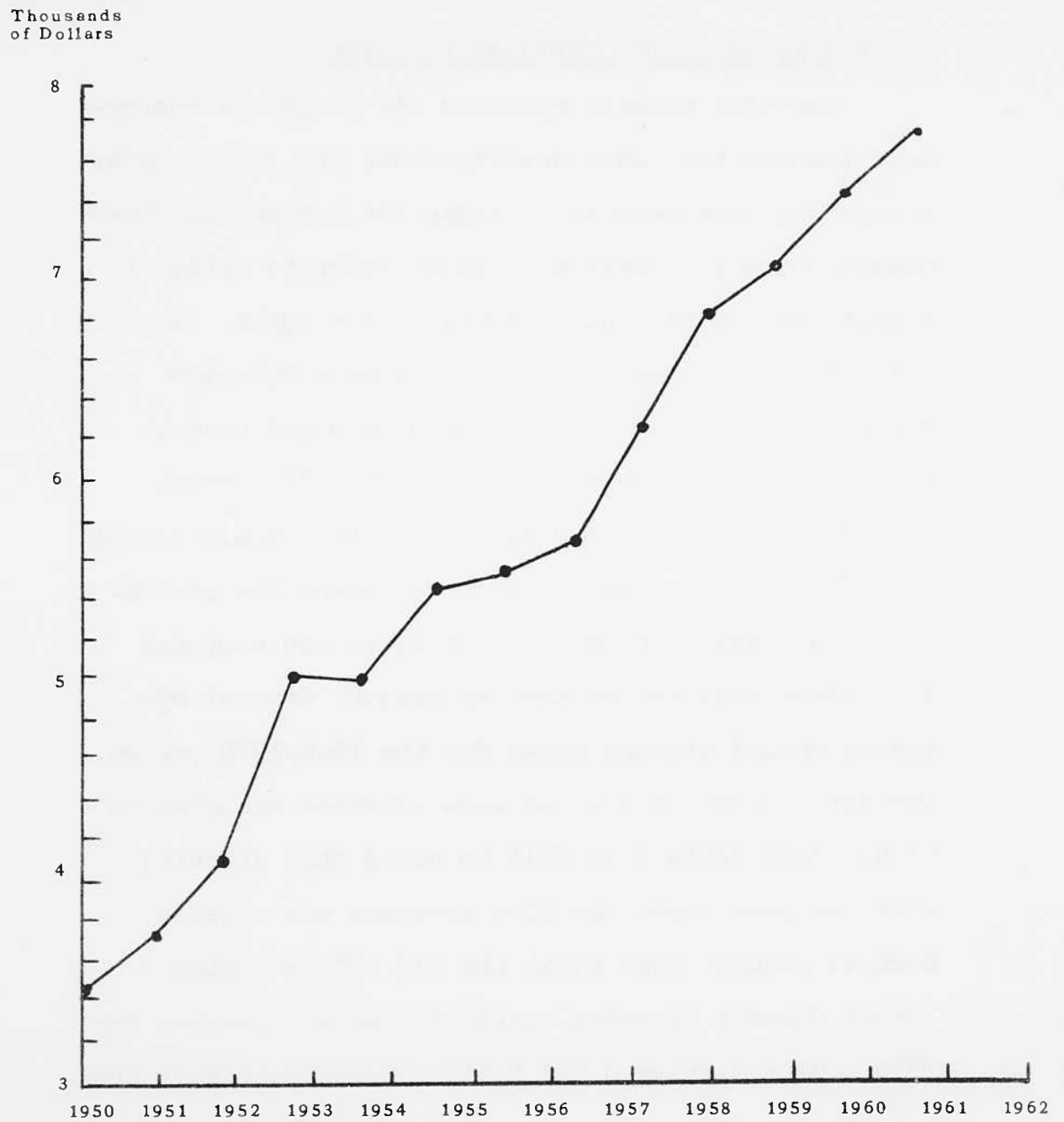
General Dynamics TFX Employment Income

Now that General Dynamics TFX projected employment figures have been developed for the period under study, the next step is to apply the average weighted General Dynamics workers' wage in order to arrive at a gross employment income total. Once again, historical information was provided by General Dynamics management to reflect the average weighted General Dynamics workers' wage for the years 1950 through 1962.⁵ Figure 2 shows graphically the average annual wage for General Dynamics workers during the period.

An average annual wage increase was computed from these figures and used to project General Dynamics annual average wages for the 1960-1970 period. The derived annual average wage increase amounted to \$330. From Table 3 it will be noted that starting with the year 1960, the \$330 increase was added to each subsequent year until the \$10,390 estimated annual General Dynamics workers' wage was reached for 1970. By multiplying the General Dynamics annual average wage by General Dynamics TFX employment, for each

⁵Ibid.

Figure 2
GENERAL DYNAMICS ANNUAL AVERAGE WAGE
(Hourly Paid and Salaried Employees)



PROJECTED GENERAL DYNAMICS

	1960	1961	1962	1963
General Dynamics TFX employment	181	355	873	4,320
General Dynamics annual average wages and salaries	\$7,100	\$7,420	\$7,750	\$8,080
General Dynamics TFX gross annual income (in thousands)	\$1,285	\$2,634	\$6,766	\$34,906
Federal income plus Social Security tax rate ^a	15%	15%	16%	16%
General Dynamics TFX disposable annual income (in thousands)	\$1,092	\$2,239	\$5,683	\$29,321

^aCalculated from: U. S. Department of Commerce, Bureau of Economic Analysis, "General Dynamics TFX Aircraft" (Washington: U.S. Government Printing Office, p. 389).

TABLE 3

GENERAL DYNAMICS TFX BASIC EMPLOYMENT DISPOSABLE INCOME

1963	1964	1965	1966	1967	1968	1969	1970
4,320	10,400	16,280	17,480	18,720	20,000	18,720	17,480
\$8,080	\$8,410	\$8,740	\$9,070	\$9,400	\$9,730	\$10,060	\$10,390
\$34,906	\$87,464	\$142,287	\$158,544	\$175,965	\$194,600	\$188,323	\$181,617
16%	16%	17%	17%	17%	18%	18%	18%
\$29,321	\$73,470	\$118,098	\$131,592	\$146,051	\$159,572	\$154,425	\$148,926

Bureau of the Census, Statistical Abstract of the United States: 1962
389.

2

year during the 1960-1970 period, a total TFX gross employment income for each year was derived.

To arrive at disposable income, there must be subtracted from TFX gross employment income that amount paid to the Federal government for personal income and social security taxes. A married couple with two dependents pays personal income and social security taxes at the rate as shown in Table 3. It will be observed that the Federal tax rate increases in accordance with the projected yearly increase to the annual average workers' wage. The applicable personal income tax plus the required social security tax deduction is converted into a total dollar amount which in turn is deleted from General Dynamics TFX gross employment income to arrive at General Dynamics projected TFX disposable employment income.

Since Texas has no personal income tax it was not necessary to consider this in deriving disposable income figures.

Table 3 summarizes all pertinent data discussed and shows the total TFX basic employment gross income by year derived from projected General Dynamics basic employment and General Dynamics projected annual average workers' wages. The table also indicates total estimated Federal personal income and social security tax withheld, by percent and by year, after which

total General Dynamics TFX disposable employment income is determined.

The Service-Basic Ratio

The purpose of the service-basic ratio is to equate employment in the service (dependent) industries to employment in the basic industries, and to permit the quantitative expression of this relationship.⁶ The service-basic ratio determines that amount of dependent employment owing its jobs to basic industry employment. The ratio expresses an interface relationship but does not necessarily indicate a causal relationship. A service-basic ratio can be derived for every basic industrial group or sub-group. All or portions of agriculture, mining, and manufacturing production which can be identified as basic "export" industry creates and supports dependent employment.

General Dynamics/Fort Worth can be broadly classified in accordance with the 1957 Standard Industrial Classification Manual as falling into the basic industrial durable manufacturing group. In keeping with the same S. I. C. coding procedure it can be further sub-categorized as transportation equipment, and broken down even further into a more detailed

⁶Dale, p. 32.

S. I. C. sub-group identifiable as aircraft and parts.⁷ Through use of the service-basic ratio General Dynamics aircraft and parts employment can be related to that amount of service employment it supports. In this research study a General Dynamics service-basic ratio is developed for the years 1960-1970. Once the ratios are calculated they can be applied to General Dynamics TFX employment in order to derive the amount of service employment it creates and supports in the Fort Worth trading area for any specific year.

It is assumed that basic industry is the foundation upon which the growth of an economy must depend, and because of the service-basic ratio the total size of the service industry in the area will be related to the total size of the basic industry. The supporting power of the individual basic industries will differ, and since relationships will be expressed in terms of employment, the relative importance of each group of basic industrial employment will be found by weighing basic employment by average incomes in the different industries. In other words, a basic industry favored by a high average industrial wage will support a greater quantity

⁷Charles M. Tiebout, The Community Economic Base Study (New York: Committee for Economic Development, 1962), p. 31-32.

of dependent employment. Because of this, the aircraft and parts industry can be expected to have a higher than average service-basic ratio than most other manufacturing industries.

The computation of the service-basic ratio for General Dynamics/Fort Worth involves the following steps:

1. Determine the amount of General Dynamics basic employment.
2. Determine the General Dynamics annual average workers wage.
3. Multiplication of (1) and (2) to find General Dynamics basic employment income.
4. Determine total basic employment in the Fort Worth trading area.
5. Develop a Fort Worth basic employment annual weighted average workers wage.
6. Multiplication of (4) and (5) to find the aggregate basic employment income.
7. Determine the total of all dependent (service) employment in the Fort Worth trading area.
8. Divide (3) by (6), and multiply by (7) to determine total number of dependent workers supported by General Dynamics basic employment.
9. Divide the amount of supported service employment found in (8) by the amount of General

Dynamics basic employment to determine the service-basic ratio of General Dynamics.

The foregoing procedure may be illustrated by a specific example based on employment and income statistics previously determined. In Table 4, for the year 1963, it was calculated that 101,150 workers will be engaged in basic employment in the Fort Worth trading area and of these, 18,000 will be employed by General Dynamics.

TABLE 4
BASIC EMPLOYMENT PROJECTED IN FORT WORTH
SUBSEQUENT TO TFX CONTRACT^a

Year	Total Employment	General Dynamics
1960	99,377	18,066
1961	99,687	17,763
1962	99,997	17,460
1963	101,150	18,000
1964	103,764	20,000
1965	106,377	22,000
1966	107,990	23,000
1967	109,553	24,000
1968	111,217	25,000
1969	110,829	24,000
1970	110,446	23,000

^aInformation extracted from Table 2, Part B.

The projected annual average wage per worker in General Dynamics during 1963 was \$8080, as shown in Table 5. The over-all Fort Worth projected basic industry annual average wage for 1963 as shown in Table 5 is \$5857. Thus, the 1963 employment income of General Dynamics (step 3) was 18,000 workers multiplied times \$8080 which is their annual average wage for that year. The rounded-off result is \$145 million.

TABLE 5
PROJECTED WEIGHTED BASIC WORKERS
ANNUAL AVERAGE WAGE^a

Year	National	Fort Worth	General Dynamics
1960	\$4,615	\$5,261	\$7,100
1961	\$4,802	\$5,474	\$7,420
1962	\$4,987	\$5,686	\$7,750
1963	\$5,137	\$5,857	\$8,080
1964	\$5,287	\$6,028	\$8,410
1965	\$5,437	\$6,199	\$8,740
1966	\$5,587	\$6,370	\$9,070
1967	\$5,737	\$6,541	\$9,400
1968	\$5,887	\$6,712	\$9,730
1969	\$6,037	\$6,883	\$10,060
1970	\$6,187	\$7,054	\$10,390

^aSee page 56 for explanation of table.

The 1963 aggregate employment income for all basic workers in the Fort Worth area was obtained by multiplying 101,150 total basic workers by the projected Fort Worth basic workers annual average wage of \$5857 (step 6) to arrive at a total of \$592 million. Table 6 shows 181,177 workers employed in the dependent industries for 1963 (step 7). The amount of 1963 service employment supported by the 18,000 General Dynamics workers, calculated in accordance with the procedure outlined in step 8, is therefor:

$$\frac{145}{592} \times 181,177 = 44,570$$

The ratio of service to basic General Dynamics employment in 1963 is 44,570 to 18,000 or, the equivalent of 2.47:1. This indicates that each basic worker employed by General Dynamics/Fort Worth supports 2.47 service workers. This, and all other projected service-basic ratios subsequent to the TFX contract award for the years 1960 through 1970, is noted in Table 7.

It has been previously indicated that the General Dynamics aircraft and parts workers annual average wage of \$8080 used for 1963 in the example was provided from General Dynamics management sources.⁸

⁸Interview with James S. Hall, General Dynamics representative, Dayton, Ohio, June 24, 1963.

PROJECTED DEPENDENT EMPLOYMENT

Year	1960	1961	1962	1963
General Dynamics employment subsequent to the TFX contract	18,066	17,763	17,460	18,066
General Dynamics employment prior to the TFX contract	18,066	17,763	17,460	17,136
Increase in General Dynamics employment	-	-	-	8,930
Service-Basic Ratio	2.33	2.37	2.41	2.45
Dependent employment due to TFX hiring	-	-	-	2,066
Dependent employment prior to the TFX contract	171,632	174,136	176,641	179,136
Dependent Employment subsequent to TFX contract	171,632	174,136	176,641	181,136

1

TABLE 6

DEPENDENT EMPLOYMENT CHANGES DUE TO TFX HIRING

2	1963	1964	1965	1966	1967	1968	1969	1970
460	18,000	20,000	22,000	23,000	24,000	25,000	24,000	23,000
460	17,157	16,853	16,550	16,247	15,994	15,640	15,338	15,033
-	843	3,147	5,450	6,753	8,006	9,360	8,662	7,967
1	2.47	2.55	2.63	2.69	2.76	2.84	2.91	2.92
-	2,032	7,773	13,898	17,760	21,536	25,833	24,600	23,183
641	179,145	181,649	184,154	186,658	189,162	191,667	194,171	196,676
641	181,177	189,422	198,052	204,418	210,698	217,500	218,771	219,859

2

TABLE 7
PROJECTED SERVICE-BASIC RATIOS
FOR THE FORT WORTH TRADING AREA

Aircraft and Parts Industry Prior to TFX Award									
1960	1961	1962	1963	1964	1965	1966	1967	1968	1969 1970
2.28	2.35	2.42	2.49	2.56	2.63	2.70	2.77	2.84	2.91 2.98
General Dynamics Subsequent to TFX Contract									
1960	1961	1962	1963	1964	1965	1966	1967	1968	1969 1970
2.33	2.37	2.41	2.47	2.55	2.63	2.69	2.76	2.84	2.91 2.92

The \$5857 Fort Worth basic workers' annual average wage, however, was not so easily acquired. It was first necessary to obtain the national basic workers' annual average wage, and with the 1955 through 1962 figures acquired, derive the estimated annual average wage increase of \$150.⁹ Since national basic annual average wages were provided for the 1960-1962 period, the \$150 annual average wage increase was projected only for the years beyond 1963 and up through 1970. See Table 5. The Fort Worth basic workers' annual average wage was provided for the year 1959.¹⁰ By comparing the given Fort Worth 1959 wage figure with the national 1959 equivalent basic workers' annual average wage, it was found that the Fort Worth basic wage rate was 14 percent higher than the national average. It was assumed that the 14 percent wage differential would continue to prevail and accordingly, was applied to the years 1963 through 1970 in Table 5, which accounts for a \$171 Fort Worth annual average wage increase per year.

From Table 5 it will be noted that the General Dynamics basic workers' annual average wage is even higher. This can be attributed to the higher skills

⁹Statistical Abstracts of the United States, 1962, p. 230.

¹⁰Blair, p. 78.

required of aircraft and parts basic industry employment as compared to the rest of manufacturing and other basic industry as a whole. It can also be attributed to the fact that General Dynamics annual average wage figures include technical and engineering salaried personnel (but not executive salaried personnel) in its compilation. The higher paid salaried personnel tend to increase the General Dynamics annual average wage to a degree greater than the national and Fort Worth annual average wage figures which are based on hourly wage rate employment alone.

Dependent employment and income is covered in more detail later in this chapter. However, it might be mentioned here that in the service-basic ratio formula, total dependent employment figures used for computing the ratio for any one of the projected years (1960-1970) includes the increase to the number of dependent workers created by the projected increase in General Dynamics basic employment for that year. In the 1963 example, an increase of 843 basic workers results in an increase of 2032 dependent workers once the 2.41 service-basic ratio for 1962 is applied. The increase of 2032 dependent workers for the year when added to the 179,145 previously projected prior to the TFX contract award, will result in the 181,177 figure used in the service-basic

formula for deriving the ratio for 1963 subsequent to the TFX contract award. A more complete explanation of the procedures concerning the above is provided in the following section to this chapter.

TFX Dependent Employment

As explained in the preceding section, the service-basic ratio is the key device for determining dependent employment. With this in mind, Table 7 was prepared to show projected service-basic ratios for the aircraft and parts industry in the Fort Worth trading area prior to the TFX contract award and for General Dynamics subsequent to the TFX award. The service-basic ratios derived prior to the TFX contract award are based on projected aircraft and parts industry ratios for 1959 and 1980.¹¹ Results of interpolations made from the two ratios for deriving individual ratios for the intervening years are shown in the table. Projected service-basic ratios shown for General Dynamics subsequent to the TFX contract were individually determined by substituting applicable data for specific years in the service basic ratio formula and arriving at the results mathematically. This procedure was illustrated in the 1963 example in the preceding section of this chapter. These ratios

¹¹Blair, p. 79.

are also shown in Table 7. It will be noted that both the interpolated service-basic ratios and those actually computed compare very closely for each corresponding year. However, it is the computed ratios based on information acquired subsequent to the TFX award that will be used in determining TFX dependent employment.

In order to determine projected total dependent employment and projected TFX dependent employment, Table 8 was devised. The service-basic ratios shown in this table are those derived subsequent to the TFX contract award, and are the same as those previously shown in Table 7. Total dependent employment, by year, has been determined by multiplying the applicable service-basic ratio for that year by the total General Dynamics basic employment. For 1960 this can be seen to be 42,094 dependent workers. Total TFX dependent employment, by year, has been determined by multiplying the applicable service-basic ratio for that year by the total General Dynamics TFX basic employment. For 1960 the number of TFX dependent workers can be seen to be 422 which is one percent of total General Dynamics dependent employment.¹²

¹²Projected TFX dependent employment percentages for the years 1950 through 1970 were originally estimated and provided by General Dynamics management in an interview conducted on June 24, 1963, Dayton, Ohio.

TABLE 8

PROJECTED DEPENDENT EMPLOYMENT SUPP

	1960	1961	1962	1963
Total General Dynamics basic employment	18,066	17,763	17,460	18,0
TFX General Dynamics basic employment	181	355	873	4,3
Percent of General Dynamics employment working on TFX	1	.2	5	2
Service-Basic ratio	2.33	2.37	2.41	2.
Total dependent employment due to General Dynamics	42,094	42,098	42,079	44,4
Total dependent employment due to TFX	422	841	2,104	10,6

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LE 8

PAYMENT SUPPORTED BY GENERAL DYNAMICS

1962	1963	1964	1965	1966	1967	1968	1969	1970
460	18,000	20,000	22,000	23,000	24,000	25,000	24,000	23,000
873	4,320	10,400	16,280	17,480	18,720	20,000	18,720	17,480
5	24	52	74	76	78	80	78	76
2.41	2.47	2.55	2.63	2.69	2.76	2.84	2.91	2.92
,079	44,460	51,000	57,860	61,870	66,240	71,000	69,480	67,160
,104	10,670	26,520	42,816	47,021	51,667	56,800	54,475	51,041

2

The year 1968 can be seen to involve 56,800 TFX dependent workers at the TFX employment rate of 80 percent. This is the highest projected amount and rate of TFX dependent employment for any one year of the study. The TFX dependent employment figures shown on this table for each year covered are important in that they are the quantities by which dependent annual average workers wages must be multiplied to arrive at TFX gross dependent employment income. This will be described in the next section of this chapter.

TFX Dependent Employment Income

In addition to determining the number of dependent employees created by the award of the TFX contract, the annual average wages of these workers had to be found. No established figures were available which showed either the national or the Fort Worth dependent (service) employment annual average wage. In order to compute TFX dependent income for the Fort Worth area, a weighted annual average wage for dependent workers had to be developed.

The Statistical Abstract of the U. S., prepared by the Bureau of the Census, provided dependent employment groups corresponding to the 1957 Standard Industrial Classification Code.¹³ The five major groups

¹³Tiebout, pp. 31-32.

were broken down into sub-groups indicating national dependent employment figures and their annual average wages. These employment figures and average wages were weighted by sub-groups and then by the major groups to arrive at a single weighted dependent workers average wage for the years 1955 through 1960. The five major groups and their weighted annual average wage can be seen in Table 9. From the averages of these years it was found that the average yearly wage increase came to approximately \$125. This amount was added to the projected dependent workers annual average wage for each year through 1970. This is also evident in Table 9.

After deriving a national weighted dependent workers annual average wage, the next step was to obtain an applicable dependent workers annual average wage for the Fort Worth trading area. This was done by adding a 10 percent differential to the national annual average. The reason for assuming an average 10 percent increase in dependent wages for the Fort Worth area was on the premise that since Fort Worth basic employment was paid at a higher rate of 14 percent than the national average, it would logically follow that Fort Worth dependent employment would also receive a higher annual average

PROJECTED DEPEND

Standard Industrial Classification Code	1960	1961	1962
Transportation and public utilities	\$5,356	\$5,564	\$5,772
Wholesale and re- tail trade	\$3,692	\$3,822	\$3,952
Finance, insurance and real estate	\$4,160	\$4,297	\$4,398
Services and miscellaneous	\$2,756	\$2,839	\$2,922
State and local government	\$3,380	\$3,515	\$3,650
National weighted annual average wage	\$3,640	\$3,765	\$3,890
Fort Worth weighted annual average	\$4,004	\$4,141	\$4,279

^aIn computing the national average wage each number of workers in that group.

TABLE 9

TED DEPENDENT WORKERS ANNUAL AVERAGE WAGES^a

1962	1963	1964	1965	1966	1967	1968	1969	1970
\$5,772	\$5,980	\$6,188	\$6,396	\$6,604	\$6,812	\$7,020	\$7,228	\$7,436
\$3,952	\$4,082	\$4,212	\$4,342	\$4,472	\$4,602	\$4,732	\$4,862	\$4,992
\$4,398	\$4,517	\$4,636	\$4,755	\$4,874	\$4,993	\$5,112	\$5,231	\$5,356
\$2,922	\$3,005	\$3,088	\$3,171	\$3,254	\$3,337	\$3,420	\$3,503	\$3,588
\$3,650	\$3,785	\$3,920	\$4,055	\$4,190	\$4,325	\$4,460	\$4,595	\$4,732
\$3,890	\$4,014	\$4,139	\$4,264	\$4,389	\$4,514	\$4,638	\$4,763	\$4,888
\$4,279	\$4,415	\$4,552	\$4,690	\$4,827	\$4,965	\$5,101	\$5,239	\$5,376

wage each S.I.C. group annual average wage is weighted proportionately to the

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workers' wage.¹⁴ The assumption is that since dependent workers' wage were contingent upon basic employment and wages, the dependent workers' wages would not increase at the same rate but at a rate somewhat less. Therefore, it was arbitrarily assumed that an increase of 10 percent over national dependent workers wages should approximate actual Fort Worth dependent annual average workers wages.

Now that TFX dependent employment and a weighted dependent employment annual average workers' wage has been determined, all that remains is to multiply the two applicable figures to derive a yearly TFX gross dependent employment income. This is accomplished in Table 10.

To arrive at disposable income there must be subtracted from TFX gross dependent employment income the amount paid to the Federal government for personal income and social security taxes. A married couple with two dependents, for instance, pays personal income and social security taxes at the rate shown in Table 10. In accordance with the applicable income tax rate plus the required social security tax rate, a deduction is made to TFX gross dependent employment income and the resulting figure is the projected TFX

¹⁴Supra, p. 56.

PROJECTED TFX DEPENDENT

	1960	1961	1962	1963
Dependent employment resulting from TFX	422	841	2,104	10,670
Dependent Employees annual average wage	\$4,004	\$4,141	\$4,279	\$4,415
Gross dependent employ- ment income (in thousands)	\$1,690	\$3,483	\$9,040	\$47,108
Federal Income plus Social Security tax rate ^a	9%	9%	9%	9%
Dependent employment disposable income (in thousands)	\$1,538	\$3,170	\$8,226	\$42,868

^aCalculated from: U. S. Department of Commerce, Bureau
(Washington: U.S. Government Printing Office). p. 389.

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TABLE 10

DEPENDENT EMPLOYMENT DISPOSABLE INCOME

	1963	1964	1965	1966	1967	1968	1969	1970
	10,670	26,520	42,816	47,021	51,667	56,800	54,475	51,041
'9	\$4,415	\$4,552	\$4,690	\$4,827	\$4,965	\$5,101	\$5,239	\$5,376
.0	\$47,108	\$120,719	\$200,807	\$226,970	\$256,527	\$289,737	\$285,395	\$274,396
%	9%	12%	12%	12%	12%	12%	12%	12%
26	\$42,868	\$106,233	\$176,710	\$199,734	\$225,744	\$254,969	\$251,148	\$241,460

ce, Bureau of the Census, Statistical Abstract of the United States: 1962
389.

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dependent employment disposable income for the appropriate year within the 1960-1970 period.

Table 10 summarizes the pertinent data discussed and shows the total TFX gross dependent employment income by year derived from projected TFX dependent employment and projected dependent employment annual average workers wages. The table also indicates total estimated Federal income and social security taxes withheld, by percent and by year, after which total TFX disposable dependent employment income is determined.

TFX Net Employment

To this point, this chapter has been concerned with total General Dynamics TFX basic employment and income and total TFX dependent employment and income projected for the 1960-1970 period under study. From information developed, it will now be determined what portion of the totals are attributable to new TFX employment and from that, what the net impact of the contract award can be expected to be on the Fort Worth trading area economy for the future years through 1970 covered by the study. It is the new or net TFX employment that will trigger primary investment of TFX derived income and secondary consumption responding in the Fort Worth trading area.

Data presented in Table 6 indicates that new basic employment hiring by General Dynamics first began in 1963 and is presumed to continue as a result of the TFX contract award through 1968. Beginning in 1969 General Dynamics total projected basic employment will start to decline, and there will be no new hiring for that year or for the years following.

The first portion of Table 6 indicates that General Dynamics basic employment projected prior to the TFX award and projected subsequent to the TFX award are both equal in amount for the years 1960, 1961 and 1962. Beginning with 1963, however, it will be seen that General Dynamics projected employment as a result of the TFX award is boosted upward to 18,000 workers. Since prior to the consideration of the TFX award only 17,157 basic employees were projected for 1963, there is now created a difference of 843 new employees of which all, in accordance with the previous declared assumption, will be new TFX General Dynamics basic employment. To determine the quantity of dependent workers supported by the new TFX basic employment, it is necessary to apply the 1963 service-basic ratio of 2.47:1. The 1963 ratio of 2.47:1 has been accordingly multiplied by the figure of 843 basic workers for that year and the result will be found to equal the 2,082 dependent worker figure shown in Table 12.

The difference between the two General Dynamics projected basic employment figures for years 1963 through 1968, as shown in Table 6, indicates a yearly increase of new basic employment as a result of the TFX contract award. For the years 1969 and 1970, however, a projected decrease to TFX basic employment is evident to the extent of 1000 workers per year. Regardless of this fact, the amount of General Dynamics basic employment for all years 1963 through 1970 is still in excess to what was projected prior to the TFX award. Therefore, dependent employment resulting from that amount of basic employment in excess to what was projected prior to the TFX award can still be described as derived from all new General Dynamics basic employment hired during the period under study.

By following the same procedure as described for 1963, the new increase to TFX dependent employment for the years 1964 through 1970 has been determined and is shown in Table 12.

TFX Net Employment Income

To TFX net employment figures (new TFX hiring) as developed, it is possible to apply projected annual average wages in order to arrive at net TFX basic and dependent gross employment income totals. For this purpose Tables 11 and 12 have been prepared.

PROJECTED GENERAL DYNAMICS

	1960	1961	1962	1963
General Dynamics net TFX employment	-	-	-	84
General Dynamics annual average wage and salaries	\$7,100	\$7,420	\$7,750	\$8,080
General Dynamics net TFX employment gross annual income (in thousands)	-	-	-	\$6,810
Federal Income plus Social Security tax rate ^a	15%	15%	16%	16%
General Dynamics net TFX employment disposable annual income (in thousands)	-	-	-	\$5,720

^aCalculated from: U. S. Department of Commerce, Bureau of Economic Analysis, "General Dynamics Corporation" (Washington: U.S. Government Printing Office), p. 389.

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TABLE 11

GENERAL DYNAMICS NET TFX BASIC EMPLOYMENT DISPOSABLE INCOME

	1963	1964	1965	1966	1967	1968	1969	1970
62	843	3,147	5,450	6,753	8,006	9,360	8,662	7,967
50	\$8,080	\$8,410	\$8,740	\$9,070	\$9,400	\$9,730	\$10,060	\$10,390
-	\$6,811	\$26,466	\$47,633	\$61,250	\$75,256	\$91,073	\$87,140	\$82,777
6%	16%	16%	17%	17%	17%	18%	18%	18%
-	\$5,721	\$22,231	\$39,535	\$50,838	\$62,462	\$74,680	\$71,455	\$67,877

Source, Bureau of the Census, Statistical Abstract of the United States: 1962
p. 389.

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PROJECTED NET TFX DEPEND

	1960	1961	1962	1963
Net Dependent Employment resulting from TFX hiring	-	-	-	2,082
Dependent Employment annual average wage	\$4,004	\$4,141	\$4,279	\$4,415
Net TFX Dependent Employment gross income (in thousands)	-	-	-	\$9,192
Federal Income plus Social Security tax rate ^a	9%	9%	9%	9%
Net Dependnet Employment Disposable income (in thousands)	-	-	-	\$8,365

^aCalculated from: U. S. Department of Commerce, Bu
(Washington: U.S. Government Printing Office). p. 389.

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TABLE 12

T TFX DEPENDENT EMPLOYMENT DISPOSABLE INCOME

	1963	1964	1965	1966	1967	1968	1969	1970
2								
	2,082	8,025	14,334	18,166	22,097	26,582	25,206	23,264
79	\$4,415	\$4,552	\$4,690	\$4,827	\$4,965	\$5,101	\$5,239	\$5,376
	\$9,192	\$36,530	\$67,226	\$87,687	\$109,712	\$135,595	\$132,054	\$125,067
%	9%	12%	12%	12%	12%	12%	12%	12%
	\$8,365	\$32,146	\$59,159	\$77,165	\$96,547	\$119,324	\$116,208	\$110,059

Commerce, Bureau of the Census, Statistical Abstract of the United States: 1962
. p. 389.

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Projected General Dynamics basic workers annual average wages by year, as previously derived and presented in Table 5, are multiplied in Table 11 by the firm's net TFX employment for the applicable year. As can be seen in the table, General Dynamics net increase in TFX employment over that originally projected prior to the contract award, is carried forward through 1970. The appropriate General Dynamics annual average wage for each year during the 1960-1970 period is multiplied by the applicable net TFX employment figure and the product, as a result, determines General Dynamics net TFX gross annual income by year.

To arrive at disposable income, there must be subtracted from net TFX gross employment income, that amount paid to the Federal government for personal income and social security taxes. As shown previously in this chapter in deriving total General Dynamics TFX gross employment income, the applicable personal income and social security tax deduction is converted into a total dollar amount which in turn is deleted from General Dynamics net TFX gross annual income to arrive at General Dynamics projected net TFX disposable annual income. From figures shown in Table 11 it can be seen that 1968 is the year reflecting the

greatest contribution of General Dynamics net TFX disposable income derived from basic employment to the Fort Worth trading area economy.

Table 12 concerns itself with developing projected net TFX dependent employment income for the 1960-1970 period under study. By applying the service-basic ratio, net TFX dependent employment has been derived from General Dynamics net TFX basic employment and is shown in the table. The applicable dependent employment figures are multiplied in Table 12 by the dependent employment annual average wage, as previously derived and shown in Table 9, to arrive at the appropriate yearly net TFX dependent employment gross income figures. As similarly done in Table 11 for basic employment, Federal personal income and social security taxes must be deducted from the dependent employment gross income figures to arrive at disposable income. This has been done and as a result it can be observed that 1968 is the peak year for net TFX dependent employment disposable income available for spending in the Fort Worth trading area economy.

Summary

This chapter has concerned itself with developing General Dynamics/Fort Worth TFX basic employment projections for the 1960-1970 period. From these

projections TFX dependent employment to be created and supported by Fort Worth TFX basic employment was derived through application of the service-basic ratio. To the total TFX basic and dependent employment figures developed was applied the appropriate annual average wage to arrive at total gross employment income expected by year in the Fort Worth trading area as a result of the TFX contract award. In addition, new TFX basic employment added to the General Dynamics work force beginning in 1963, and how new TFX dependent employment was derived was explained and shown. To the net TFX basic and dependent employment figures developed was applied the appropriate annual average wage to arrive at net gross employment income expected by year in the Fort Worth trading area as a result of the contract award. In both cases, Federal personal income and social security taxes were deleted and disposable income figures derived and shown for each year of the 1960-1970 period.

The net outcome, is that from the presentation given in this chapter one can determine disposable income attributable to total employment created in the Fort Worth trading area due to the TFX contract award or, determine disposable income attributable to net or new employment created in the Fort Worth trading area due to the TFX award.

CHAPTER V

THE MULTIPLIER DOCTRINE

Introduction

This chapter will deal with the theory of determining the multiplier effect for the Fort Worth, Texas trading area. Since the last chapter went into detail on the service-basic ratio, which in itself is a multiplier, a clarification should be made as to the need of the multiplier doctrine.

It should be noted that a multiplier is a measurement of exports, and any additional investment or income into a community due to increased exports will be amplified by the amount of the multiplier. This amplified amount is always greater than the initial investment and this creates new goods and services in the community as a result of the increased exports.

The service-basic ratio, when applied to General Dynamics and the Fort Worth trading area, will show approximately the amount of investment income placed into the community for a specific year and also spent during that year. The multiplier doctrine will be a

theoretical substantiation for the service-basic ratio. It should be remembered that the service-basic ratio process is a more realistic approach to the problem while the multiplier doctrine is a theoretical approach. Also, the multiplier doctrine is that of measuring an impact and the effects of responding can cover many years, rather than any one specific year as shown in the service-basic ratio. If data were not available to determine the service-basic ratio for a community, the multiplier doctrine could be used, since data for determining the marginal propensity to consume (MPC) is usually more readily available.

Determining the Marginal Propensity to Consume

In order to find the multiplier to be applied, the marginal propensity to consume (MPC) must first be known. The general formula for determining the multiplier is

$$\frac{1}{1-MPC} = \text{Multiplier.}^1$$

The multiplier is then applied to the extra spending to determine the amplified effect of additional income into the Fort Worth trading area.

For purposes of this research project, the marginal propensity to consume (MPC) was determined

¹Paul A. Samuelson, Economics (New York: McGraw-Hill Book Company, Inc., 1961), p. 268.

for the United States since the information necessary for the Fort Worth trading area was not considered sufficient. It is assumed that the national marginal propensity to consume (MPC) will approximate that of the Fort Worth trading area for the period under study.

The assumption that the national marginal propensity to consume will approximate that of the Fort Worth trading area is based upon a six year study of net effective buying income and retail sales for the years 1957 through 1962 in the Fort Worth metropolitan area.²

The marginal propensity to consume for the six year period was .683 as compared to the national average of .691 which was compiled over a sixteen year period.

The net effective buying income and retail sales were used in determining the Fort Worth MPC as compared to the net national product and consumption expenditures for the national MPC. The net effective buying income is considered as total cash actually available for spending. That is, it is income less non-cash items such as food and fuel produced and consumed by farmers, imputed rentals of owner-occupied homes, incomes received by trusts, pension and welfare funds and income of non-profit institutions.

²Sales Management Survey of Buying Power (New York: Sales Management, Inc., 1958-1963)

Retail sales takes into account such items as food, general merchandise, apparel, furniture and household appliances, automotive devices, gas station sales, lumber and building hardware, and drugs. This ratio of disposable income to personal consumption within the Fort Worth metropolitan area is a good indicator of the marginal propensity to consume for the entire trading area.

Since the Fort Worth figures are only for a six year period and the national average is over a sixteen year period, it was felt that the national average would be a better indicator of marginal propensity to consume than for the shorter period.

In determining the marginal propensity to consume, the net national product and the consumption expenditures of the United States for a sixteen year period (1946-1961) were tabulated.³ This information is shown in Table 13. By plotting the tabulated statistics in the form of a scatter diagram, Figure 3, the estimating line which describes the nature of the relationship between the two variables and the point of intercept of the Y axis is determined. In order to mathematically prove the point of the

³U.S., Bureau of the Census, Historical Statistics of the United States: Colonial Times to 1957., p. 139; and U.S., Bureau of the Census, Statistical Abstract of the United States: 1962., pp. 313-315.

intercept of the Y axis and the slope of the estimating (trend) line, the method of least squares was used.⁴ The purpose of using the least squares method was to determine the marginal propensity to consume, which is the slope of the estimating line. By determining the marginal propensity to consume, a forecast can be made of the multiplier effect within a designated area at a specified time or to show a trend of future spending.

In order to fit a straight line (trend line) by the method of least squares, as shown in Figure 3, two normal equations must be obtained and solved simultaneously, since there are two constants, or unknowns, to be found. These unknowns are

a = point of intercept on the Y axis

b = slope of the estimating line or marginal propensity to consume. This straight line has been so fitted that the sum of the squares of the Y deviations from it is less than those from any other straight line. A curve fitted in this manner is usually considered by statisticians to be the best with which to estimate the values of one variable when values of the other variables are known.⁵

⁴Frederick E. Croxton and Dudley J. Cowden, Applied General Statistics (New York: Prentice-Hall, Inc., 1940), p. 655

⁵Ibid.

TABLE 13

COMPUTATION OF VALUES USED IN COMPUTING ESTIMATE
 PROPENSITY TO CONSUME IN CONSUMPTION EXPENDITURE
 NATIONAL PRODUCT OF A 16 YEAR PERIOD
 (BILLIONS OF DOLLARS)

Year	Net National Product X	Consumption Expenditures Y	XY
1961	473.4	338.10	160,056.5
1960	460.2	328.50	151,175.7
1959	441.7	313.50	138,472.9
1958	405.9	293.20	119,009.8
1957	402.6	284.76	114,644.3
1956	384.5	269.92	103,784.2
1955	365.5	256.94	93,911.0
1954	334.3	238.03	79,573.4
1953	338.9	232.65	78,845.0
1952	323.0	219.77	70,985.7
1951	307.0	209.81	64,411.6
1950	265.5	190.80	50,657.4
1949	240.8	178.83	43,062.2
1948	244.0	177.45	43,297.8
1947	221.5	165.57	36,673.7
1946	200.0	146.91	29,382.0
Total	5,408.8	3,844.74	1,377,927.8

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TABLE 13

COMPUTATION OF VALUES USED IN COMPUTING ESTIMATED EQUATIONS FOR
 PROPENSITY TO CONSUME IN CONSUMPTION EXPENDITURES AND NET
 NATIONAL PRODUCT OF A 16 YEAR PERIOD
 (BILLIONS OF DOLLARS)

Net National Product X	Consumption Expenditures Y	XY	X ²
473.4	338.10	160,056.54	224,107.56
460.2	328.50	151,175.70	211,784.04
441.7	313.50	138,472.95	195,098.89
405.9	293.20	119,009.88	164,754.81
402.6	284.76	114,644.38	162,086.76
384.5	269.92	103,784.24	147,840.25
365.5	256.94	93,911.00	133,590.25
334.3	238.03	79,573.43	111,756.49
338.9	232.65	78,845.09	114,853.21
323.0	219.77	70,985.71	104,329.00
307.0	209.81	64,411.67	94,249.00
265.5	190.80	50,657.40	70,490.25
240.8	178.83	43,062.26	57,984.64
244.0	177.45	43,297.80	59,536.00
221.5	165.57	36,673.75	49,062.25
200.0	146.91	29,382.00	40,000.00
5,408.8	3,844.74	1,377,927.81	1,941,479.11

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Figure 3
 NET NATIONAL PRODUCT AND CONSUMPTION EXPENDITURES
 FOR THE 16 YEAR PERIOD 1946-1961
 (BILLIONS OF DOLLARS)

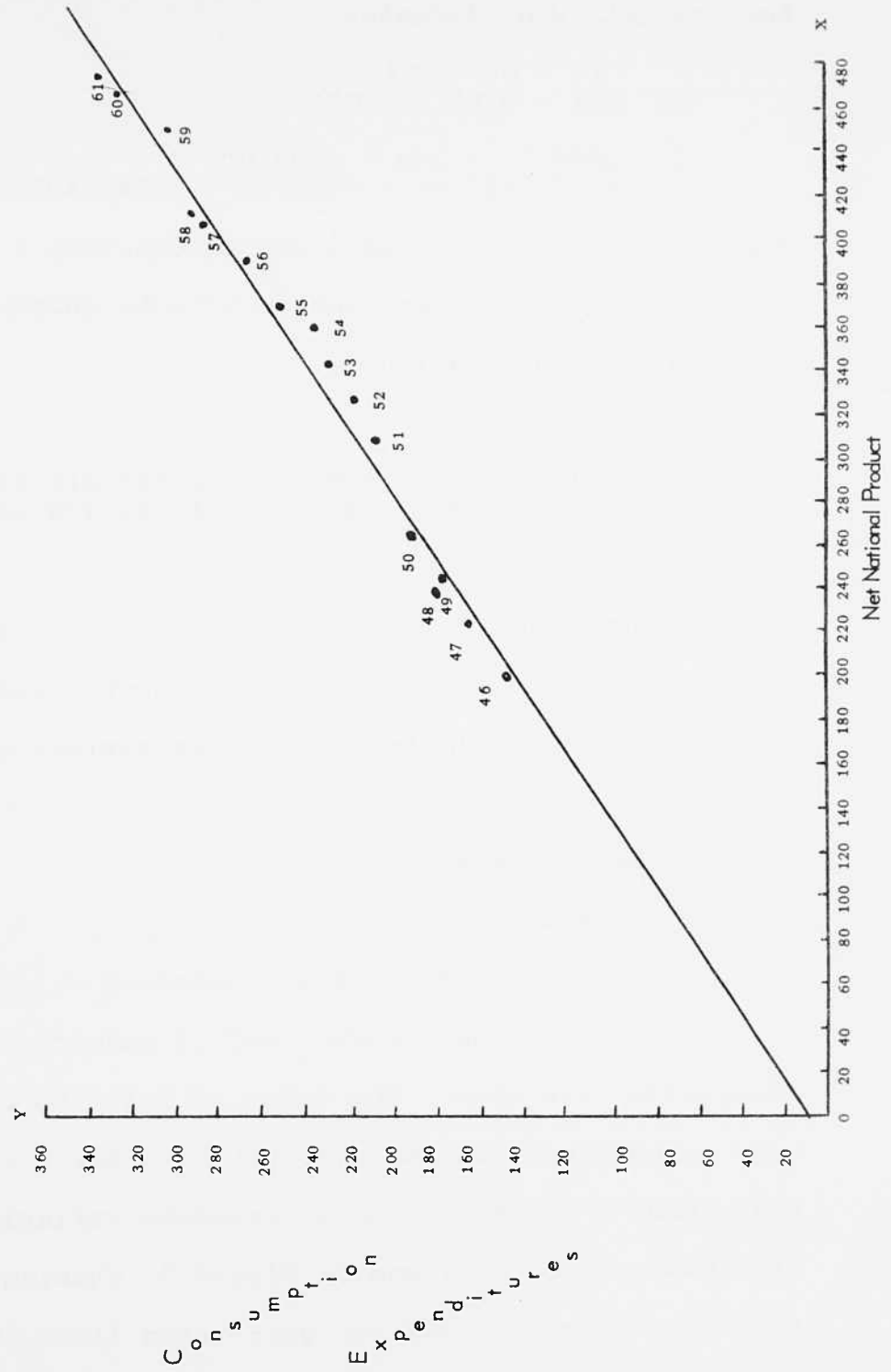


Table 13 shows the computations that are necessary to determine the values that must be substituted for the following formula:

$$\begin{aligned} \text{I} \quad \Sigma Y &= Na + b \Sigma X \\ \text{II} \quad \Sigma XY &= a \Sigma X + b \Sigma X^2 \end{aligned}$$

$$\begin{aligned} \text{I} \quad 3844.74 &= 16a + 5408.8b \\ \text{II} \quad 1,377,927.81 &= 5408.8a + 1,941,497.11b \end{aligned}$$

Multiplication of all the items in equation I by 338.05 permits the cancellation of a by subtracting equation I from equation II.

$$\text{I} \quad \times 338.05$$

$$\begin{aligned} \text{I} \quad 1,299,714.36 &= 5408.8a + 1,828,411.04b \\ \text{II} \quad 1,377,927.81 &= 5408.8a + 1,941,479.11b \end{aligned}$$

$$b = .691$$

To find the value of a, since the value of b is now known, equation I will be computed substituting the value of b. N is the number of observations used in Table 13.

$$\text{I} \quad \Sigma Y = Na + \Sigma Xb$$

$$A = 6.70$$

The values of X and Y are observed values since X is the net national product and is considered an independent variable. The value of Y is the consumption expenditure related directly to X for a specific year, thus Y is considered a dependent variable. This observation is found in Figure 3, showing the relationship of the sixteen year trend (1946-1961) of the net national product and consumption expenditures in the United States.

Since $a = 6.70$ and $b = .691$, the equation of the line will enable one to estimate the consumption expenditures in a designated area when their net product is known and may be stated as

$$Y_c = a + bX.$$

Y_c would be the computed consumption expenditures and X would be the net product for any particular year.

Determining the Multiplier

Now that the marginal propensity to consume (MPC) has been computed, it can now be applied to the multiplier formula. The national marginal propensity to consume (MPC) was calculated to be .691 and the Fort Worth MPC was calculated to be .683. Either MPC can be used to determine the multiplier as rounding off either MPC to the nearest fraction would still result in an MPC of $2/3$. Applying the multiplier formula, the multiplier is determined to be 3.

$$\frac{1}{1-2/3} = \frac{1}{1/3} = 3$$

By using the reciprocal of the MPC, or the marginal propensity to save (MPS), the same solution is derived.

$$1,000 \div .309 = 3.23 \text{ or}$$

$$1,000 \div .317 = 3.15 \text{ or rounded off to } 3.$$

It must be remembered that only an indicated multiplier has been calculated for a specific period of time. It is quite probable that if a different period of time had been chosen to tabulate statistics, a different multiplier may have been found. The reason that net national product was used instead of disposable income was to include corporate savings as well as personal savings, as this would show more of the total savings in an economy. The statistics for 1945 were eliminated since this showed the drastic effects of the war years and would not show normal income and expenditures.

The period of time covered in this project is from 1960 to 1970. Fluctuations in the business cycle could change the MPC, thus the multiplier, but it is assumed that the next decade will approximate the last sixteen year period for showing the multiplier effect.

This amplified effect of additional income into a community is called the multiplier doctrine.⁶ The word "multiplier" itself is used for the numerical coefficient showing how great an increase in income results from each increase in such investment spending. Any additional income derived from added employment

⁶Samuelson, p. 266.

due to the award of the TFX contract in the Fort Worth trading area will be amplified by the multiplier doctrine. This not only includes direct (basic) employment at the General Dynamics plant in Fort Worth, but also for all additional goods and services procured within that area as a result of the TFX contract. Taxes will not be considered as investment spending within the Fort Worth trading area since General Dynamics is a government-owned plant. A recent court decision ruled that this government-owned plant does not have to pay local taxes and accordingly, none have been paid by General Dynamics since 1957.⁷

To illustrate how the multiplier theory will show a secondary expansion of income and production, over and above the primary increase of employment and revenue, the resulting chain reaction takes place.

If General Dynamics hired 843 new employees in 1963 due to the TFX contract, as shown in Table 6, with an annual average salary of \$8,080, shown in Table 5, approximately \$6,810,000 in new investment income has been placed into the Fort Worth economy.⁸ This investment income is not to be

⁷Interview with James Hall, General Dynamics representative at Dayton, Ohio, June 24, 1963.

⁸Supra, Table 6, p. 54, and Table 5, p. 52.

construed as consumption expenditures. As local income from the export industry (General Dynamics) increases, new plant and equipment, or consumer investment, must be added in order to produce additional needs. Thus, along with a propensity to consume, a propensity to invest in local capital goods would apply. The forecast for 1963 contemplates an increase in the direct export of aircraft from General Dynamics. Some of these inputs will be supplied by local firms which grow with the expanding export market. Other inputs will come from new firms which locate in the community. The remaining inputs will be imported. This investment income of \$6,810,000, then, is a measurement of imports of new goods in the community made possible by the export of aircraft.

If all employees have the marginal propensity to consume of $2/3$, they will now spend \$4,540,000 on new consumption goods. The producers of these goods will now have an extra income of \$4,540,000. If their marginal propensity to consume is also $2/3$, they in turn will spend \$3,026,666, or $2/3$ of \$4,540,000 (or $2/3$ of $2/3$ of \$6,810,000). So the process will go on, with each new round of spending being $2/3$ of the previous round.

Thus the whole endless chain of secondary consumption responding is set up the primary

\$6,810,000 of investment spending. But it is a dwindling chain, and it all adds up to a finite amount. By geometric progression, the spending is as follows:

$$\begin{array}{r}
 \$6,810,000 \\
 + \\
 \$4,540,000 \\
 + \\
 \$3,026,000 \\
 + \\
 \$2,017,776 \\
 + \\
 \$1,345,184 \\
 + \\
 \dots\dots\dots \\
 \$20,430,000 = \frac{1}{1-2/3} \times \$6,810,000 \text{ or } 3 \times \$6,810,000
 \end{array}$$

This shows that, with an MPC of 2/3, the multiplier is 3, consisting of the 1 of primary investment plus 2 extra of secondary respending.⁹

In conclusion, the multiplier doctrine and the service-basic ratio can be contrasted to show the relationship of theory and reality for the projected economic impact of the TFX contract award due to increased hiring by General Dynamics.

By applying the multiplier doctrine to new hiring by General Dynamics in 1963, it was found that approximately \$20 million was placed in the Fort Worth economy, as previously illustrated. It should be remembered that the theory of the multiplier is that of measuring an impact and is not necessarily associated

⁹Samuelson, p. 267.

with time. The secondary respending could be done within a year or it could take many years to be respent.

The service-basic ratio, when applied to 1963, will give a more realistic picture of what impact General Dynamics hiring will have upon the Fort Worth economy for that specific year. Table 7 shows that the service-basic ratio for General Dynamics in 1963 is 2.47:1. Table 6 shows that General Dynamics will be hiring 843 additional employees in 1963 at an annual wage of \$8,080 (Table 5). If the service-basic ratio is 2.47:1, then 843 General Dynamics additional employees will support 2,082 dependent employees at an annual wage of \$4,415 (Table 9). By the process of multiplying dependent employees by their wages and adding the new basic income, a realistic figure of investment income and secondary respending is accomplished.

$$843 \times 2.47 = 2,082 \text{ dependent employees}$$

$$2,082 \times \$4,415 = \$9,192,030 \text{ dependent income}$$

$$843 \times \$8,080 = \$6,810,000 \text{ new basic income}$$

This correlation shows that approximately \$16 million will be invested and spent in the Fort Worth area during 1963 as compared to approximately \$20 million developed by the multiplier doctrine. This difference in investment income will tend to approximate each

other as the service-basic ratio increases yearly, as shown in Table 7.

By repeating the same process as mentioned above for 1970, the multiplier doctrine shows approximately \$248 million being invested into the Fort Worth economy as against approximately \$208 million from the service-basic ratio. Thus, in 1963, the service-basic ratio income was 80% of the multiplier doctrine income and in 1970 the percentage rose to 84%. This process has not taken into account the additional income that Fort Worth will derive from local procurement created by General Dynamics nor are any leakage factors taken into consideration in this illustration. These factors will be taken into account in a later chapter.

The multiplier doctrine will be used to show the amplified effect of local procurement in Tables 14 and 15, respectively, as shown in Chapter VI. Since the service-basic ratio is applied only to employment, it is not applicable to local procurement income figures and, thus, requires the use of the multiplier doctrine. As previously stated, the multiplier doctrine is a theoretical substantiation of the service-basic ratio and can be used when information needed to derive the service-basic ratio is not available.

CHAPTER VI

SUPPLEMENTAL TFX ECONOMIC FACTORS

Preliminary

Previous chapters have developed and projected General Dynamics TFX basic employment and income figures, and projected dependent employment and income figures, by year, for the 1960-1970 period under study. The income figures then were converted to total disposable income contributed by TFX basic and dependent employment to the Fort Worth trading area. These dollar figures appear in Table 14. It is the purpose now to discuss income leakage factors, TFX local procurement, and other various economic factors which because they are not measurable can not be incorporated in the TFX impact study.

Dallas TFX Income Leakage

To properly indicate the actual impact of TFX basic and dependent employment income in the Fort Worth area, consideration must be taken of that portion of TFX employment income leakage to outside areas. General Dynamics has determined from their personnel

ECONOMIC IMPACT OF THE TFX CO
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	1960	1961	1962	1963
Total General Dynamics (TFX) basic employment disposable income	\$1,092	\$2,239	\$5,683	\$29,321 \$
Minus Dallas (TFX) export employment income (25%)	\$273	\$560	\$1,421	\$7,330 \$
Total Adjusted General Dynamics (TFX) basic employment disposable income	\$819	\$1,679	\$4,262	\$21,991 \$
Total dependent employment (TFX) disposable income	\$1,538	\$3,170	\$8,226	\$42,858 \$1
Minus Dallas (TFX) export employment income (25%)	\$384	\$792	\$2,056	\$10,717 \$
Total adjusted (TFX) dependent employment disposable income	\$1,154	\$2,378	\$6,170	\$32,151 \$
(TFX) local procurement	\$100	\$200	\$500	\$2,400
(TFX) local procurement with multiplier of 3 applied ^a	\$300	\$600	\$1,500	\$7,200 \$
Impact of TFX award on Fort Worth trading area	\$2,273	\$4,657	\$11,932	\$61,342 \$1

^aLocal procurement secondary respending would normally excess of one year. For the purpose of this study, however, in the year that the initial procurement expense is incurred

1

TABLE 14

THE TFX CONTRACT ON THE FORT WORTH TRADING AREA
(thousands of dollars)

1963	1964	1965	1966	1967	1968	1969	1970
\$29,321	\$73,470	\$118,098	\$131,592	\$146,051	\$159,572	\$154,425	\$148,926
\$7,330	\$18,367	\$29,524	\$32,898	\$36,513	\$39,893	\$38,606	\$37,231
\$21,991	\$55,103	\$88,574	\$98,694	\$109,538	\$119,679	\$115,819	\$111,695
\$42,858	\$106,233	\$176,710	\$199,734	\$225,744	\$254,969	\$251,148	\$241,460
\$10,717	\$26,558	\$44,177	\$49,933	\$56,436	\$63,742	\$62,787	\$60,365
\$32,151	\$79,675	\$132,533	\$149,801	\$169,308	\$191,227	\$188,361	\$181,095
\$2,400	\$5,200	\$7,400	\$7,600	\$7,800	\$8,000	\$7,800	\$7,600
\$7,200	\$15,600	\$22,200	\$22,800	\$23,400	\$24,000	\$23,400	\$22,800
\$61,342	\$150,378	\$243,307	\$271,295	\$302,246	\$334,906	\$327,580	\$315,590

and normally be expected to extend over an undeterminable time period in
7, however, the assumption is made that all responding will be accomplished
is incurred.

2

records that approximately 25 percent of all General Dynamics/Fort Worth workers live outside the area and are residents of the Dallas trading area. This means that 25 percent of all General Dynamics/Fort Worth employees commute to work from Dallas and its surrounding suburbs. General Dynamics has advised that they anticipate that this current three to one Fort Worth - Dallas employment ratio will continue to apply to any new TFX employment hiring.¹

Because 25 percent of all TFX employees reside in the Dallas area it is assumed that very little of their wages are spent in Fort Worth except as necessary when traveling to and from work. A further rationale, is that TFX Fort Worth residents doubtlessly do some shopping in Dallas. This spending in Dallas by TFX Fort Worth natives is assumed to offset the limited amount of spending by Dallas TFX commuter employment while in the Fort Worth area. Therefore, in Table 14 it will be seen that the 25 percent Dallas TFX commuter employment, converted to disposable income, is deleted from total General Dynamics TFX basic employment disposable income. Since General Dynamics/Fort Worth basic employment disposable income is decreased by this income leakage factor of 25

¹Interview with James S. Hall, General Dynamics representative, at Dayton, Ohio, June 24, 1963.

Figure 4

COMBINED FORT WORTH - DALLAS TRADING AREA

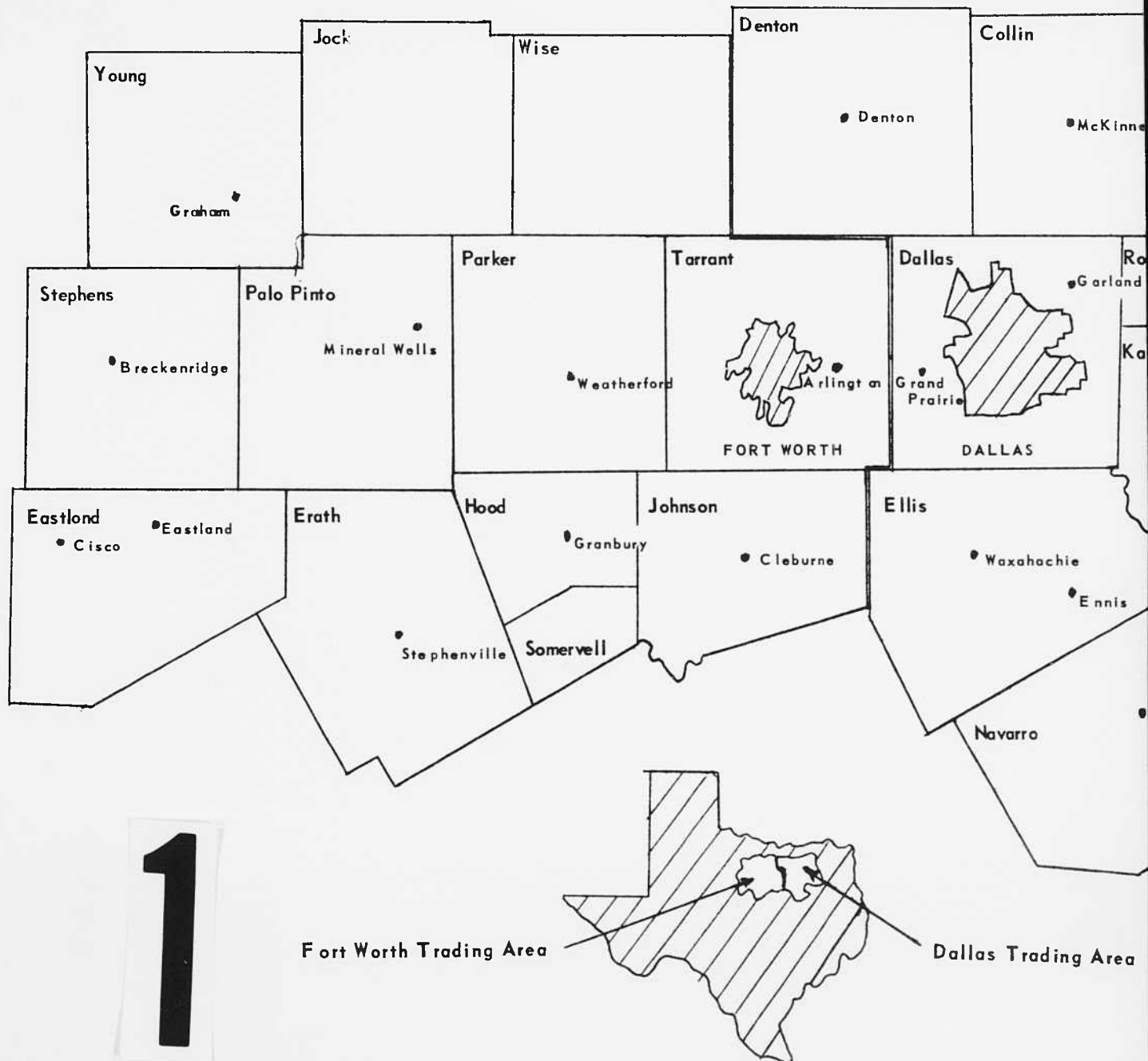
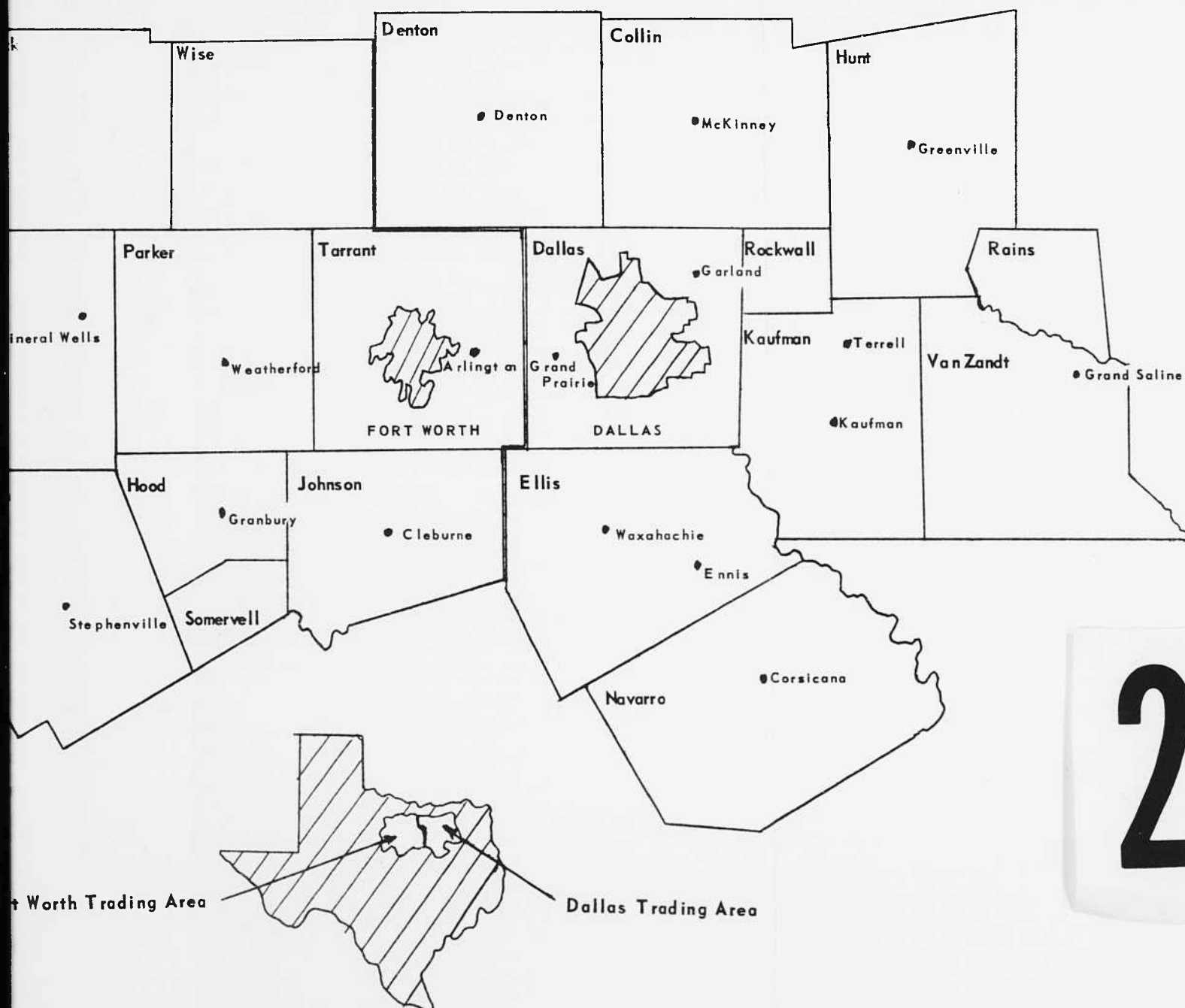


Figure 4

FORT WORTH - DALLAS TRADING AREAS



percent, then it follows that dependent employment income created by TFX basic employment should also be decreased by 25 percent. This decrease is also indicated in Table 14. The net result of the above is an adjusted General Dynamics TFX basic employment disposable income figure, and additionally, an adjusted TFX dependent employment disposable income figure for the Fort Worth trading area. Again, see Table 14 for the adjusted employment income figures by years for the 1960-1970 study period.

While it is not the purpose to determine the impact of the TFX award on the Dallas trading area, it can never-the-less be seen from the foregoing that there is an impact which could be measured in part by the projection of Dallas TFX commuter employment and income as similarly done for the Fort Worth trading area.

An additional employment income consideration is that of dividends and interest received from investments and savings. Data covering dividend and interest payments received by General Dynamics TFX employees was not available and therefore, income figures appearing in Table 14 are based only on earned wages.

General Dynamics TFX Local Procurement

An impact factor relative to the Fort Worth economy as yet unconsidered is that of General Dynamics local procurement of goods and services in support of TFX production. Past local procurement figures have been provided by General Dynamics which for the years 1958 through 1962 averaged approximately \$10 million per year. General Dynamics responsible personnel are of the opinion that \$10 million can still be considered a realistic local procurement yearly estimate for the years through 1970.² With this as a basis, an assumption was made that General Dynamics TFX local procurement could be most accurately projected for the years 1960 through 1970 if General Dynamics TFX employment were considered relative. In other words, the percentage of the estimated yearly \$10 million local procurement figure devoted to TFX local procurement for any one year will be assumed to depend directly upon that percentage of TFX employment relative to total General Dynamics employment for the corresponding year. In 1963, for instance, approximately 24 percent of total General Dynamics employment will be engaged in TFX work. Since it is assumed that TFX local procurement is

²Ibid.

directly related to TFX employment, then 24 percent of \$10 million, or \$2.4 million, can be projected as the local procurement dollar amount to be spent by General Dynamics in the Fort Worth area in support of TFX aircraft production for that year. Local TFX procurement of \$8 million for 1968 is the peak projected year for the period. All TFX local procurement projections by year for the 1960-1970 period are presented in Table 14.

Adjusted disposable income and TFX local procurement figures are totaled, as seen in Table 14, to arrive at the economic impact by year of the TFX award on the Fort Worth trading area. It will be noted that the theoretical multiplier of three, as derived in Chapter V, has been applied to TFX local procurement figures.

Impact Factors Not Measurable

Certain impact factors, could they have been measured and included in the study, would have affected the impact results otherwise derived. One such factor is that of spending patterns. It has been assumed that after deducting Federal personal income and social security taxes and disposable income leakage to the Dallas area, the remaining TFX workers' disposable income would be spent in the

Fort Worth economy. This is not necessarily the case, however, as the more income people receive the greater will be the tendency to spend more outside the immediate community on such things as vacations and clothes buying trips, etc. No way was found to determine what proportion of disposable income of General Dynamics workers had been spent in past years outside the Fort Worth area in such a manner and therefore, it was impossible to estimate what proportion of their spendable income for projected years would be spent outside the area. Although not measurable spending patterns are, however, an additional income leakage factor that if they could be calculated would reflect a further decrease to Fort Worth disposable income figures.

Despite vacations and buying trip expenditures, area residents still spend most of their income on local goods and services creating the sales dollars for further local consumption of goods and services. However, not all of what is spent locally is spendable income. Part of each dollar paid out is money spent to bring in merchandise from outside the community (pay for imports) which may go for wages to non-residents, and to other such non-local sources. No way could be found, however, to determine what portion of disposable income earned by TFX workers

actually remains in the Fort Worth economy for local consumption and respending and what amount leaves the area.

Certain industries, of which the automobile industry is an example, contribute only a small portion of their sales to the local economy. The salesman's commission, and the profit retained by the dealer and which is respent locally as rent, maintenance, advertising, etc. would remain in the Fort Worth area. The larger share of the sales dollar would go to Detroit, however, from where purchases would be made from other various economic areas for steel and other required goods and items needed for automobile production. Meanwhile, the purchase of an equally high priced item but one which is manufactured locally would contribute more to local economic expansion and growth because more of the sales dollar would remain in the community for respending in the form of workers wages, re-investment, and local procurement of required goods and services for support of business operations. It is not always possible to determine what portion of respending remains in the local economy but it can be logically assumed that a larger portion of purchasing power

will be retained by the local economic area when the item purchased is manufactured and consumed locally.³

As indicated above, Fort Worth disposable income figures presented in Table 14 would be further reduced if it were possible to measure the leakage of local sales dollars to other economic areas. No accurate estimate can be made, but it is evident that the final yearly TFX dollar impact figures as disclosed in the table are on the optimistic side and would be somewhat lower if all income leakage factors could be computed.

Acceleration Principle

An additional impact factor caused by the TFX award to the Fort Worth trading area is that of investment demand induced by growth of sales and income. The added TFX basic and dependent employment income in the Fort Worth community will increase the demand for consumer goods which will lead to accelerated changes in the level of production of capital goods needed to make the consumer items. The following example is presented as an illustration of how the acceleration principle applies.

³Of course, if the item is manufactured locally and exported for sale, the new outside income thereby derived will have even a greater multiplier effect on the local economy.

Assume that there is a steady consumer demand for 1,000 widgets per year, and that production for this level of demand requires the use of 10 machines, each of which produces 100 widgets. Assume further, as is reasonable, that one widget-making machine wears out and has to be replaced each year. As long as consumer demand stays the same, the demand for widget-making machines will be for one machine per year.

But suppose that for some reason the consumer demand for widgets increases from 1,000 to 1,100 per year, an increase in consumer demand of 10 percent. To produce the additional widgets, the manufacturer will not only have to replace one widget-making machine as scheduled for the year but will also have to buy another one as well. The demand of the manufacturer for widget-producing machines has thus doubled whereas the consumer demand for widgets has increased only 10 percent.

Now, if consumer demand fails to increase further and stabilizes itself at 1,100, the demand for machines will actually decrease -- to 1.1 per year. Thus capital goods industries may expand sharply when consumer demand increases, but they may also contract as a result of the failure of consumer demand to maintain a rate of increase. If consumers merely buy as much as they did before, the capital goods industry will go into a slump. It is as though we have to keep running faster and faster to stay where we are.

Of course, if consumer demand for widgets should fall by 10 percent -- that is, from 1,000 to 900 -- the producer would need only 9 machines for the coming year instead of 10. He would not need to buy any new widget-making machine at all. So a 10 percent decline in consumer demand would have reduced the demand for machines to zero.

The acceleration principle applies also to inventories. Suppose again that consumer demand for widgets is 1,000 per year and that the retailer maintains an inventory equal to sales, that is, an inventory of 1,000. Plainly, then, he must buy 1,000 widgets a year from the manufacturer. But suppose consumer demand increases by 20 percent (that is, from 1,000 to 1,200). In the year of that increase, the retailer would have to buy 1,400 widgets, an increase of 40 percent in his purchasing. He would have to increase his purchasing by that much in order to satisfy the increased consumer demand (200) and to bring his inventory up to the new sales level (up, that is,

by 200). Thus a small increase in consumer demand may bring about a much larger increase in production. If demand later stabilizes at 1,200, he will cut his orders from 1,400 to 1,200. The "acceleration principle" builds up the force of an expansion, but it also provides a cause for the downturn; thus when consumer demand is stable or growing slowly, producers of capital goods or inventory may suffer.⁴

The acceleration principle is recognized as contributing to the prosperity of the Fort Worth trading area only so long as consumption sales continue to grow at a rate which requires that capital goods and inventories continue to grow at a rate in excess of that needed for their replacement. Insofar as TFX projected income figures indicate, the increasing amount of spendable income available to the community will be interrupted in 1968. By that date dis-investment in the capital goods industries will begin to take affect on the Fort Worth trading area economy due to the reduction in consumption spending.

Summary

Earlier discussions in this chapter have dealt with income leakage factors and TFX local procurement insofar as they effect disposable income contributed by total TFX basic and dependent employment to the

⁴Marshall A. Robinson, Herbert C. Morton, and James D. Calderwood, An Introduction to Economic Reasoning (Washington, D. C.: The Brookings Institute, 1959), pp.176-178.

Fort Worth trading area economy. It is also of prime importance, however, to show the effect of income leakage factors and TFX local procurement on disposable income contributed by new or net TFX basic and dependent employment. For this purpose Table 15 was devised.

As explained earlier, 25 percent of all General Dynamics/Fort Worth TFX employment commute to work from Dallas. As similarly computed in Table 14, and for the same reasons previously given, it will be seen in Table 15 that the 25 percent Dallas TFX commuter employment has been converted by year to disposable income dollar amounts and deleted from net General Dynamics TFX basic employment disposable income. The result is an appropriately adjusted disposable income figure. The same 25 percent deletion has been made to TFX dependent employment disposable income and a similar adjusted disposable income figure derived.

General Dynamics TFX local procurement figures appearing in Table 15 are the same as previously computed for the 1960-1970 period in Table 14. Procurement figures were based on total General Dynamics basic employment and regardless of the amount of new TFX hiring for any one year will still be spent at the yearly rate derived. This explains why during

NET ECONOMIC IMPACT OF THE

	1960	1961	1962	1963
Net General Dynamics (TFX) basic employment disposable income	-	-	-	\$5,000
Minus Dallas (TFX) export employment income (25%)	-	-	-	\$1,250
Net adjusted General Dynamics (TFX) basic employment disposable income	-	-	-	\$4,750
Net dependent employment (TFX) disposable income	-	-	-	\$8,300
Minus Dallas (TFX) export employment income (25%)	-	-	-	\$2,000
Net adjusted (TFX) dependent employment disposable income	-	-	-	\$6,300
TFX local procurement	\$100	\$200	\$500	\$2,400
TFX local procurement with multiplier of 3 applied ^a	\$300	\$600	\$1,500	\$7,200
Net impact of TFX award on Fort Worth trading area	\$300	\$600	\$1,500	\$17,700

^aLocal procurement secondary responding would be in excess of one year. For the purpose of this study, the impact is assumed to be in the year that the initial procurement expense is incurred.

TABLE 15

EFFECT OF THE TFX CONTRACT ON THE FORT WORTH TRADING AREA
(thousands of dollars)

1962	1963	1964	1965	1966	1967	1968	1969	1970
-	\$5,721	\$22,231	\$39,535	\$50,838	\$62,462	\$74,680	\$71,455	\$67,877
-	\$1,430	\$5,558	\$9,884	\$12,709	\$15,615	\$18,670	\$17,864	\$16,969
-	\$4,291	\$16,673	\$29,651	\$38,129	\$46,847	\$56,010	\$53,591	\$50,908
-	\$8,365	\$32,146	\$59,159	\$77,165	\$96,547	\$119,324	\$116,208	\$110,059
-	\$2,091	\$8,036	\$14,790	\$19,291	\$24,137	\$29,831	\$29,052	\$27,515
-	\$6,274	\$24,110	\$44,369	\$57,874	\$72,410	\$89,493	\$87,156	\$82,544
\$500	\$2,400	\$5,200	\$7,400	\$7,600	\$7,800	\$8,000	\$7,800	\$7,600
,500	\$7,200	\$15,600	\$22,200	\$22,800	\$23,400	\$24,000	\$23,400	\$22,800
,500	\$17,765	\$56,383	\$96,220	\$118,803	\$142,657	\$169,503	\$164,147	\$156,252

ding would normally be expected to extend over an undeterminable time period in this study, however, the assumption is made that all responding will be accomplished expense is incurred.



1960, 1961 and 1962 there is shown in Table 15 a net impact figure even though no new TFX hiring had yet taken place.

Adjusted General Dynamics TFX basic employment disposable income and adjusted TFX dependent employment disposable income have already had the multiplier incorporated in their computation. However, the theoretical multiplier of three as previously derived in Chapter V must be applied to the TFX local procurement yearly totals in Table 15 to allow for primary investment and secondary responding. The net disposable income figures and the adjusted local procurement figure are totaled to arrive at the net economic impact by year of the TFX award on the Fort Worth trading area.

Other impact factors, not included in the study, were mentioned earlier in the chapter. These factors, such as spending patterns etc., could not be measured and their possible impact on the Fort Worth trading area economy can not be determined. However, as indicated in the discussion of total disposable income, these same impact factors can be expected to similarly effect net disposable income totals. Also, the accelerator principle while recognized as an important factor, once again cannot be directly

applied to net basic and dependent disposable income or its effect measured with respect to the Fort Worth trading area economy.

CHAPTER VII

AN ECONOMIC IMPACT OF THE TFX CONTRACT

Previous chapters in this thesis have adapted various aspects of economic base study concepts to the military aircraft and parts industry to determine the impact of the TFX contract award on the Fort Worth trading area. In order to determine the impact of the TFX award, it was decided to base the study primarily on employment and income projected statistics as they were the most easily obtainable and probably the most appropriate unit of measurement. This same employment multiplier methodology used can be applied to other Air Force and DOD contract economic impact studies. Its application is also valid in determining the impact on those communities or areas that have, or are about to have contracts suddenly terminated.

General Dynamics TFX basic employment in Fort Worth was projected for the 1960-1970 period. By applying the service-basic ratio, dependent employment was derived. In the peak year of 1968, for instance, 20,000 General Dynamics employees were

estimated to be engaged in TFX aircraft production. Of this number, 9,360 are new employees due to the contract award. By applying the service-basic ratio for 1968, it was found that 9,360 workers will support 26,582 service workers. If so desired, net TFX employment and total TFX employment figures can be computed for all years within the 1960-1970 period to indicate for any one year the number of jobs created and supported by the TFX contract award.

The economic impact of the TFX contract on the Fort Worth trading area can be measured in either one of two ways. First would be the total impact which would include all General Dynamic employees working on the TFX contract, plus their related dependent employment and local procurement. The second method would consider the net impact which would include only the increase in new hiring at General Dynamics resulting from the TFX contract, plus the related dependent employment and local procurement.

The first method of measuring the total impact, as shown in Table 14, includes and takes into account the General Dynamics employees who were transferred from other assignments within General Dynamics to the TFX contract. In accordance with accepted employment projections, as previously provided by the Blair economic base study, these employees would be working with General Dynamics even though the TFX contract had

not been awarded to that concern. However, to show the total effect of the TFX contract on the Fort Worth area, all employment on the TFX contract was taken into consideration. The service-basic ratio was applied to the total TFX basic employment to derive total TFX dependent employment. These figures were then converted to basic and dependent disposable income, as shown in Table 14. Also, the multiplier of 3 was applied to TFX local procurement which was then combined with basic and dependent disposable incomes to arrive at the yearly total impact of the TFX contract. The total dollar impact is graphically shown in Table 14. For the eleven year period under study (1960-1970), a total of more than \$2 Billion was placed into the Fort Worth economy from all aspects of the TFX contract.

The second method of measuring the economic impact of the TFX contract would be to consider the net effect. This would take into account only the new hiring at General Dynamics that resulted from the TFX contract. Since there was no new hiring at General Dynamics for performance on the TFX contract in 1960, 1961 and 1962, the only dollar impact attributed to the TFX award for those three years was the previously determined TFX local procurement figures. The first hiring of new employees for the

TFX award begins in 1963. To the new basic hiring figures are applied the service-basic ratios to derive dependent employment and with the inclusion of local procurement, a yearly net impact of the TFX contract is determined. These results are shown in Table 15. For the eleven year period under study, the net effect of the impact of the TFX contract is approximately \$924 million. The contrast between the total impact of the TFX contract and the net impact of the TFX contract is shown by year in Table 14 and Table 15, respectively.

The most valid and pertinent TFX impact indicated by this study is that which is illustrated in Table 15, reflecting disposable income contributed to the trading area as a result of new TFX hiring. Prior to new hiring, all TFX positions were being filled by personnel already holding jobs with General Dynamics/Fort Worth in other capacities. As the B-58 and other programs were phased out, the workers made available moved into newly created TFX jobs. While these jobs were newly created by the TFX award, they did not require additional people from outside General Dynamics to fill them. They were filled from within the company. Beginning in 1963, however, the TFX program required new workers in numbers above what could be provided from within the General Dynamics/

Fort Worth plant. This new hiring and what it is estimated to contribute to the Fort Worth trading area is disposable income over and above that which would be otherwise expected had the TFX award never been made.

The amount of disposable income anticipated to be available for spending during the 1960-1970 period as a result of the TFX contract award will have an obviously marked effect on the Fort Worth trading area. Not only will more money be available for spending but the increase in General Dynamics TFX and other job opportunities in the expanding economy will entice outsiders to immigrate to Fort Worth for employment. The new TFX hiring peak, expected to reach 9,360 by 1968, will in great part be drawn from outside the Fort Worth trading area and will swell the total Fort Worth labor force appreciably. The influx of new workers into Fort Worth will cause greater demands for housing and other required necessities. Not only will existing land and housing values and rents increase, but because of greater demand new housing starts will also increase, creating more construction and related employment. Increased volumes of disposable income in the area will enhance retail trade. Merchants will most likely need additional sales

and other personnel to keep up with the increased sales volume. Inventories will be enlarged to insure that stock will be on hand for sales as required. Laundries, movie theatres, hotels and motels, and other miscellaneous service industries will also be affected by the increase in population and disposable income. Local government will receive an increase in tax and other revenues. Even something so simple as receipts from parking meters will in its small way contribute to Fort Worth municipal revenues for subsequent responding for such things as street and sewer construction and improvement and other public projects. Public utilities and public and private transportation facilities will have to be revitalized and expanded to handle the increase in traffic. Even agriculture, especially truck farming and dairy production, will benefit locally from the increase in trading area population and income. Banks and other financial institutions will increase their deposits and thereby have larger sums from which to provide reinvestment funds and to float loans.

Because of the increase in employment and income in the community, people will have more money for leisure and cultural pursuits heretofore not provided by the community. Increased interest and

participation will cause municipal and private sponsorship of dramatic and music groups, possible construction of, or expansion to, auditoriums, libraries and other educational and leisure facilities. The equivalent of a Disneyland is already in operation midway between Fort Worth and Dallas which, while not necessarily attributable to the TFX contract award, does indicate the type of enterprise that appears in a prosperous and expanding economy, such as evidenced by both the Fort Worth and Dallas trading areas. An increased area population and income will cause an expansion in hospital and health facilities. Additional private as well as public educational institutions may also be a result.

The growth in the Fort Worth economy will encourage import substitutions. That is, those products previously imported for local consumption that will, in many instances, now be produced locally. Former import industry if relocated in the Fort Worth trading area will create new employment and contribute additional income. In addition, if some part of production is for export, then additional income will be derived from export sales which will be re-invested or respent in the local area.

New supporting industrial facilities may be created in the area due to expansion of General

Dynamics production. Those firms supplying needed goods and services to General Dynamics/Fort Worth TFX operations might have previously felt it unprofitable to have a plant locally because of inadequate total sales volume in the trading area. An increase in General Dynamics production as a result of the TFX award, however, might be the deciding factor in a firm's decision to move or expand into the Fort Worth trading area. There can be little doubt that industrial development provides the most effective and rapid leverage on the total local economy, and there can be few communities which do not desire, or have not at some time endeavored to induce new industrial enterprises to locate with them or to encourage the expansion of existing industry.

An additional and oftentimes underrated impact on the local economy in times of anticipated economic expansion and growth is that of individual attitudes. Proper mental attitudes and forward looking, optimistic thinking goes a long way toward inducing and encouraging community expansion and growth. Faith and confidence in the future and in the community is always necessary. The psychological effect created by the TFX award was just enough of a prod to incite this type of thinking among the Fort Worth community and

business leaders to help make possible maximum trading area expansion and growth.

The net economic impact on the Fort Worth trading area as a result of the TFX contract award can be expressed and summarized as contributing over the eleven year period (1960-1970), \$924 Million of primary investment plus secondary consumption respending. The breakdown of this net dollar impact figure indicates General Dynamics TFX basic employment will contribute approximately \$296 Million to the Fort Worth trading area during the 1960-1970 period. For the eleven year period, dependent employment will contribute approximately \$464 Million to the Fort Worth trading area economy. During the same period the \$54.6 Million TFX local procurement figure with the multiplier of 3 applied, will result in a primary investment and secondary respending total of approximately \$164 Million. By combining basic and dependent employment disposable income figures in which the multiplier effect is already included with the amplified TFX local procurement figure, a net TFX economic impact on the Fort Worth trading area is shown to be \$924 Million.

To conclude, the value of an economic impact study to the Air Force and the Department of Defense

is that it shows how and to what extent defense contracts contribute to the growth and prosperity of limited area economies. It also identifies depressed or labor surplus areas created by cutbacks or terminations of defense contracts and thereby indicates availability of unemployed skills by specific geographic areas that might influence future military contract awards. Finally, Air Force and Department of Defense sponsored impact studies can also help forecast defense employment requirements and opportunities for future periods for which local communities can prepare and provide trained personnel.

APPENDIX

NEW SOURCE SELECTION POLICY ON MAJOR WEAPON SYSTEMS RESULTING FROM TFX CONTRACT AWARD

Deputy Secretary of Defense Roswell Gilpatric announced that the Defense Department was initiating a new source selection policy on major items of procurement, with final selection authority resting with the Secretary of Defense.

Gilpatric described the new policy as "an extension and perfection of the present procedure" for evaluating and selecting the sole contractor for a major new weapon procurement. He specified that it would not downgrade the present weight given to military boards in the evaluation process.

The subcommittee of the 21-member Defense Industry Advisory Council who participated, in an advisory capacity, in the drafting of the new source selection policy was appointed last year. Defense Secretary Robert McNamara will take over chairmanship of the council from Gilpatric when Gilpatric leaves his government post in the summer of 1963.

Action will be taken shortly by the Defense Department in five other areas considered by the

Council at its third meeting in May, 1963, Gilpatric reported. These are:

1. Classified briefings of industry on future research and development plans will be brought under closer coordination by the Secretary of Defense.

2. New rules will be issued relaxing management controls under incentive type contracts.

3. Regulations establishing a system of "weighted guidelines" for profits or fees on non-competitive negotiated contracts will be issued. They will be based on a study by Logistics Management Institute last fall.

4. Defense Department's long-standing policy of banning systems engineering contractors from entering into competition for production will be written out.

5. Records of contractor performance will be established, probably in early June of 1963.¹

¹"DOD Plans New Selection Policy", Aviation Week & Space Technology, (May 13, 1963), p. 29.

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This report represents the work of students of the School of Systems and Logistics. Material included in the report has been developed by the students as a portion of their educational program during attendance at the School.

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