MILITARY-BASE IMPACT ON A LOCAL ECONOMY: A CASE STUDY OF THREE MILITARY BASES IN TWO METROPOLITAN STATISTICAL AREAS

By

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by

Kenneth Eugene Hawkins
This thesis is dedicated to my three children; Rachel Anne, Beatrice Rose, and Quinton Zachary with the hope of inspiring them to achieve higher goals than mine.
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# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1. Employment populations for Jacksonville Naval Air Station (Jax NAS) study area</td>
<td>39</td>
</tr>
<tr>
<td>2-2. Employment populations for Mayport NS study area</td>
<td>40</td>
</tr>
<tr>
<td>2-3. Employment populations for MacDill AFB study area</td>
<td>42</td>
</tr>
<tr>
<td>3-1. Key to dependent variables</td>
<td>64</td>
</tr>
<tr>
<td>3-2. Jax NAS dependent variables</td>
<td>70</td>
</tr>
<tr>
<td>3-3. Mayport NS dependent variables</td>
<td>72</td>
</tr>
<tr>
<td>3-4. MacDill AFB dependent variables</td>
<td>73</td>
</tr>
<tr>
<td>4-1. Jacksonville NAS study area regression results for percentage change in commercial area between 1973 and 2000.</td>
<td>96</td>
</tr>
<tr>
<td>4-2. Jacksonville NAS study area regression results for percentage change in median household income between 1980 and 2000.</td>
<td>98</td>
</tr>
<tr>
<td>4-3. Jacksonville NAS study area regression results for percentage change in residential area between 1973 and 2000.</td>
<td>99</td>
</tr>
<tr>
<td>4-4. Mayport NS study area regression results for percentage change in commercial area between 1973 and 2000.</td>
<td>102</td>
</tr>
<tr>
<td>4-5. Mayport NS study area regression results for percentage change in median household income between 1980 and 2000.</td>
<td>103</td>
</tr>
<tr>
<td>4-6. Mayport NS study area regression results for percentage change in residential area between 1973 and 2000.</td>
<td>105</td>
</tr>
<tr>
<td>4-7. MacDill AFB study area regression results for percentage change in median household income between 1980 and 2000.</td>
<td>107</td>
</tr>
<tr>
<td>4-8. MacDill AFB study area regression results for percentage change in residential area between 1980 and 1999.</td>
<td>109</td>
</tr>
<tr>
<td>A-1. Key to Independent Variables.</td>
<td>120</td>
</tr>
<tr>
<td>Figure</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2-1</td>
<td>Income flows.</td>
</tr>
<tr>
<td>3-1</td>
<td>Jacksonville Metropolitan Statistical Area (Image created using FGDL and Census Bureau Data).</td>
</tr>
<tr>
<td>3-2</td>
<td>Mayport NS study area census-tract boundaries.</td>
</tr>
<tr>
<td>3-3</td>
<td>MacDill AFB study area census-tract boundaries.</td>
</tr>
<tr>
<td>3-4</td>
<td>Jacksonville NAS study area census-tract boundaries.</td>
</tr>
<tr>
<td>3-5</td>
<td>Modes of transportation in the Mayport NS study area.</td>
</tr>
<tr>
<td>3-6</td>
<td>Urban and economic growth in Mayport NS study area (1973-2000).</td>
</tr>
<tr>
<td>3-7</td>
<td>Transportation routes to Jax NAS.</td>
</tr>
<tr>
<td>3-8</td>
<td>Residential growth in the Jax NAS study area (1973-2000).</td>
</tr>
<tr>
<td>3-9</td>
<td>Commercial growth in the Jax NAS study area (1973-2000).</td>
</tr>
<tr>
<td>3-10</td>
<td>Tampa MSA.</td>
</tr>
<tr>
<td>3-11</td>
<td>Modes of transportation accessible to MacDill AFB.</td>
</tr>
<tr>
<td>3-12</td>
<td>Commercial area percentage change 1973-2000 for Jax NAS study area.</td>
</tr>
<tr>
<td>3-13</td>
<td>Residential area percentage change 1973-2000 for Jax NAS study area.</td>
</tr>
<tr>
<td>3-14</td>
<td>Median household income percentage change 1980-2000 for Jax NAS study area.</td>
</tr>
<tr>
<td>3-15</td>
<td>Commercial area percentage change 1980-2000 for Mayport NS study area.</td>
</tr>
<tr>
<td>3-16</td>
<td>Residential area percentage change 1973-2000 for Mayport NS study area.</td>
</tr>
<tr>
<td>3-17</td>
<td>Median household income percentage change 1980-2000 for Mayport NS study area</td>
</tr>
<tr>
<td>3-18</td>
<td>Commercial area percentage change 1980-1999 in the Tampa study area.</td>
</tr>
</tbody>
</table>
3-19. Residential area percentage change 1980-1999 in the Tampa study area. ............82

3-20. Median household income percentage change 1980-2000 of the Tampa study area. ..........................................................................................................................83
Military bases have had a profound impact on urban and regional economic growth. Our objective was to assess the impact of military bases on local economic-growth rates in three distinct metropolitan statistical areas (MSAs). We examined the extent to which proximity to a military-base or the Central Business District (CBD) affects local economic growth rates and the degree to which variability in growth is explained by the distance to a base.

Our study population included three metropolitan statistical areas: Jacksonville Naval Air Station (NAS) and Mayport Naval Station (NS) located in Jacksonville, Florida, and MacDill Air Force Base (AFB) located in Tampa, Florida. We used spatial analysis and multiple regression analysis to determine a discernable impact on economic-growth rates of the localized areas from each of the three military bases at the 95% confidence level. Our hypothesis was that military bases have a discernible impact on economic growth rates at a geographical scale (census-tract level) because of proximal
distances and accessibility along transportation corridors between the base and major commercial and financial nodes at the 95% confidence level.

Spatial analyses showed discernible impact on the economic growth rates of the study areas; however, the cause of economic growth is not discernible among impact from the base, commercial nodes, economic nodes, demographics, distance variables and accessibility variables in the study areas. Regression analyses revealed possible positive and negative causes for economic-growth rates of the study areas. However, the significance of base impact on economic-growth rates was negligible in all cases. The study areas showed no evidence of localized spillover effects.
CHAPTER 1
INTRODUCTION AND LITERATURE REVIEW

Base Impact on Urban and Economic Growth of the Localized Area

Military bases have had a profound impact on urban and regional economic growth. Our objective was to investigate to what extent variability in urban and economic growth rates are explained by proximity to important nodes in 3 distinct study areas. Specifically, we investigated the degree to which variability growth ratios are explained by distance to a military-base vs. other prominent nodes in the metropolitan areas (e.g. CBD, commercial, residential, and industrial) by spatial relationships.

Our hypothesis was that military bases have a discernible impact on economic-growth rates at a geographical scale (census-tract level) because of proximal distances and accessibility along transportation corridors between the base and major commercial and financial nodes at the 95% confidence level.

Problems Associated with Base Realignment and Closures

Base Realignment and Closures (BRAC) have occurred since the formation of the Department of Defense (DoD). Before the 1980s, BRAC was a defense function handled primarily by the DoD. The DoD did not have to answer to any governmental offices when BRAC actions were considered. After the Vietnam War, Congress began to get involved because they felt that BRAC was targeted toward those states that did not fall into line with defense spending. Several congressional members began organizing to prevent BRAC; and by the late 1970s, Congress passed regulations that prevented the DoD from approving any BRAC actions without congressional authorization.
Congressional intervention prevented further BRAC actions until 1988. The events that occurred between 1981 and 1988 concerning the United States and the Soviet Union led to the eventual collapse of the Soviet Union and a change in the DoD’s mission and planning. The DoD had to consider the downsizing of personnel and the ability to rapidly respond to changing military and strategic needs. The development of new weapon systems and training led to a “modernization” of the DoD and a reevaluation of their infrastructure.

The DoD had to deal with another problem from Congress while modernizing. By 1988, defense spending had been an integral part of the Reagan administration’s plan on crippling the Soviet economy. The intense defense development programs during the 8 years of Reagan succeeded in bringing an end to the 40-year-old Cold War. Problems associated with the post-Cold War defense spending brought about a change in Congress and cuts in defense budgets. The DoD argued that cuts in their budget would affect development of training, and weapons, and the creation of rapid deployment forces. Congressional leaders argued that downsizing military strategies would include a review of weapons development programs and potential base closures. The DoD argued that some bases were no longer vital to the new mission of post-Cold War defense, leading to new rounds of BRAC. Eventually, Congress agreed that there was a need to consider BRAC actions.

The new rounds of BRAC were considerably different than BRAC actions before the 1980s. The new rounds of BRAC that Congress agreed to would be more of a congressional function than BRAC actions of the past. Although the DoD would have a say as to what bases should be considered, a commission would be established to review the bases and make recommendations to Congress. BRAC would evolve over the next 7
years because of differences between Congress and the DoD; however, intervention in
the 1995 round by President Clinton prevented any further BRAC action until 2005. The
Government Accounting Office (GAO) and the Congressional Budget Office (CBO) are
the two primary organizations that review and report the progress of previous BRAC
actions and serve as part of a check-and-balance system between the DoD and Congress.
The problem is that both the DoD and Congress have alternative agendas concerning
BRAC. The DoD needs to close unnecessary bases; however, Congress is concerned
about economic impact from base closures. Although, there is a need to close bases,
political considerations come into play. Congress paints a gloom-and-doom picture of
base closures (which previous research has shown is not necessarily true); and the DoD
has a valid argument that base reduction has not matched the reduction in force, and that
reduction in costs for unnecessary bases can be effectively applied to other budgetary
concerns.

Preparation of BRAC in cities and metropolitan statistical areas (MSAs) with bases
can prevent or reduce the effects of economic impact. When a new round of BRAC is
announced, federal, state, and local government officials actually try to prevent base
closures in their respective areas. Unfortunately, the local population believes in the
gloom-and-doom scenario painted by Congress and will do anything they can to prevent
the closure of bases to protect their local economics. Much preparation and planning must
be done to prepare for the economic impact that occurs with base closure and/or
realignment. City planning and commerce officials, and other business and government
organizations can reduce the negative economic impacts with proper organization and
planning. The land use associated with the loss of a base can be replaced with new
businesses and industries by rezoning. If substitute industries are situated to move in,
when the military moves out, the impact should be substantially reduced. There is one
other useful alternative of proper planning and organization: the prevention of BRAC.
One of the criteria that the DoD and BRAC commissions consider when choosing bases
for BRAC actions is the urban growth of the local area approaching the outer boundaries
of the base (also known as encroachment). The DoD’s major concern about
encroachment on a base’s boundaries mainly arises with bases that have airfields.
Complaints of noise pollution and other civilian issues generally cause problems for the
military in the local area. The DoD has argued that local planning and commerce officials
should keep in mind the problems associated with encroachment and other civilian issues
when determining future land use in the local areas.

BRAC assessments need to (and usually do) consider the economic impact of the
local area. A key to preventing real dangers to local communities and economic impact is
to consider the size of the urban area and the diversity of its economy; most BRAC
actions in the past have involved large military bases in or near MSAs. Recent studies
(Dardia et al. 1996, Cockrell 1998, Hooker and Knetter 2001) that the economic impact
in past areas have not been as severe as predicted. Recovery of the areas has been swift
and their economies have typically recovered fairly rapidly. The areas affected were
typically in major MSAs with diverse industries that aided in economic recovery. Future
BRAC assessments need to consider the impact of bases in smaller urban areas (such as
Jacksonville, NC; and Manhattan, KS) whose industries are predominantly service-
related and thrive on the military presence. BRAC actions in these types of communities
can be devastating. Accessibility of bases to the central business district (CBD) may also
play a vital role in how urban planning and economic growth rates in areas near bases
may be potentially affected by base closures. Land use before, during, and after BRAC needs to be considered if negative economic impacts must be reduced.

**Base Realignment and Closure, Economic Impact, Accessibility, Military Bases, and the Central Business District**

**Determining Base Realignment and Closure (BRAC)**

The first BRAC Commission was formed in December 1988 and Congress authorized a new round of closures. Reminded of the difficulties of base closures in previous years, Congress acted by passing legislation that would allow the DoD to close bases, yet allow Congress to keep control of the proceedings and actions involving these base closures. The Defense Base Closure and Realignment Act of 1990 was passed to correct deficiencies from the first round of BRAC in 1988. Many congressional members were not overly enthused with the selections made in 1988, particularly those from California. Since 1988, economic impact of the urban areas affected by BRAC recommendations have caused resistance from Congress and individual states’ legislative bodies in an era where it was necessary to reduce the military infrastructure which meet the post Cold War goals of the Department of Defense (DoD). There are a great number of government documents from the Government Accounting Office (GAO) and Congressional Budget Office (CBO) that express in detail the concerns of the DOD and Congress and economic impact from BRAC recommendations. The GAO publications primarily discuss the importance of the reduction in military infrastructure. Yet the concern of economic impact because of BRAC is discussed in the same GAO publications. According to the GAO (Holman 1995, 1996, 1998, 1999, 2001a, 2001b, 2001c, 2004, Wiggins 1996) the increases in the DOD budget and spending during the 1980s led to significant changes in the future of military planning and policy. The DoD
reevaluated the mission objectives and determined that excessive spending could be reduced in some areas and redirected to meet the requirements for spending on research and development (R&D) of better weapons systems, equipment and improved readiness of units. Once the DoD determine what bases or functions on a base were unnecessary, a list of those facilities and functions were drawn and proposed to BRAC. BRAC later released those reports to Congress and the Congressional Budget Office (CBO) as well as the Government Accounting Office (GAO). Recommendations were made to determine the effect of cost reduction for the DoD and the negative impact on the economies of urban areas in close proximity to the bases targeted for closure or realignment.

Of importance was the impact on the employment of the local community, real estate values, and future use of the land returned to the urban region. The DoD is interested in the cost to maintain, train and operate the facility and its personnel. Another issue that DoD takes into consideration is the urban region's growth and the encroachment of growth toward the base and the subsequent; particularly bases with aviation units that require flight training and operations. Virtually no attention, however, is paid to the spatial relationships between military bases and the Central Business Districts and other important nodes in the urban area. Moreover, the economic impact of military personnel leaving the urban region and the loss of linked income is of secondary concern. The studies need to look much further than just the loss of jobs in the civilian sector and changes in real estate values, as future business opportunities from the availability of land may play a vital role in the recovery process once a base is closed. Urban planners must control the potential growth in areas progressing into encroachment on the fringe of military bases, and plan in accordance to remove the possibility of encroaching land uses. The first step in planning is to determine the location of a base’s
aviation component and second the base’s training areas. By creating a buffer or no
growth zone between the urban land use and the base would improve a region’s chance of
surviving possible base closure. A good example of land use encroachment can be seen in
the MacDill Air Force Base study area because the base is centrally located in the Tampa
MSA. Jacksonville Naval Air Station has not been as fortunate as urban growth from
Orange Park (south of the base) and Jacksonville (north of the base) have surrounded the
boundaries of the base. Fortunately, the base’s airfield is located away from the urban
growth and near the St. John’s River. While urban sprawl has occurred in the area
surrounding the base, the effects of this urban growth pattern has been beneficial to the
base because of the real estate values and the industrial and commercial activity near the
base. Thus, encroachment has not been a major problem even though the urban growth
reached the boundaries of the base. One final factor that prevents recommendation for
closure is the mission of the base: it is home to the air wings that support the carrier
group based at Mayport NS. Closure of Jax NAS could occur, however, the space
required for the base’s mission is not sufficient at Mayport NS. Therefore, if the Jax NAS
closed, the mission of Mayport NS would be adversely affected. Without air support for
the carrier group stationed at Mayport NS, the mission of the base would be weakened
enough for base closure consideration.

By 1995, the DoD had established a list of criteria that appeared to satisfy both
sides. The list of DoD criteria was published by the GAO (GAO-95-133, 1995) and is the
basis for the DoD’s recommendation for future rounds of BRAC. According to the GAO
the list of DoD criteria is broken into three categories with individual criteria for base
selection in each category.

DoD Criteria for Selecting Bases for Closure or Realignment:
• Military Value (priority consideration is to be given to the four military value criteria)
  − Current and future mission requirements and the impact on operation readiness of DoD’s total force.
  − The availability and condition of land, facilities, and associated airspace at both the existing and potential receiving locations.
  − The ability to accommodate contingency, mobilization, and future total force requirements at both the existing and potential receiving locations.
  − Cost and manpower implications.
• Return on investment
  − The extent and timing of potential costs and savings, including the number of years, beginning with the date of completion of the closure or realignment, for the savings to exceed the costs.
• Impact
  − The economic impact on communities.
  − The ability of both the existing and potential receiving communities’ infrastructures to support forces, missions, and personnel.
  − The environmental impact.

Once the bases are recommended on these criteria, the recommendations are presented to the BRAC Commission for further investigation. The final BRAC recommendations are then presented to legislative and executive branches for approval.

Although the process seems rather simple, many factors can disrupt the process beginning with the DoD selections. A GAO report (Holman 1995) stated that the DoD is sensitive to the economic impact on affected communities; however, later GAO reports (Holman 2001c, Holman 2004) discussed the importance economic impact has in DoD’s selection criteria, but military value has top priority in all selection processes. The GAO reported (Holman 2004) a list of requirements that the DoD adopted to establish a guideline for all services and DoD agencies to implement in the base selection process:
• All installations must be compared equally against selection criteria and a current force structure plan developed by the Secretary of Defense.

• Decisions to close military installations with authorization for at least 300 civilian personnel must be made under the BRAC process. Decisions to realign military installations authorized for at least 300 civilian personnel that involve a reduction of more than 1,000 or 50 percent or more of the civilian personnel authorized, also must undergo the BRAC process.

• Selection criteria for identifying candidates for closure and realignment must be made available for public comment before being finalized.

• All components must use specific models for assessing (1) the cost and savings associated with BRAC actions and (2) the potential economic impact on communities affected by those actions.

• Information used in the BRAC decision-making process must be certified—that is, certified as accurate and complete to the best of the originator’s knowledge and belief. This requirement was designed to overcome concerns about the consistency and reliability of data used in the process.

• An independent commission is required to review DoD’s proposed closures and realignments and to finalize a list of proposed closures and realignments to be presented to the President and, subject to the President’s approval, to Congress.

• The BRAC Commission is required to hold public hearings.

• The BRAC process imposes specific time frames for completing specific portions of the process (see app. I for time frames related to the 2005 BRAC round).

• The President and Congress are required to accept or reject the Commission’s recommendations in their entirety.

• In addition to GAO’s role in monitoring the BRAC process, service audit agencies and DoD Inspector General (IG) personnel are extensively involved in auditing the process to better ensure the accuracy of data used in the decision-making and enhance the overall integrity of the process.

One requirement caused some previous complications with the BRAC process: the acception or rejection of the BRAC Commission’s recommendations in their entirety by both the President and Congress. Apparently Congress gives the final endorsement for all BRAC recommendations. Twight (1989) gave an insight to congressional actions concerning BRAC recommendations. According to Twight (1989), congressional
members appear to be more concerned with their own political ambitions than addressing the issue of needed BRAC actions, which according to the previously mentioned GAO and CBO reports, Congress agreed that there is a need for BRAC. Twight (1989) explained the question of congressional decision-making in the BRAC process through several examples such as prior authority for base closures and realignment before 1988, actions that occurred because of recommended base closures before 1988, and congressional actions that occurred to refuse the recommendation of DoD proposed BRAC actions before 1988. Schwalbe (2003) described the actions and attitudes of Congress, the Presidency, and DoD during the recent BRAC rounds and supported Twight’s research.

Another problem that needs to be addressed is the education of the general public concerning BRAC. As long as Congress defines the economic impact as being devastating to local, regional, and state economies, the average citizen without a grounded understanding of economic principle will believe that their own economic well-being will be jeopardized with any BRAC actions in their community. Dardia et al. (1996) conducted research for the RAND Institute that studied the effects of BRAC in three communities in California between 1992 and 1995. When the bases in the study (Fort Ord, George AFB, and Castle AFB) were selected for closure many California legislators at both state and federal levels tried in vain to prevent the closures. The study eventually concluded that predicting economic impact is extremely difficult, especially in the before closure stages, and those predictions are not necessarily an end-all scenario as they may appear for the communities affected, however, they also concluded that waiting for long-term studies to be conducted is not reasonable. The answer to these problems is very complex because the problem is very complex. The past history between the DoD
and Congress concerning BRAC is key to solving many of the problems that have arisen in the previous four rounds of BRAC.

One goal was to meet the requirements of the Balanced Budget and Emergency Deficit Control Act of 1985. The Senate bill S.1702, sponsored by Senators Gramm, Rudman and Hollins, called for the elimination of the federal budget deficit by cutting the domestic spending by one-half and the defense spending by one-half. Another mission the DoD was reevaluating was the situation that was developing in the Soviet Union. The increased spending on defense by the Reagan administration had repercussions in the Soviet Union. In an attempt to keep up with American advances in military technology, the Soviet Union was quickly creating a hazardous national situation because of increased spending in their own military efforts to keep up with the United States. BRAC was created for the purpose of assisting the DoD in determining what course of action would be feasible in reducing costs and making defense spending more efficient. Dunbar (2000) conducted research concerning BRAC while attending the National Defense University and National War College. In Dunbar’s report, the past history concerning Congress, the DoD, and base closures reflects similar actions reported in the previously mentioned references: Congress’ inability to trust the DoD’s recommendations for base closures and realignments.

An interesting aspect of Dunbar’s research was the DoD’s method of base closure before 1988. According to Dunbar, most base closures and realignments were conducted to the nuclear response from the Soviet Union. The bases were made larger and placed farther from larger Metropolitan Statistical Areas (MSAs) to prevent the annihilation of population centers in the event of a nuclear war. Unfortunately the economic development between an urban area and the military bases increased the ability of urban
growth between the two locations. Many cities that were near a military-base may have been a small city or mid-sized city when realignment occurred thirty or forty years ago. Some examples are the two areas chosen for our study: Tampa and Jacksonville, Florida. According to the U.S. Census Bureau in 1970, the population for Duval County Florida (Jacksonville) was 528,865 and Hillsborough County Florida (Greater Tampa) was 490,265. Referring to Rugg’s (1972) research on urban growth patterns and the economic development of MSAs, the two MSAs were in early stages of economic growth patterns that resulted in a megalopolis in the Tampa area and Jacksonville’s MSA spilled over into surrounding counties (Clay, Nassau, and St. John’s). The difference between the two areas is the location of the military bases. The 1980 Census reports the population for Duval County Florida as 571,003 and Hillsborough County as 646,960.

At this time the Tampa-St. Petersburg MSA had become a small megalopolis, whereas the growth in Jacksonville shows a slight increase in the MSA’ growth. During this phase of Tampa’s growth, MacDill AFB could have developed a significant impact on Tampa’s economy. The population of Hillsborough County in 1990 was 834,054 and almost matched the population of Pinellas County reported at 851,659. By 2000 the population of Tampa was 998,948 and Pinellas was 921,482, thus the population Hillsborough County’s ability to grow toward the east permitted the population to pass that of Pinellas County, which had almost grown to the full extent of the county’s borders. Although there is no direct connection between MacDill AFB and either St. Petersburg or Orlando, the significance of their interaction with Tampa and its’ economic base should be consistent with previous regional studies concerning base closure impact.

The significance of military bases being situated near major accessibility routes increases their nonbasic activity value to the economic development of the local
community. For example, Orange Park in Clay County was closer to Jacksonville NAS and Mayport NS was situated near the beaches area of Duval County. The growth between both bases and Jacksonville and the growth between the bases and the smaller communities developed into the Jacksonville MSA. Another factor that enhanced the growth involved the earlier BRAC rounds closing several smaller Naval bases in Florida and realignment to the two bases in Jacksonville.

The GAO detailed the problems involved in preparing the land and facilities for exchange to the local communities in many of their reports (Holman 1997, 1998, 2001a, 2001c). Normally the average time for transfer of land can be between 3 to 7 years. Most of the time consuming factors involved environmental cleanup; however, parcels of base property are turned over when they are ready for use.

The means of overcoming a base closure and keeping the economic impact at a minimum would rely on several factors: preparation of the base for closure, alternative methods of turning property over at a quicker pace, privatization in place, finding new environmental cleanup technology, and preparing the local economies for transition to newer nonbasic activities to name a few. The most important aspect of preparing the local community for a base closure is explaining that the economy is not going to be destroyed as most politicians would have them believe. Often Congressional members agreed that there may be a need to redirect defense spending from unnecessary costs to R&D and improved readiness of forces, until the closure or realignment of a base is situated within their congressional district. On learning which facilities and functions are revealed many congressional members begin grass root operations to “save” the base from closure. The most common method of organizing the grass root campaign is through an official website of a federal or state legislator or in some instances the governor’s office.
Another method of starting a grass root campaign is the website of a local university’s political science, journalism, or public relations department. Every state that has a military-base has a website that is designed to prevent the closures of their bases by presenting different studies conducted by local universities, institutions, or research facilities. State or federal legislators sponsor most of the websites. For example, U.S. Senator Dianne Feinstein has a webpage that discussed practically any congressional concern for citizens of California. Interestingly, Feinstein has a history of voting for defense budget cuts; however, her webpage (Feinstein 2004) has many sites that argue against any base closures in California.

The fact remains that the DoD has a need to determine the means to reduce costs and improve budget efficiency. Congress needs to understand that some bases have little or no military value and are wasteful spending of tax dollars or if the base and its functions are that important to the urban region then increase defense spending. However, the purpose of BRAC is to save tax dollars in the first place and increasing the defense budget to save bases and functions of bases is detrimental in more ways to the economy of the whole instead of a small part of the state or nation. The GAO (Holman 2001a) discussed in great detail the DoD’s budget, costs, and savings because of BRAC.

The importance of Congress’s role in the process is they give the final approvals of all BRAC commission decisions. Congress has been difficult in approving past BRAC recommendations. Congress denied the last two rounds of DoD requests for BRAC commissions because of previous discrepancies. However, one of Congress’ concerns with BRAC was possible interference after the recommendations had been approved by any party and outside the requirements established by the 1990 act. Schwalbe (2003) explained in explicit detail the interference that occurred in 1995. President Clinton
interfered with the approved closing of two bases, which clearly was prohibited by Congress. Although the interference did create a new concept (privatization in place) of possibly protecting military bases in future BRAC rounds, the Congressional response was overwhelmingly strong against any future BRAC considerations. The political weapon of Congress has been the economic impact that is created by base closures. Although the short-term effect can be disruptive and possibly devastating to the urban areas that are affected by BRAC, studies have shown otherwise.

The upcoming BRAC round in 2005 will be quite different than the previous four BRAC rounds. BRAC 2005 is designed to improve DoD budget spending; however, it will include some significant changes that make it different that the previous four BRAC rounds. Schwalbe (2003) characterized this new round of BRAC as the “Mother of all BRACs” and explained Secretary of Defense Donald Rumsfeld’s plans to cut the same amount of surplus that was cut in the BRAC round of 1988 to 1995 combined. The 2005 round will also cut at least 25 percent of the DoD’s remaining real estate. Based on Public Law 107-107, Section 3000, there are some important details that are required before the next BRAC round can occur. Before any recommendations can be made, DoD has to prepare a force-structure plan. The Secretary of Defense concerning any possible national security threats between 2005 and 2025 must base the plan on an assessment. DoD must then submit that assessment to Congress detailing the inventory of DoD’s infrastructure based on the force-structure plan. The greatest impact for DoD and BRAC requests occurred with the law amending the Defense Base Closure and Realignment Act of 1990 significantly changing the selection criteria. DoD has been directed by Congress in the upcoming BRAC round to make military value the primary consideration for recommendation for BRAC action. DoD is to assign the bases values as before, however,
when making the recommendation the values are to be based on the following:
preservation of training and staging areas; preservation of military installations
throughout a diversity of climate and terrain areas in the U.S. for training purposes; high
consideration of joint war fighting, training, and readiness; and high consideration for
contingency, mobilization, and future total force requirements at locations that support
operations and training. The selection criteria based on military value was not only
changed, but also mandated as the primary factor for BRAC consideration, however,
selection criteria is not only relegated to military value. Other selection criteria include
the extent and timing of potential costs and savings for DoD, the economic impact on the
local communities affected, the local communities being able to support additional
infrastructure and forces, and factors concerning environmental costs for cleanup,
restoration, and disposal.

Ten years have passed since the last BRAC round. Since 1995, Senator John
McCain and Senator Carl Levin have sponsored congressional action for two new rounds
of BRAC. In two Congressional Research Service Reports for Congress, Lockwood
(1999, 2000) reported the results of previous BRAC actions up to that time. Lockwood
also reported concerns of the DoD’s request for two more rounds of BRAC and the
reasons given by the DoD for the new rounds and congressional action concerning the
need for new BRAC Commissions. Lockwood emphasized similar results that were
published by the GAO and CBO concerning the costs and savings of the DoD after the
previous four rounds.

Lockwood reported the estimated savings at $5.7 billion; however, the GAO
reported (Holman 2001b) the estimated annual savings had increased $5.6 billion in 1999
to $6.1 billion by 2001. The GAO reported (Holman 2004) the estimate is now nearly $7
billion in annual savings from the previous four BRAC rounds. The BRAC savings have been substantial according to the reports. However, BRAC was not the only action by the DoD designed to reduce defense spending. The Balanced Budget and Emergency Deficit Control Act of 1985 called for the defense budget to be cut in half, BRAC alone would not reduce the defense budget by half. Lockwood (1999) discussed an understanding of the DoD’s requests for BRAC. Lockwood explained that Secretary of Defense William Cohen released the Quadrennial Defense Review (QDR) in 1997, which simply reported a major review of the military’s strategies and capabilities. According to Cohen’s review, the reduction in force had drastically surpassed the reduction of infrastructure. There was a significant difference in Cohen’s percentages: force structure was reduced by 33 percent; infrastructure was reduced by 21 percent. Cohen’s conclusion was a request for two new rounds of BRAC in 1999 and 2001. Although Cohen’s arguments for two new rounds of BRAC were creditable, Congress was still stinging from the interference of the 1995 BRAC round and was in no hurry to appease the DoD’s requests. Cohen continued to emphasize the need for BRAC by declaring the significant savings from BRAC would achieve the balance between force structure and infrastructure, thus supplying the necessary funding for future readiness of force and weapons development to bring the modern military up to speed with the military mission.

The 105th Congress neglected to give Cohen serious consideration because of their concerns of political and economic fallout within their own districts. There are some instances that BRAC can be difficult for smaller communities to overcome. Fort Riley Kansas is a major Army base in the middle of the plains in Kansas. The city that would be impacted economically from Fort Riley’s closure if it were to occur is Manhattan Kansas, a small city by most standards with a population of 44,831 in 2000 (US Census,
2000). Manhattan Kansas’ economic activity is predominantly agricultural; however, it is home to Kansas State University and Fort Riley. The university and military installation are the two largest nonbasic activities within the small city. Farming is a way of life for most of the people in the area surrounding Manhattan, but the agricultural industry relies heavily on weather and climate. If the base were to close and several years of drought occurred after the closing, the economic impact could possibly destroy the small city. This is one reason Congress has a legitimate argument concerning BRAC. The fact is that most military installations are located near areas, cities or metropolitan areas that have a larger, diverse economy.

Finally, recent global events have given Congress another argument against future BRAC actions. Since September 11, 2001, the military mission and goals have been enhanced with the War on Terror and Operation Iraqi Freedom. Although there has been a great deal of bipartisanship concerning America’s military actions in both operations, a majority of congressional members have used the military actions as an argument to prevent further BRAC until the actions have been resolved. A GAO report (Holman 1998) emphasized the importance of reduction of operations and maintenance of infrastructure (O&M) if the DoD is to meet the required expenses to modernize the force structure. If the infrastructure costs are not met, then diverting the funds required for force modernization to O&M jeopardizes the overall goals of the DoD. Another GAO report (Holman 1998) discussed the Quadrennial Defense Review and the expected savings from personnel reductions might not be achieved. According to this report an expected $3.7 billion would be saved by 2003 if forces were reduced by 175,000 personnel.
At the time of these reports it is possible that no one knew of the future consequences that occurred on September 11, 2001. Since that fateful day our forces have been stretched to a breaking point. Schwalbe (2003) explained the Department of Defense’s position to counter the requirements of meeting the demands of today’s military. The DoD will assign some bases to inactive status that are selected for BRAC. Once a base is relinquished to the private or civilian sector it cannot serve a military purpose or be applied a military function. Because of the possibility of future need the DoD will try to retain some of the properties in an inactive status similar to the status assigned naval vessels when they are decommissioned, but may be needed for future missions. If the DoD reduced the bases to meet the same percentage of personnel and then a surge in personnel occurred to meet the military requirements for the War on Terror, there may not be enough bases to house the rise in force structure.

Other methods could be considered for studying BRAC. Geographical Information Systems (GIS) have advanced to a high level in the past twenty years. Particularly, geospatial and imagery analysis have grown more advanced and many avenues for research can be utilized to improve possible necessary scenarios that could create means of preventing or accepting BRAC recommendations in the future. The best use of GIS is the planning for land use of BRAC recommendations before the bases being recommended. If each urban area that has a base were to plan for the closure or realignment of the base, then planning for the reduction of economic impact could negate the effect or at least lessen the economic impact.

**Concern over Economic Impact**

Gentrification plays a role in urban and economic growth. A recent trend seen in many MSAs is a revitalization of Central Business Districts. The gentrification consists
of older buildings and structures being renovated or destroyed and new buildings and structures being built in place of the old and the environmental cleanup of parks or green spaces within the CBDs. Gentrification permitted large metropolitan areas to not only reclaim areas within the CBD, but also to renew economic activity within the CBD that was viable with the economic growth and activities that were continuing to spread from the city’s center.

A Thesis presented to Virginia Polytechnic Institute by Hogan (1997) discussed the negative economic impact on local communities that experienced BRAC actions. Hogan argued that the interference from Clinton in 1995 set precedence for future BRAC considerations: privatization in place. The argument for privatization in place has merit because it saves the DoD money in several ways without disrupting local economies. The method would allow portions of a base or functions of a base to be maintained by private industry and remove the operating cost from the DoD and place the burden of cost on private industry. A strong argument for base closures is made using the data reported by the Business Executives for National Security (BENS) Hill Advisory (1997) on employment figures from base closures compared to the total U.S. employment and the job loss of Fortune 500 companies: approximately 120,000 jobs from four BRAC and over 250,000 from Fortune 500 companies in the first six months of 1996.

**Alleviating Negative Economic Impact with Accessibility**

Rugg (1972) explained the phenomenon as the “multiplier effect” using previous research conducted by Hoyt (1961). Utilizing the economic base theory and defining the military-base as a nonbasic activity of the Tampa MSA, MacDill AFB had become a normal supplement to the new basic activity of Tampa MSA. The coalescence of Tampa and St. Petersburg led to newer transportation and accessibility routes over the bodies of
water that separated the two MSAs. The new routes were also located closer to MacDill AFB. The newer roads and the urban growth fed one another and in 1990 the growth of Tampa-St. Petersburg continued until 2000 when the megalopolis of Tampa-St. Petersburg-Orlando could be seen forming along Interstate 4 (I-4). Tampa MSA has accessibility to other areas other than the Central Florida Megalopolis. Two Interstate highway systems are significant to Tampa: I-75 and I-4. Interstate 75 gives Tampa accessibility to areas on a north-south axis. Interstate 4 is the highway that connects the Central Florida Megalopolis. Both interstates connect to other interstates (I-10 and I-95), which increases the basic economic activity for the Tampa MSA. Jacksonville is not as fortunate as Tampa because its economic base is relegated to greater distances. Jacksonville’s basic activities require accessibility to MSAs at greater distances. Atlanta, Georgia; Tallahassee, Florida; Savannah, Georgia; the cities along Florida’s Atlantic seaboard; and eventually the Central Florida MSA provide infrastructural exchanges to Jacksonville’s basic activities. The nonbasic activities related to military bases in Jacksonville play an important role in the city’s economic growth and development. The presence of military personnel and bases provide an economic stimulus in terms of sales and services supported by military related transfer income and consumption.

Another aspect with the military bases is their location within the Jacksonville MSA. Both bases lie on important transportation routes into the heart of the Jacksonville MSA. The urban growth pattern in Jacksonville has shown a tendency for growth toward the bases rather than toward the major transportation routes leading to Savannah, Georgia (I-95 to the North); Atlanta, Georgia (I-10); and Tallahassee, Florida (I-10). Industrial growth patterns appear to follow the major transportation routes; however, residential and commercial growth appears to follow the routes toward the bases. The relative locations
of the CBD to the bases are key to certain urban growth patterns. The need to study the economic base of the region that immediately surrounds the CBD and the base and the major routes that connect the two is an area that should be considered when studying the economic impact of BRAC. This area will potentially absorb the greatest impact after BRAC actions. Presence of a military-base is a nonbasic function and transfer of payments are of great importance to the local economy, helping to boost the tax base and increase the commercial and residential activity in the area. The closure of a base doesn’t necessarily impact the MSA as a whole, but as the RAND study (Dardia, et.al. 1996) of three bases in California showed us, the impact on the local communities and areas juxtaposed to the base are profound.
CHAPTER 2
METHODS

Economic Growth and Development because of Military Bases and the Central Business District: Economic Base Theory and Accessibility

Military Bases, Central Place Theory, and the Central Business District (CBD)

Walter Christaller conducted a great deal of research revealing the relationship between an urban center and economic growth. Central Place Theory (Christaller, 1933) suggested that a city tends to decentralize as its economic base grows. Nonetheless, a disproportional amount of growth was associated with more central locations. The more recent literature (Rostow 1960; Rugg 1972; Palm 1981; Forkenbrock 1990; O’ Sullivan 1993; Boarnet 1996; Wu 1998; Vickerman et.al. 1999; Banister and Berechman 2000; Nelson and Moody 2000; Berechman 2001; et.al.) highlighted other factors that influence urban growth patterns and the role of commercial, financial, and residential districts in the centralization of growth along prominent nodes or corridors. Military expenditures and income also played a vital role in the growth pattern of an urban center. This is the argument that is normally presented by congressional members when arguments for selected base closures are recommended.

Since Christaller’s research concerning Central Place Theory (1933) was published, most research conducted concerning urban planning and growth place a great deal of emphasis on the economic indicators within an urban area, its surrounding region, and the nearby trade centers. The significance of the economic impact of industry loss and gain may determine the scale in which an urban center may grow, the rate of growth, and the pattern of growth. Moreover, employment mix and a city’s function or economic profile
will also play a role in determining a city’s ability to weather adjustments from the loss of various industries.

**Economic Base Theory**

The spatial relationship of the urban and regional economy can affect urban growth pattern. Economic base theory is one method of explaining the impact of industry loss or gain. According to Yeates and Garner (1976) economic activity may be expressed by the following equation:

\[
\text{Total activity in the city} = \text{Total in basic activity} + \text{Total in nonbasic activity}.
\]

\[
(TA) = (BA) + (NBA)
\]

Total income of the city = Total income derived from basic activities + Total income derived from nonbasic activities.

The basic-nonbasic ratio (BA/NBA) represents the ability of basic (export-oriented) activity to support nonbasic activities such as retail sales, consumer and producer services, etc. Nonbasic activities are also supported by transfer payments and transfer income (government expenditures on military bases fall into this category). According to Fik (2000) the basic-nonbasic ratio creates a multiplier, which is applied to determine the impact of transfer income on employment expressed:

\[
\frac{\text{Total Economic Activity}}{\text{Basic Economic Activity}} = \frac{\text{Basic Economic Activity}}{\text{Basic Economic Activity}} + \frac{\text{Nonbasic Economic Activity}}{\text{Basic Economic Activity}}
\]

\[
(TE / BE) = (BE / BE) + (NBE / BE)
\]

Whereas TE / BE is the multiplier and is represented with the symbol \( m^* \) the new equation is:

\[
m^* = 1 + (NBE / BE)
\]

In addition to the multiplier, Fik explains 4 different types of income flows or transactions, which have an effect on the economic growth trends on an area. The type of
income flow that typically concerns the impact a military-base has on the local economy is transfer of income. A visual representation of income flows is given in Figure 2-1. The importance of this concept can be relative to military-base closures because transfer payments to the base support industry at the metropolitan level.

Figure 2-1. Income flows.

Methods for a New Approach to Predicting Economic Impact from BRAC

Military Bases Applied to Economic Models

Military bases are a nonbasic function of urban centers and supply a transfer of income from the federal government as well as from the military labor force. Federal funding for military bases includes purchasing necessary goods and supplies from the local urban economy. Since most urban growth models are based on economic foundations, spatial characteristics and classifications, involve social and political factors,
and must rely on transportation networks; a strong argument can be given to reflect the possibility of the military factors in recent years having an influence on economic growth. Although the military impact has not been commonly used in previous research of urban growth and planning or in economic models, military bases are usually lumped in with one or more land use categories (most often institutional) or certain labor force categories such as governmental employment. However with recent controversial issues concerning base closures, studies are becoming more recognizant of the economic impact an urban center may face on a base targeted for closure. Risa Palm (1981) explained in great detail interesting points of the defense spending in previous years and the impact on regional urban economic growth in the South and West regions of the United States. Palm also referred to other research conducted concerning federal defense spending (Rostow 1960; Sale 1975; Perry and Watkins 1977; Weinstein and Firestine 1978) and the economic development of the regions in which the defense spending was concerned. The importance of the research may be the foundation of current defense spending trends in the same regions, and the greater impact it now has with higher military salaries.

Several factors in recent years also contribute the growing influence military bases have in the nonbasic function of an urban center: increases in military pay, emphasis on research and development, support services, civilian labor force requirements, and import of perishable goods are just a few. In recent years the military pay increases have normally been higher than the cost of living increases in the South, Southwest and Midwest regions of the United States. Because of the restructuring of the military’s training operations and equipment (TO&E) has changed significantly since the Cold War, many of the urban centers that contained bases have industries that are reliant on federal contracts to supply goods and services required for the fulfillment of the military
obligation to the United States. A concern of many urban centers is the closure of bases can relegate those industries to closure as well. The economic impact on the urban center can be devastating to the urban economy if there is a significant reliability of the urban center’s industry on the nonbasic function of the base. However, according to Economic Base Theory (Rugg 1972; Yeates and Garner 1976; Christian and Harper 1982; Mayer and Hayes 1983; Hartshorn 1992; Fik 2000; et.al.) an urban center with a diverse economic base should overcome the loss of one type of industry given the depth and breadth of its other industrial linkages. Therefore, the argument of many DoD officials is the restructuring of land use available after a base closure should be utilized efficiently to compliment and/or enhance existing basic-nonbasic functions of the urban center. The opposing view is the time it takes to replace the lost source of revenue can be difficult or impossible to overcome in the short term and lead to the eventual destruction of certain sectors of the urban center in the long term.

Urban transportation systems play a significant role to military bases. Highway systems are vital to military bases. Mobility of military labor force is vital to location of the base. Most employees of the military must be on the job earlier than the civilian sector and thus having a reliable transportation network to travel to work is necessary. Nelson and Moody (2000), Kim and Chung (2001), and Kim et al. (2003) discussed the importance of transportation corridors and their effects on urban growth models. The three study areas chosen for our study have major transportation corridors that connect the military bases to other nodes including the CBD. Another important feature of the transportation corridors is the availability to the residential areas to and from the military bases. The access to transportation corridors outside the localized area may also allow for some military members to live outside the study areas. Availability of transportation
corridors throughout the MSA may account for the spillover seen in previous research (Dardia, et.al. 1996; Hooker and Knetter, 2001) concerning economic impact from base closures. The land use classification given by St. John’s Water Management District (Jacksonville) for the years 1973 through 2000 show significant changes in residential and commercial growth (predominantly an increase in both) near the major thoroughfares and beltways near the military bases. Whereas the lack of area for growth in the MacDill AFB study area allows growth of commercial area at the expense of residential area and vice-versa. According to Christian and Harper (1982) agglomeration economies are enhanced from beltways that are proximal to railroads, airports, and seaports as they allow for the clustering of linked industries. Both of these cities have specialized transportation functions because trade is a major activity in both urban centers.

Christian and Harper (1982) explained the input-output model as a method of forecasting manufacturing (industrial) forces on economic growth. Mayer and Hayes (1983) basically described the model as a series of input-output matrices and can be used to account for all sector inputs and outputs of a city. In the case of a military-base, the inputs and outputs could be income or revenue.

**Previous Economic Impact Studies from Military-base Closures**

The RAND study (Dardia et al. 1996) was mentioned the most in the research conducted concerning BRAC and was based on three California bases that were closed in the early rounds of BRAC from 1988 to 1994. The study used three benchmarks to gauge the changes of economic impact. The three benchmarks are: (1) expert projections of what would take place in each community, (2) the experience of a matched set of California bases that had not closed, and (3) the experience in the broader regions in which the closed bases were located. The study had mixed results based on the variables
that were selected. The variables that were used included: population, housing units, vacancy rate, unemployment, labor force, K-12 school enrollment, and retail sales. The variables considered the changes in each after the bases closed and the region’s proximity to the bases. The study revealed the gloom-and-doom scenario as being an extreme prediction. Initial results showed that overcoming the negative effects were not as difficult as had been predicted. The study also revealed that spillover into other areas from BRAC was negligible as distance from the base increased. According to the RAND study, the impact affected the unemployed workers and their families and the revenue lost by individual businesses more than the community as a whole. This allowed the community to overcome the impact through proper planning and land use. If there is good indication that the economic climate in the region is favorable, then impact from BRAC will be swift. Smaller and less diverse economies will require substantial longer recovery times. Thus it stands to reason that the growth and development patterns of a region be studied when a base is targeted for BRAC action. The conclusion given in the RAND study simply stated that predicting the effects of economic impact are difficult.

The RAND study mentioned distance, but the study did not use distance as a variable. An example of variables that could explain distance in a spatial relationship between the bases and commercial nodal activity are the straight-line distances between the bases and other nodes or the CBDs. Accessibility of the base to the CBD and other nodes is also vital to understand the economic impact of BRAC.

US Senator Dianne Feinstein’s webpage had the text of a letter (2004) she sent to Peter Potochney, the director of BRAC. She emphasized three issues need to be added to the military value section of the BRAC criteria. The second issue she outlined includes accessibility considerations. However, Senator Feinstein did not include the proximity to
the CBD an important node in most urban economies. Another aspect that Senator Feinstein failed to mention is the population of California. California has roughly one-sixth of the United States total population. Thus, it would be easy to presume that if there are more bases in California and more people, then California should have a higher proportion of the numbers in base closures and personnel unemployed. Feinstein’s arguments are lost to the BRAC Commission because previous studies (Dardia, et.al. 1996; Hooker and Knetter, 2001) did not support her. Senator Feinstein did have one advantage with her argument: most of the bases closed in previous rounds have left very few choices for the BRAC Commission in future rounds.

Certain factors determine the economic recovery from BRAC actions. The GAO explained the factors in detail (Holman 2001c) and supplied a visual representation of those factors. According to the GAO, eight factors significantly affect economic recovery: (1) reuse of base property, (2) government assistance, (3) public confidence, (4) leadership and teamwork, (5) natural and labor resources, (6) diversified local economy, (7) regional economic trends, and (8) national economic conditions. The last two factors listed possibly played the strongest roles in previous BRAC actions and economic recovery for those areas. The important issue to keep in mind with the next round of BRAC is that national recovery is not the only factor that needs to be studied for the economic recovery of BRAC actions.

Hooker and Knetter (2001) studied the economic effect of employment and personal income effects that occurred from BRAC. They explained the importance of the reduction in defense spending from 1986 to 1998 and the need for base closure; however, they also mentioned the difficulties in deciding the bases selected for closure. The most singular factor, as mentioned in the previous studies, involved in the fight against BRAC
is the economic effect on the local community. Hooker and Knetter approached the problem using a newly constructed dataset to study the employment and personal income effects at the county level. They explained that military bases are a major employer of most counties in which the base is located (up to 30% in some cases according to the study); and thereby accounted for a larger share of income and tax revenue in the area. Hence, transfer payment, related income played a vital role in these local community’s economic stability. Government transfer payments helped pay for certain activities within the local community, especially in the operation and maintenance of the local communities infrastructure and services. Normally local taxes are utilized in education, road repairs, community development, maintenance of parks, etc. The importance of the transfer payment differs in one major aspect; the federal government (in the form of property tax, sales tax, and other taxes that are owed) pays the taxes for the operation and maintenance of the base. Normally the taxes collected by the civilian sector (sales, property, and in most states a state income tax) pay for the operation, services, and maintenance of the local community. Communities with a military-base enjoy the luxury of receiving additional tax support from the federal government; thus they attempt to overcome the decision for BRAC to occur in their communities.

Hooker and Knetter mentioned an interesting point concerning BRAC and the local community: the opportunity cost of the resources the base affords the community after it is closed. In particular, they cited the available land the community received and the possible use of the land after it was released to the community as the most important consideration. Hooker and Knetter gave two examples of scenarios that can assist the recovery of local economies after the bases closed (in a study of the Presidio of San Francisco Army Base and Moffett Field Naval Air Station in the Silicon Valley, both...
bases in California). Primarily using employment and personal income indicators in their study and measuring the responses from the counties by comparing the results to counterfactual scenarios. The first scenario assumed the county’s employment and per capita personal income growth rate equal to the state’s growth rate. The second scenario assumed the difference between the county and the state’s growth rate in the years before the time of base closure would have persisted after the base closed. In the case of their study they chose to use a two-year period before base closure to measure growth. The results of their research showed that nonbase employment grew faster in closure counties than it did in the counterfactual model. The study proved that spillover from job loss on bases did not affect the surrounding areas as assumed from the impact analysis. Instead, the study proved that if the bases’ resources are properly used in alternative ways, then an increase of job creation could occur if industries with higher multiplier effects are brought in to substitute for jobs lost under the base closure. Hooker and Knetter explained the findings are similar to recent studies that were conducted by Davis et al. (1996) based on the dynamics of labor markets in larger regions involving basic industries. Hooker and Knetter (2001) also found similar results to Aschauer’s (1990) “below-unity estimates of output multipliers for government consumption and military investments from aggregate data.” The personal income results from Hooker and Knetter’s study also revealed very little impact from BRAC. According to Hooker and Knetter there were no statistically significant impact on per capita income from BRAC. Furthermore, the study indicated a slight growth in per capita personal income in the county compared to the state’s growth after BRAC. Hooker and Knetter gave two explanations for the results: (1) generally outgoing military personnel have below-average income in comparison to income of employees working in other sectors and (2)
the older and more experienced civilians who lose jobs tend to gain employment at higher salaries. According to Hooker and Knetter, economic impacts have traditionally been projected instead of estimated and measured. They argued that projections from input-output models tend to ignore the capacity of regional economies to adjust to closures. They further argued that the main issue to measuring economic impacts was the estimation of impacts that would occur without base closure. The type of base is another factor Hooker and Knetter mentioned that tends to assist the community in recovering from base closure. Bases that require more highly skilled workers, utilize more methods of transportation for shipping and receiving of supplies, personnel, and equipment, and provide more resources for future development tend to assist the local community’s recovery after they are closed. Air Force bases normally fit the criteria described and in past BRAC actions were usually the majority of the larger bases selected. Hooker and Knetter concluded that future studies should attempt to assess obscured results instead of simply project results of economic impact. They also emphasized the importance of refuting the negative impact predicted and concentrate on establishing the positive aspects that can occur with the proper and well-developed planning of the use of the base’s resources after closure.

The preceding research suggested several main issues for further study of base closure impact: (1) do not predict, estimate the impact on economic growth rates from base closures, (2) include distance variables and accessibility to transportation corridors, (3) consider the percentage of total population that is employed at the base in question, (4) research should consider using a smaller geographical scale to estimate impact at local levels, (5) include a larger number of social and economic independent variables to increase the variability and random pattern of the model, (6) and apply the criteria for
base closure as defined by the Department of Defense (DoD). Our study considered the previously aforementioned research and was consistent with similar methods used in the previous research. However, the six issues discussed were included in our study to determine the base’s negligible impact on the economic growth rates at a smaller geographical scale (census-tract level), whereas previous research is conducted at a larger geographical scale (county, regional, or greater).

**New Approach to Predicting Economic Impact from BRAC**

**Base Realignment and Closure (BRAC) 2005 and Florida's Bases**

The next round of BRAC was scheduled for January 2005. Since the next round was announced, many politicians from the federal to the local level have organized to prevent BRAC from occurring in their state or local community. Florida is the home of many military bases. Past BRAC rounds have resulted in the closure of several installations in Florida; however, the upcoming round has affected the state more than it has in past rounds. Governor Jeb Bush has already authorized the state to organize grassroots activities to raise over $200 million dollars to fight BRAC in Florida. The main reason for the governor’s action may be because of statements given by Secretary of Defense Rumsfeld concerning the relocation of Central Command from MacDill AFB in Tampa, Florida to the Middle East and possible closure of MacDill AFB. Although MacDill AFB has been the base most often involved in the rumors of BRAC, Florida is concerned about the possibility of other base closures. The largest bases in Florida are Pensacola Naval Air Station (NAS), Eglin AFB, Mayport Naval Station (NS), Jacksonville NAS, MacDill AFB, Patrick AFB, and Key West NAS. Other bases in Florida that do not have a large permanent military personnel presence include Camp Blanding and Avon Park Bombing Range because of their mission as training bases.
Jacksonville and Tampa, Florida

Jacksonville and Tampa were chosen for our study because they are the largest MSAs with bases in Florida. The economic activities in the MSAs, the size of the CBDs, the transportation corridors between the bases and CBD from the surrounding communities and the diversity of factors involved if bases are chosen for closure allow for the development of modeling the estimates for economic impact. The bases chosen for the study included MacDill AFB in Tampa and Jacksonville NAS (Jax NAS) and Mayport NS in Jacksonville. An important factor concerning our study compared to past studies involved the area being studied. Instead of incorporating an entire MSA, county or region, our study emphasized the census-tracts that surround and connect the transportation corridors between the CBD and base. The previously mentioned studies practically stated that spillover from base closures was negligible. Instead of focusing on the projected impact of a potential base closure, our study assessed if there was a discernible statistical relationship between distance to a military-base and urban economic growth rates taking into account the locational accessibility to the CBD and other prominent urban nodes.

According to the Jacksonville Chamber of Commerce the total number of employees at Jax NAS was 24,648 and Mayport NS was 15,001 in the year 2000. However, when aggregating the total number of military members and federal government employees in the census-tracts that were selected for the study areas the numbers were smaller. In 1980, Jax NAS had 15,484 military members out of a total population of 249,362 that resided in the study area and by 2000 the military population had declined to 5,032 out of a total population of 303,909. The federal government employees that resided in the study area for Jax NAS (south central Jacksonville) in 1980
were 6,500 and in 2000 the number of federal government employees was 6,802. An explanation that could account for the change in military members was the addition of homes on the base itself and the improved pay military members experienced over the last twenty years. However, the number of civilian employees increased. The closure of Cecil Field NAS in west Duval County may account for the increase in civilian employees near Jax NAS. One other factor could account for the reduction of military members living near Jax NAS: Jax NAS supplies the aviation units for the carrier group stationed at Mayport NS on the mouth of the St. John’s River and Atlantic Ocean in east Jacksonville. Mayport NS study area had a military population of 11,541 out of a total population of 197,768 in 1980 and 9,190 out of a total population of 272,590 in 2000. The reduction in population thus rejects the theory that personnel had migrated from Jax NAS. The only other conclusions could be the growth of military housing on the bases, which may not be included in the census or the increase of average salary allowed military members to move further from the bases. Finally, many service members may have been out to sea when the census was being taken. Jax NAS and Mayport NS have been a part of Jacksonville for the most part of last century (at least since World War II). During the past thirty years, the required number of service members has been approximately 20,000 for Jax NAS and 15,000 for Mayport NS. Additional Federal employees for the Mayport NS study area numbered 3,960 in 1980; the population was 4,802 in 2000. Basically an increase was observed in civilian employment by the federal government while a reduction was observed in military member population. Of greater importance is the fact that military population has been reduced in the local area of both study areas while there has been significant economic and urban growth. However, the
significant growth in civilian employees working on the base in question may have an adverse effect from BRAC.

The significance of the civilian and military population of persons working on the base is approximately one percent of each study area’s total population. The small percentage of the total population working on the bases in each study area suggested that the impact on the economic growth rates from the base may prove to be negligible.

**Jacksonville NAS and Mayport NS Study Areas and Diversity of Industrial Employment: 1980 and 2000**

Industry employment data gathered from the 1980 and 2000 census showed the overall changes in employment profiles with the study regions. The categories of employment were broken down into thirteen employment groups or sectors for each of the three study areas (Tables 2-1, 2-2, 2-3). The employment figures for 1980 and 2000 for the residents of Jax NAS are seen in Table 2.1.

The employment of residents in the Mayport NS study area was compared using the same categories that were used for Jax NAS. The employment populations for 1980 and 2000 for the residents of Mayport NS are shown in Table 2-2. The Mayport study area was similar to Jax NAS because there were a majority of increases in employment in most of the categories; however, the increases were not as significant as they were in the Jax NAS study area. The reduction in military residents was not as significant in the Mayport study area. Over twenty years the reduction was approximately 2,000 residents in the Mayport study area, where Jax NAS saw a reduction of over 10,000 military residents. One other factor that was not considered for the reduction of military personnel was the DoD’s reduction in force since 1986. The reduction in force could be a significant factor, however, according to the Jacksonville
Chamber of Commerce, Jax NAS has over 24,000 employees in 2001 and approximately 6,000 of those employees were civilian employees. The tendency of growth employment from the basic activities in the Jax NAS study area indicated that base closure should not have a negative economic impact according to the study conducted by Hooker and Knetter (2001) and percentage of the study area’s total population employed by the military. However, the DoD may decide that the mission of the base prevents the selection of the base for BRAC. Jax NAS supplies the air support for the carrier group that is stationed at Mayport. More importantly, Mayport is the only port other than Norfolk, Virginia on the eastern seaboard that is home to carrier groups, thus meeting vital criteria for the mission of the Department of the Navy and the defense of the Eastern United States. However, if relocation of the carrier group from Mayport to another base with a similar mission occurs; then it is almost assured that Jax NAS will be closed.

**MacDill AFB and Tampa, Florida**

The same industrial employment variables used in Jacksonville were also used in Tampa. Armed Forces personnel that lived in the study area in 1980 were 10,624 out of a total population of 249,646 and in 2000 were 2,172 out of a total population of 263,580. The number of federal employees that resided in the study area numbered 3,651 in 1980 and 3,091 in 2000. Again, explaining the significant reduction in military personnel in the study area may involve several factors, which are not known, but may have possible causes. The important issue for our study was the significant reduction of military personnel residing in the study areas. Since the reductions of military personnel have occurred, then BRAC should not have as much of a significant impact from the loss of military salaries. Unlike the Jacksonville study areas, the number of federal employees also decline.
Table 2-1. Employment populations for Jacksonville Naval Air Station (Jax NAS) study area

<table>
<thead>
<tr>
<th>Economic Activity</th>
<th>Employment 1980</th>
<th>Employment 2000</th>
<th>Difference</th>
<th>Percentage Difference</th>
<th>Transaction Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural, Forestry, Fishing, and Mining</td>
<td>1,153</td>
<td>569</td>
<td>-584</td>
<td>-50.65</td>
<td>BE</td>
</tr>
<tr>
<td>Construction</td>
<td>6,300</td>
<td>9,827</td>
<td>3,527</td>
<td>55.98</td>
<td>BE</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>10,203</td>
<td>9,222</td>
<td>-981</td>
<td>-9.61</td>
<td>BE</td>
</tr>
<tr>
<td>Transportation, Communications, and Public Utilities</td>
<td>9,098</td>
<td>14,490</td>
<td>5,392</td>
<td>59.27</td>
<td>NBE</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>5,228</td>
<td>5,604</td>
<td>376</td>
<td>7.19</td>
<td>NBE</td>
</tr>
<tr>
<td>Retail Trade</td>
<td>17,233</td>
<td>17,936</td>
<td>703</td>
<td>4.08</td>
<td>NBE</td>
</tr>
<tr>
<td>Financial, Insurance, and Real Estate</td>
<td>10,338</td>
<td>17,725</td>
<td>7,387</td>
<td>71.45</td>
<td>NBE</td>
</tr>
<tr>
<td>Business and Repair Services</td>
<td>5,073</td>
<td>14,695</td>
<td>9,622</td>
<td>189.67</td>
<td>NBE</td>
</tr>
<tr>
<td>Personal Services, Entertainment, and Recreation</td>
<td>5,465</td>
<td>11,265</td>
<td>5,800</td>
<td>106.13</td>
<td>NBE</td>
</tr>
<tr>
<td>Health Services</td>
<td>8,004</td>
<td>15,203</td>
<td>7,199</td>
<td>89.94</td>
<td>NBE</td>
</tr>
<tr>
<td>Education Services</td>
<td>7,383</td>
<td>8,526</td>
<td>1,143</td>
<td>15.48</td>
<td>NBE</td>
</tr>
<tr>
<td>Other</td>
<td>5,097</td>
<td>6,514</td>
<td>1,417</td>
<td>27.80</td>
<td>NBE</td>
</tr>
<tr>
<td>Professional Services</td>
<td>7,444</td>
<td>7,618</td>
<td>174</td>
<td>2.34</td>
<td>NBE</td>
</tr>
<tr>
<td>Public Administration</td>
<td>5,032</td>
<td>10,452</td>
<td>-5,420</td>
<td>-67.50</td>
<td>NBE</td>
</tr>
</tbody>
</table>

a Recreation is both a basic and nonbasic activity. b Includes civilian employees on military base.

According to past studies, especially Hooker and Knetter (2001), if the employment in the area is higher than the regional or state growth rates, then base closures should not have a significant negative impact on the local community. Reductions in the number of military personnel residing in the study areas have been noted, and the changes in federal employees have seen increases in Jacksonville and reductions in Tampa.
### Table 2-2. Employment populations for Mayport NS study area

<table>
<thead>
<tr>
<th>Economic Activity</th>
<th>Employment 1980</th>
<th>Employment 2000</th>
<th>Difference</th>
<th>Percentage Difference</th>
<th>Transaction Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural, Forestry, Fishing, and Mining</td>
<td>937</td>
<td>513</td>
<td>-424</td>
<td>-45.3%</td>
<td>BE</td>
</tr>
<tr>
<td>Construction</td>
<td>5,881</td>
<td>8,982</td>
<td>3,101</td>
<td>52.7%</td>
<td>BE</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>8,326</td>
<td>7,838</td>
<td>-488</td>
<td>-5.9%</td>
<td>BE</td>
</tr>
<tr>
<td>Transportation, Communication, and Public Utilities</td>
<td>8,171</td>
<td>13,487</td>
<td>5,316</td>
<td>65.1%</td>
<td>NBE</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>4,271</td>
<td>4,804</td>
<td>533</td>
<td>12.5%</td>
<td>NBE</td>
</tr>
<tr>
<td>Retail Trade</td>
<td>15,910</td>
<td>15,905</td>
<td>-5</td>
<td>0.0%</td>
<td>NBE</td>
</tr>
<tr>
<td>Financial, Insurance, and Real Estate</td>
<td>8,482</td>
<td>16,730</td>
<td>8,248</td>
<td>97.2%</td>
<td>NBE</td>
</tr>
<tr>
<td>Business and Repair Services</td>
<td>4,205</td>
<td>14,107</td>
<td>9,902</td>
<td>235.5%</td>
<td>NBE</td>
</tr>
<tr>
<td>Personal Services, Entertainment, and Recreation(^a)</td>
<td>4,701</td>
<td>11,281</td>
<td>6,580</td>
<td>140.0%</td>
<td>NBE</td>
</tr>
<tr>
<td>Health Services</td>
<td>5,377</td>
<td>12,689</td>
<td>7,312</td>
<td>136.0%</td>
<td>NBE</td>
</tr>
<tr>
<td>Education Services</td>
<td>6,366</td>
<td>8,342</td>
<td>1,976</td>
<td>31.0%</td>
<td>NBE</td>
</tr>
<tr>
<td>Other Professional Services</td>
<td>4,240</td>
<td>6,126</td>
<td>1,886</td>
<td>44.5%</td>
<td>NBE</td>
</tr>
<tr>
<td>Public Administration(^b)</td>
<td>5,281</td>
<td>6,211</td>
<td>930</td>
<td>17.6%</td>
<td>NBE</td>
</tr>
<tr>
<td>Armed Forces</td>
<td>11,451</td>
<td>9,190</td>
<td>-2,261</td>
<td>-19.75</td>
<td>NBE</td>
</tr>
</tbody>
</table>

\(^a\) Recreation is both a basic and nonbasic activity.  \(^b\) Includes civilian employees on military base.

However, federal employment was only one factor in determining economic impact. Establishing an overall view of employment in the study area must be achieved as previously done in the Jacksonville area. The employment data by sector for 1980 and 2000 for the residents of Tampa are shown in Table 2.3.

The changes in military personnel that reside in the study area are similar to Jacksonville. However, unlike Jacksonville the percentage of the total population in the study area employed at the military-base was significantly smaller (less than 0.5%).
Although the percentage of the total population in the study area of military employees was significantly small, the impact on economic growth rates from base closure should be consistent with the percentage of military employees seen in the total population of the study area (a negative impact of less than 1% on the economic growth rates in the study area).

There was a marked and noticeable difference between employment changes in Jacksonville and those in Tampa. The categories that show an increase in employment did not show a dramatic increase, while there was a substantial decrease in military residents in the area and the decreases in employment in the categories was greater than those categories with increases. Considering the study of Hooker and Knetter, the reduction in employment may enhance the possibility of improvement of industry and employment in those industries with base closure. First, the base in Tampa is an Air Force base and is associated with more extensive resources and skilled employment. Second, the lack of space for growth proximal to MacDill AFB creates possible scenarios for further growth with available space created with base closure. Finally, the location of the base is prime real estate with obvious advantages in terms of transportation and residential growth. Furthermore, the location has several notable qualities: (1) the base is accessible to the CBD by several major roads, (2) it covers about one-fourth to one-third of the lower portion of a peninsula, thus it is accessible to sea transportation, (3) it is home to a large airfield, therefore it is accessible to air transportation, (4) infrastructure is in place to support all of the transportation routes, and (5) prime real estate for residential development. Given the characteristics, MacDill might be construed as a prime candidate for BRAC selection. There is one other factor that the DoD may consider for MacDill
AFB and that is encroachment. According to census data and reports, the Tampa area is one of the fastest growing MSAs in the United States.

Table 2-3. Employment populations for MacDill AFB study area.

<table>
<thead>
<tr>
<th>Economic Activity</th>
<th>Employment 1980</th>
<th>Employment 2000</th>
<th>Difference</th>
<th>Percentage Difference</th>
<th>Transaction Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural, Forestry, Fishing, and Mining</td>
<td>1,825</td>
<td>320</td>
<td>-1,505</td>
<td>-82.5%</td>
<td>BE</td>
</tr>
<tr>
<td>Construction</td>
<td>6,141</td>
<td>7,593</td>
<td>1,452</td>
<td>23.6%</td>
<td>BE</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>13,078</td>
<td>9,607</td>
<td>-3,471</td>
<td>-26.5%</td>
<td>BE</td>
</tr>
<tr>
<td>Transportation, Communications, and Public Utilities</td>
<td>8,675</td>
<td>11,811</td>
<td>3,136</td>
<td>36.1%</td>
<td>NBE</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>6,025</td>
<td>5,291</td>
<td>-734</td>
<td>-12.2%</td>
<td>NBE</td>
</tr>
<tr>
<td>Retail Trade</td>
<td>19,929</td>
<td>14,921</td>
<td>-5,008</td>
<td>-25.1%</td>
<td>NBE</td>
</tr>
<tr>
<td>Financial, Insurance, and Real Estate</td>
<td>9,007</td>
<td>14,981</td>
<td>5,974</td>
<td>66.3%</td>
<td>NBE</td>
</tr>
<tr>
<td>Business and Repair Services</td>
<td>5,975</td>
<td>19,124</td>
<td>13,149</td>
<td>220.1%</td>
<td>NBE</td>
</tr>
<tr>
<td>Personal Services, Entertainment, and Recreation(^a)</td>
<td>6,829</td>
<td>11,780</td>
<td>4,951</td>
<td>72.5%</td>
<td>NBE</td>
</tr>
<tr>
<td>Health Services</td>
<td>7,847</td>
<td>13,009</td>
<td>5,162</td>
<td>65.8%</td>
<td>NBE</td>
</tr>
<tr>
<td>Education Services</td>
<td>7,247</td>
<td>8,281</td>
<td>1,034</td>
<td>14.3%</td>
<td>NBE</td>
</tr>
<tr>
<td>Other Professional Services</td>
<td>5,236</td>
<td>5,827</td>
<td>591</td>
<td>11.3%</td>
<td>NBE</td>
</tr>
<tr>
<td>Public Administration(^b)</td>
<td>4,956</td>
<td>5,087</td>
<td>131</td>
<td>2.6%</td>
<td>NBE</td>
</tr>
<tr>
<td>Armed Forces</td>
<td>10,624</td>
<td>2,172</td>
<td>-8,452</td>
<td>-79.56%</td>
<td>NBE</td>
</tr>
</tbody>
</table>

\(^a\) Recreation is both a basic and nonbasic activity. \(^b\) Includes civilian employees on military base.

The growth of Tampa allows the DoD to consider the possibility of the growth to enhance the economic recovery from base closure and the fact that Tampa’s growth has encroached on the AFB in the last twenty years causes problems because of the air traffic
from the base. The best possible solution for both sides is to consider how to assist in proactive planning in the event MacDill AFB is closed.

**Recovering from Economic Impact Assuming Tampa or Jacksonville Bases Are Selected for BRAC 2005**

Undoubtedly, the local community’s economy will be affected because of BRAC. Proper planning for BRAC should be started immediately to assist the recovery from economic impact because of BRAC. Hardest hit might be the areas juxtaposed to the base (in the short run), if there are economic spillovers that are highly localized. Our study examined the extent to which proximity to a base affects local economic growth rates and the degree to which variability in urban growth is explained by distance to a base (which accounts for the locational accessibility to other prominent nodes within the urban economy).

**Software Used for Our Study**

The dependent and independent variables were taken or created from 1980, 1990, and 2000 US Census Bureau STF3A Files using Microsoft Access and Microsoft Excel programs. The 1980 STF3A Files were distributed in text format and Microsoft Access was used to create the 1980 database of social and economic (independent) variables and dependent variables used for our study. Once the 1980 database was created, the 1980, 1990 and 2000 database files were converted to Excel files for further use. ESRI ArcGIS 8.0 was used to create the distance and accessibility variables required for our study. ArcGIS was also used for the spatial analyses, which is discussed in greater detail in the next chapter. NCSS was the statistics software program used for the stepwise and multiple regression analyses that are discussed further in chapter four.
CHAPTER 3
MAPPING URBAN GROWTH AND CHANGE

Chapter 2 discussed previous research concerning study areas for BRAC and economic impact. Most studies were concerned with a large area surrounding the base, normally an entire city, county, MSA, or region. The previous studies discussed in Chapter 2 did not, however consider the inclusion of the growth patterns between the CBD and base. The previous studies also minimized the factors concerning economic impact. The RAND study utilized factors that addressed population, housing units, vacancy rates, unemployment, labor force, K-12 enrollment, and retail sales. Hooker and Knetter addressed employment and per capita personal income changes. The majority of reports that addressed the issues and factors concerning base closure were centered primarily on population, employment or unemployment, and income and not on spatial patterns or urban spatial structures. The importance of base closure not having a significant negative impact did not explain whether the base had an immediate impact on urban and economic growth patterns in areas with close proximity to a base. Spatial analysis and statistical evidence was needed to support the hypothesis that military bases influence the areas near or contiguous to the base’s perimeter. If there was evidence that the military-base enhances the local economic growth, then the negative impact of base closure may decline with increasing distance from the base.

The purpose of our study was to assess the local impact of military bases. The previous studies hold that local spillover effects were negligible, yet these studies did not
actually include distance variables nor did they consider variability in relation to the locational accessibility of areas to the base and other prominent urban nodes.

Previous research has also been couched from a small-scale perspective, encompassing entire counties, regional areas, or entire MSAs. By contrast, our study focused on intra-MSA variability and incorporated distance measures for a more restricted study area.

Figure 3-1 is an image of the Jacksonville MSA including both study areas. Of greater importance was the impact on the immediate areas that border or lie in close proximity to a military-base.

**Software Used to Create the Images for the Study Areas**

The software package used to create images for our study was ArcGIS 8.0. The data was gathered from several sources. The data used in the image processing of the Jacksonville study areas came from The University of Florida’s Geoplan Center ([http://www.geoplan.ufl.edu/](http://www.geoplan.ufl.edu/)) under the Florida Geographic Data Library (FGDL) and the map data was available with the St. John’s River Water Management District ([http://www.sjrwmd.com/programs/index.html](http://www.sjrwmd.com/programs/index.html)). The data for image processing of the Tampa – MacDill AFB study area also came from the FGDL and land use data came from the Southwest Florida Water Management District ([http://www.swfwmd.state.fl.us/data/gis/libraries/physical_dense/lu95.htm](http://www.swfwmd.state.fl.us/data/gis/libraries/physical_dense/lu95.htm)). Many processes and tools were used to develop the images in ArcGIS (ESRI, 2001). The most commonly used tools were the Spatial Analyst tool, Editor tool, and Xtools Pro. US Census TIGER Line files were used to establish the 1980 census-tract borders by taking the maps included in the 1980 US Census catalogues and editing the 2000 US census-tracts in ArcMap using the editor tool.
The edited census-tracts were then corrected using Xtools Pro to calculate the area in square feet. The census-tracts were the unit of analysis in our study. The dependent
and independent variables were calculated using census-tract data, Florida Geographic Data Library files, and land use files from St. John’s River and Southwest Florida Water Management Districts. Furthermore, the distance variables were calculated by using spatial data (specific land use variables) and the distance between each of the nodes, CBD, and military bases.

Another important aspect of the census-tract’s utilization as the unit of analysis was because of decentralization of each study area. Decentralization was revealed through the creation of multinodal and polycentric patterns within the area. According to Christian and Harper (1982) decentralization of employment and industry was a pattern of urban growth that has been recorded since the 1940s. Christian and Harper described the process of decentralization by explaining the vital role of multiple nodes (multinodal) within a region and their impact on urban economic growth patterns. Christian and Harper basically stated that the outward growth from the CBD led to more prominent roles of the nodes on economic growth patterns within the area. Thus, if holding to Christian and Harper’s work, the Jacksonville and Tampa study areas are decentralized and the CBDs of both areas are reliant on the strength of the nodes within the area for further economic growth. Furthermore, Christian and Harper explained the significance of the development of the multinodal system seen in both the Jacksonville and Tampa study areas. The phenomena of suburban growth after World War II led to outlying suburban centers that interacted with the CBD in a manner that greatly enhanced the economic growth of the region. The examples that were revealed in the Jacksonville study areas were the beach communities in the Mayport NS study area and Orange Park in the Jax NAS study area. Unlike Jacksonville, MacDill AFB is not proximal to the outlying nodes for Tampa, which are St. Petersburg and other major metropolitan areas.
that are connected to the megalopolis of Central Florida. Centers of industry and commerce are also nodes within an urban center’s area of influence described by Christian and Harper (1982) as another aspect of the multinodal system explained. The commercial nodes used in our study played a vital role along with distance variability measures in assessing the military-base’s impact on economic growth. Christian and Harper also explained the importance of polycentric spatial structures’ role in the economic growth of an area. According to the polycentric spatial structures’ roles given by Christian and Harper, commerce and industry are structured along hierarchical lines that influence decision-making functions by directly or indirectly determining new industry or commercial locations, thus influencing the impact of economic growth rates within an area or region. The connectivity of major transportation corridors to the multinodal systems (keeping in mind the roles of polycentric spatial structures, and decentralization of the MSAs) in the census-tracts of the study areas was the determining factor in the decision for census-tracts being the units of analysis. The ArcGIS Spatial Analyst tool was used to calculate distance measures to the base and the CBD from the centroids of census-tracts. The purpose of the spatial analysis was to attempt to find a possible spatial relationship between the base and the surrounding area. Particularly, the commercial interaction between the base, CBD, and key commercial areas within the study area distance factors that may play a role in the economic relationship the base may have with the local community.

Creating Shapefiles for the Study Areas

Since the unit of analysis for the study areas was the census-tract, the first step taken in creating the shapefiles for our study areas was determining the census-tract boundaries for the earliest time period being used in our study. Since our study’s
temporal limits were 1980 to 2000, 1980 was the ideal time for establishing the census-tract boundaries. 1980 census-tract boundaries were created using ArcGIS software programs, 1980 Census-tract maps included in US Census catalogues, and the 2000 US Census TIGER Line files (see Figures 3-2, 3-3, and 3-4).

Establishing Study Area Boundaries Using Shapefiles

The Jacksonville Metropolitan Statistical Area

Jacksonville MSA encompasses several counties in northwest Florida: Duval, Clay, St. John’s, and Nassau Counties. Our study will involve two bases in the Jacksonville MSA: Mayport Naval Station and Jacksonville Naval Air Station. Mayport NS is situated along the southern side of the mouth of the St. John’s River as it empties into the Atlantic Ocean and east of the CBD. The Mayport NS area of study is entirely in Duval County. Jacksonville NAS is on the western side of the St. John’s River before the river turns to the east of the CBD. The Jacksonville NAS study area was situated along the southern border of Duval County and also encompassed the portion of Clay County that contains the Orange Park city limits. The means of creating a localized study area for the two bases was accomplished by using US Census-tracts from the US Census TIGER Line Files. By using census-tracts an area can be created for studying the economic impact between the bases and the CBD. The importance of the CBD is simple: The CBD is the heart of the area’s economic activity. The area between the CBD and the base defined the most active economic corridor.
Figure 3-2. Mayport NS study area census-tract boundaries.

Figure 3-3. MacDill AFB study area census-tract boundaries.
Figure 3-4. Jacksonville NAS study area census-tract boundaries.

Census-tract boundaries in the study areas changed over time with increase in population.

To overcome the problems associated with tract boundary change, the 1980 census-tracts
were used and the data from the 1990 and 2000 census were changed to fit within the boundaries of 1980.

**Mayport NS Study Area**

The Mayport NS study area was unique because there were only two major accessibility routes to the base from the CBD. A large portion of the Jacksonville MSA lies to the north of the base; however, there is only one highway spanning the St. John’s River to the base and it was built during the time of the study and did not open until recently. The other bridges cross the river after most of the major transportation routes enter the CBD (see figure 3-5). The inability to reach the base by road from the northern portion of the Jacksonville MSA limits encroachment and reduces the likelihood of spillover effects. The important factor was that the base may impact only those areas that were accessible between the base and the CBD. Since there were no direct routes to the north of the base, the need to test for economic impact in those areas may be irrelevant. Another important factor concerning urban growth was the lack of railroad activity near the base. Figure 3-5 illustrates the lack of rail accessibility to the beaches and base. Although there is a lack of railroads near the base, there is an abundance of air activity. Craig Field is located in the center of the study area and the military-base has an airfield for the purpose of transferring aircraft from Jax NAS to the carrier group. Future urban growth is possible because of the new highway construction connecting the northern regions to the area near the military-base. However, the possibility of increased growth could be improved with connecting railroads to the industrial areas in the region, especially if the base is considered in future base closures.
Another unique feature of Mayport NS is the site and situation of the base. The military-base is situated at the mouth of the St. John’s River emptying into Atlantic Ocean (Figure 3-5). The site is located on very marshy land and was unsuitable for development when the base was first built. Recent advances in urban development have made development of most of the land surrounding Mayport NS an easy and profitable task. The rapid development of land near Mayport NS has become an encroachment issue with the DoD since BRAC rounds began to take place in 1988. The most important issue with encroachment involves bases with airfields; Mayport NS has an airfield for the purpose of outfitting the carrier group before maneuvers. If urban growth continues at its present rate in this area, the base could become a prime target for future BRAC rounds (See Figure 3-6).
Figure 3-6. Urban and economic growth in Mayport NS study area (1973-2000).

Note: Urban and economic growth combines the commercial and residential land use areas for the given year.

The true indicator of economic impact did not rely on images that have been represented thus far, but in the data that was represented in those figures.

**Jacksonville Naval Air Station (Jax NAS)**

Jax NAS has greater accessibility to the Jacksonville CBD and possibly plays a greater role in economic development in the local area. Jax NAS is accessible to three major highways. Two of those highways (Interstate 95 and US Route 17) lead to the heart of the CBD, the third highway (Interstate 295) leads to Jacksonville’s entire periphery locations (See Figure 3-7). Finally Jax NAS is situated between Jacksonville’s CBD and Orange Park. The Jax NAS location is almost in the center of the Jacksonville MSA (See
Figure 3-1). The location of the base may allow for greater nonbasic activity between the base and the MSA, which was the basis of the studies mentioned in the previous Chapters, and possibly influence the urban and economic growth in the local communities surrounding the base. Of greater importance is the underlying potential of land use if the base is closed. Because of the base’s location, availability of diverse transportation routes, and the potential for industrial, residential, and commercial growth, the opportunity to improve the economic impact after a base closure has greater potential than a base closure in Jacksonville, North Carolina or Manhattan, Kansas. Camp LeJeune Marine Corps Base in Jacksonville, North Carolina and Fort Riley, Kansas, which are located in smaller towns and are the predominant source of income for those communities and play a greater role in the economy. Bases in large MSAs have only a small function in the economic structure with the ability to overcome economic impact from base closure. However, the vital role of the base’s mission to the overall goal of the DoD establishes the DoD’s criteria for base closure.

There has been a tremendous amount of urban growth in Jax NAS study area since 1973. Jacksonville has shown a tremendous amount of growth to the south of the CBD, just as is seen to the east of the CBD. Mayport NS had the advantage of being near three smaller towns on the beaches; Jax NAS also has an advantage of being near a fast growing community to the south: Orange Park (See Figure 3-7). Access to major highways to the south of Jacksonville has assisted the local communities in this area to prosper and grow, in addition the presence of the base and access to the Intercoastal Waterway via the St. John’s River has provided additional means of growth in the area. Unlike the Mayport NS area, tourism is not as much a factor on the local economy.
However, an advantage the Jax NAS study area has over the Mayport NS study area is the access to major 

Figure 3-7. Transportation routes to Jax NAS.
Figure 3-8. Residential growth in the Jax NAS study area (1973-2000).
Figure 3-9. Commercial growth in the Jax NAS study area (1973-2000). Highways, particularly the Interstate system. Interstate 295 connects Jax NAS to most of the MSA’s industrial areas. The importance of the transportation corridors to Jax NAS
could be used as an argument for base closure because of the prime real estate that would be made available if the base is selected for closure (Figures 3-8 and 3-9).

**Tampa-MacDill AFB Study Area**

The Tampa MSA has similar and different attributes with the Jacksonville MSA. The similarities for both consist of four counties, have a coastal boundary, and have a population over one million. The Tampa MSA differs from the Jacksonville MSA because of more CBDs of closer cities, more diverse modes of transportation within the Tampa MSA, and greater spatial diversity. The Jacksonville MSA consists primarily of the city of Jacksonville, whose city limits is the entire county of Duval; and then Clay, Nassau, and St. John’s counties make up the rest of the MSA. After Jacksonville-Duval County, the next most populated county is Clay County with a population of approximately 150,000. The Tampa MSA has a huge economic advantage because of population: the next most populated county after Tampa-Hillsborough County is Pinellas County with a population at approximately 900,000. Jacksonville-Duval County’s population is smaller than the population in Pinellas County. The smallest population by county in the Tampa MSA is Hernando County and the population is approximately the same as Clay County. The extreme difference in population provides more opportunity for urban and economic growth and a better means to overcome the negative economic impact that may result from a base closure. The greatest difference between the two MSAs is the Tampa MSA is the furthest left boundary of a Megalopolis: the Central Florida Corridor, which extends from the Tampa MSA in the west through the Lakeland and Orlando MSAs in the central portion of the megalopolis to Daytona on the Atlantic coast.
The proximity of major metropolitan CBDs to the Tampa CBD is an advantage that Tampa has over many MSAs or urban areas with military bases. The CBDs of Clearwater and St. Petersburg, Florida are not very far from Tampa’s CBD (See Figure 3-10). MacDill AFB is separated from the St. Petersburg CBD (the next closest CBD to the base after the Tampa CBD) by Tampa Bay. The base does have access to St. Petersburg’s CBD by Gandy Bridge, which spans Tampa Bay. However, any economic impact from base closure should affect the Tampa CBD before any affect would occur on the other CBDs in the Tampa MSA. Also, any localized effect of urban and economic growth from the base would not include any areas outside of the study area because of natural boundaries mentioned previously. Income and taxes generated by the base and base personnel predominantly affects the commercial and service activities within the immediate area. Another byproduct of income and property taxes paid by the government and personnel affect the immediate area in the form of income being produced for schools, police, fire, and emergency services, and some medical services. More importantly, urban and economic growth may depend on improvement and expansion of these types of services in the local area. The development of these services do not depend on the presence of the base alone, normally residential growth has more of an impact on the increase or decrease of these services within the local area.

Failing to reject a discernable significance of the base on urban and economic growth in our study area may be difficult. The basic principles of Central Place Theory explained the enormous effects a CBD has on urban and economic growth, especially if the CBD has a strong spatial and economic relationship with outlying nodes. The Tampa CBD has very densely populated cities as nodes whose CBDs are possibly as strong as
Tampa’s. The proximity of MacDill AFB to the Tampa CBD may cause difficulties because of the CBD’s economic strength and past growth trends from the CBD.

Figure 3-10. Tampa MSA.
Figure 3-11 illustrates the distinct advantage MacDill AFB has because of its relative location. The proximity of MacDill Air Force Base to the CBD and the availability of all major modes of transportation may support the spatial relationship the base has with the CBD. The availability of railroads, highways, air transportation and a port may allow some possibility of the base having discernable significant impact of economic growth on the localized area. Economic-growth should exhibit a rather healthy growth trend because of the movement of goods and services within the area between the base and the CBD. A spatial relationship in terms of commercial, industrial, and residential growth should support a positive impact of economic growth from the presence of the base.

**Empirical Approach to Study Areas**

**Dependent Variables and Each Study Area**

The dependent variables created for the three study areas assessed the military-base impact on urban and economic growth at the localized level. Three dependent variables for analyzing economic growth were chosen to test the variability of military-base impact. The tables of dependent variables’ values selected for the regression analyses of our study areas are found in Tables 3-2 through 3-4 with a key explaining the dependent variables created for regression analyses found in Table 3-1. The three dependent variables used in regression analyses were percentage change in commercial land use, percentage change in residential land use, and percentage change in median incomes. Three periods of time were included to warrant a progression of growth in our study areas: 1980 to 1990, 1990 to 2000, and 1980 to 2000.\(^1\) The period of time that produced

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\(^1\) St. John’s River Water Management District 1973 landuse data was employed, the landuse data for 1980 was not available and Southwest Florida Water Management District 1999 landuse data was employed, the landuse data for 2000 was not available.
the best analytical results was 1980 to 2000. The dependent variables were tested in a multiple regression analysis at 95% confidence level.

Figure 3-11. Modes of transportation accessible to MacDill AFB.

Independent Variables and Each Study Area

Several types of independent variables are created for each study area (Appendix A, Table A-1). The first sets of variables are created using socio-economic and demographic data taken from the US Census Bureau between the years 1980 and 2000.
Another set of variables is created from land use data (commercial and residential areas) taken from the St. John’s River and Southwest Florida Water Management Districts. Variables representing percentage changes between 1980 and 2000) are created from the socio-economic and demographic variables and land use variables.

Table 3-1. Key to dependent variables.

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<tr>
<th>Name</th>
<th>Database ID</th>
<th>Description</th>
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<tr>
<td>Percentage Change in Commercial Land use Area</td>
<td>PCTΔCMR80_CMRR99</td>
<td>The percentage change of area by square feet of commercial land use, the numbers following identify the total commercial area for that year.</td>
</tr>
<tr>
<td>Percentage Change in Residential Land use Area</td>
<td>PCTΔRES80_ RES99</td>
<td>The percentage change of area by square feet of residential land use, the numbers following identify the total residential area for that year.</td>
</tr>
<tr>
<td>Percentage Change in Median Household Income</td>
<td>PCTΔMD_HHLD_INC</td>
<td>The percentage change calculated for the median household income for the given years.</td>
</tr>
</tbody>
</table>

Distance variables were also created measuring straight-line and road distances between the military-base, nodes, and the CBD. Variables for accessibility indices were created from straight-line and road distances between the nodes, CBD, with distances to the bases, as well as accessibility indices between the nodes and CBD without distances to the bases. The majority of independent variables were similar for each study area, specifically the socio-economic, demographic, land use, and percentage change variables. However, the accessibility and distance variables were significantly different for each study area. The differences in the number of independent variables per study area were because of the varying amount of distance measures between nodes, the CBDs, and bases. The Jacksonville study areas had more independent variables because there were more nodes in the study areas.
Choropleth maps suggested the possibility of military-base impact by observing the percentage of change of the dependent variable and the proximity of the base. However, choropleth maps did not discern the impact of a base on the economic growth rates for the localized area.

**Results of Choropleth Maps for the Jax NAS Study Area**

The percentage change in commercial area of the Jax NAS study area illustrated the possible impact that a nearby nodal CBD may have on urban and economic growth of the study area (Figure 3-12). The census-tract immediately below the military-base is the Orange Park CBD; a tremendous amount of growth occurred in the census-tracts surrounding the Orange Park CBD and the military-base. Although the nodal CBD possibly influences the factors for growth in the localized area, there is a possibility that the military-base may also serve as an impacting force on the urban and economic growth of the localized area. Also of importance is the growth occurring on the opposite side of the St. John’s River from the military-base.

The major highways (I-95 and US 1) that travel from the south of the CBD can be redirected to the military-base by connecting with I-295, this provides a transportation corridor from the base to the CBD via a different route and thus may explain the growth from the CBD. There is a great deal of growth seen, but major highways lead to another nodal CBD in the MSA (St. Augustine), which is approximately 30 miles further south. The certainty seen in figure 3-12 was substantial commercial growth between 1973 and 2000; however, commercial growth was only one of the variables involved to explain possible economic growth. Figure 3-13 illustrated the residential changes in the Jax NAS study area.
The significance seen in the figure was similar to the commercial change seen for the same areas. Several assumptions can be made for the significance in change of the residential area. First, the availability of open land for development as the CBD’s urban growth expanded was more prominent to the south and west of the CBD between 1973 and 2000.

Second, highly accessible transportation routes leading from the CBD were found in the localized areas to the south and lead to major nodal CBDs (Orange Park and St. Augustine). Finally, many areas near military bases were normally reserved for planning because of the airfields located on such bases; air traffic tended to act as a negative factor on land values, especially residential areas. The residential growth in the study area illustrated a strong possibility that the base may have some impact on the urban and economic growth of the localized area.

The percentage change in median household income showed some greater growth immediately south of the Orange Park CBD. The growth rates for median household income were apparent in figure 3-14. Unlike the observations for the land use changes, the greatest growth was between the base and the CBD. Possible assumptions were similar to those given for land use changes. Another indicator may be seen in real estate values over the time periods studied or the area may be more attractive to one-person households.

**Results of Choropleth Maps for the Mayport NS Study Area**

The percentage change in commercial area for the Mayport NS between 1973 and 2000 illustrated an interesting occurrence between the CBD and the three beach CBDs. Figure 3-15 showed the greatest amount of change in commercial area occurred in census-tracts proximal to the beaches and base, particularly census-tracts 143.01, 143.02,
and 146. Thus reflecting a great amount of change occurring between the CBD, major
nodes and the base. Overall, the greatest amount of growth occurred near the three beach
nodes to the south of Mayport NS. The base may have some influence in the growth of
the area because of its location; however, the growth tends to follow the transportation
corridors in the study area.

Figure 3-15 illustrated growth along the transportation corridors, which follow the
principles of Central Place Theory and Economic Base Theory in the spatial relationship
of the growth compared to the proximity of the CBD. The figure also illustrated a return
in growth toward the CBD possibly because of interaction between the CBD and the
beach nodes and base.

The percentage of change in the residential area between 1973 and 2000 was quite
different than the changes seen in the commercial area in the Mayport NS study area.
Figure 3-16 illustrated the greater changes in residential growth occurred closer to the
beach nodes. The majority of census-tracts near the CBD actually experienced a decline
in residential area, particularly those census-tracts that underwent or experienced a
change in commercial area. The explanation could be because of the development of low-
lying land in the largest census-tract in our study area (tract 143.02). The development of
newer techniques to reclaim land that is normally unsuitable for building such as swamp
and marshland has allowed the further development of the areas closer to the base and
beaches. The expansion of residential growth in those areas may have allowed the
expansion of residential area in the outer areas of our study area and making land in the
CBD readily available for commercial development.

Figure 3-17 illustrated the percentage of median household income having a similar
pattern of growth that was seen with percentage change of residential area. The CBD and
other prominent urban nodes showed strong trends in growth. Of great interest was the strongest trend in growth that was observed in the areas closest to the base.

**Results of Choropleth Maps for the MacDill AFB Study Area**

The first aspect to remember concerning the differences between the two bases in Jacksonville and MacDill AFB in Tampa is MacDill AFB does not lie near a nodal CBD. MacDill AFB is situated approximately 6 miles south of the CBD and is separated from the remainder of the MSA because of its location on the southern tip of the Interbay Peninsula. The spatial relationship to the CBD leads to the assumption that any growth in the study area will be influenced primarily by the CBD. However, the base may still have an impact on the economic growth in the localized area because of several factors: proximity to the CBD, isolation of the base from most of the MSA because of its location, the accessibility of diverse modes of transportation that are located near the base, and the small amount of land available for commercial, residential, and industrial development. Of greater importance is the available land resulting from the closure of the base could open up more opportunities for economic growth because of the other factors. Before the base can be selected for closure, the impact the base has on the area should be assessed even if the DoD and the BRAC commission select the base for closure. If a significantly substantial impact can be proven, the argument against base closure has stronger support.

The census-tracts representing the greatest percentage change in commercial area are close to the CBD (figure 3-18). The majority of commercial growth is located in tracts surrounding the CBD. Of greater importance is the number of census-tracts that show a negative value in commercial growth. Five of the eight census-tracts immediately to the north of the base show negative growth and three of the five have substantial
negative growth. An assumption can be made that the base may have no impact or a possible negative impact on the economic growth of the localized area. Several factors may explain the negative growth within the immediate area; such as, gentrification, creating available land for rezoning and development, and increases in real estate values.

Only the three census-tracts reflecting substantial negative commercial growth (figure 3-18) have a positive value in residential growth (figure 3-19). The remainder of the census-tracts may have an extremely small amount of positive residential growth (maximum value of 0.02), but mostly negative growth values are represented. The values seen in residential and commercial growth support the earlier assumptions concerning the limited amount of space available for any growth in the study area.

The greatest amount of percentage change seen in median household income is along a major transportation corridor between the CBD and the base (Figure 3-20). Although there is a substantial amount of growth observed in the census-tracts, the impact provided by the base may be in conjunction with impacts because of the CBD.

**Review of Choropleth Maps Results**

The choropleth maps suggested that the bases in the Jacksonville study areas may have discernible impact on the economic-growth of the localized areas. Although the spatial analyses illustrate the possibility of discernible impact from the base on the economic-growth of the localized area, the nodal CBDs may actually have more of an impact on the economic growth than the bases. However, the bases may increase the effects of the nodal CBDs’ impact on economic-growth of the localized area.

Unlike the study areas in the Jacksonville MSA, the spatial analyses for the Tampa study area suggested that the CBD is the predominant force in the economic growth of the study area.
Table 3-2. Jax NAS dependent variables.

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Table 3-3. Mayport NS dependent variables.

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Table 3-4. MacDill AFB dependent variables.

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Figure 3-12. Commercial area percentage change 1973-2000 for Jax NAS study area.

Note: 1973 land use data used since 1980 land use data not available.
Figure 3-13. Residential area percentage change 1973-2000 for Jax NAS study area.
Figure 3-14. Median household income percentage change 1980-2000 for Jax NAS study area.
Figure 3-15. Commercial area percentage change 1980-2000 for Mayport NS study area.

Note: 1973 land use data used since 1980 land use data not available.
Figure 3-16. Residential area percentage change 1973-2000 for Mayport NS study area.

Note: 1973 land use data used since 1980 land use data not available.
Figure 3-17. Median household income percentage change 1980-2000 for Mayport NS study area.
Figure 3-18. Commercial area percentage change 1980-1999 in the Tampa study area.

Note: 1999 land use data used since 2000 land use data not available.
Figure 3-19. Residential area percentage change 1980-1999 in the Tampa study area.

Note: 1999 land use data used since 2000 land use data not available.
Figure 3-20. Median household income percentage change 1980-2000 of the Tampa study area.
CHAPTER 4
REGRESSION ANALYSES OF THE STUDY AREAS

Multiple regression analyses were conducted using NCSS software to model variations in percentage change of median household income, commercial area and residential area from 1980 to 2000 for each of the three study areas. The units of analysis chosen for our study were census-tracts of the study areas. The socio-economic and demographic data used for the dependent and independent variables were taken from STF3 files of the US Census Bureau. Distance and accessibility index variables were created from the Florida Geographic Data Library (FGDL) files. Additionally, several accessibility indices were created to account for variations in locational of various census-tracts to selected commercial nodes, including the Central Business District (CBD), retail hubs, and the military-base. Moreover, straight-line and road distances were calculated between both these nodes to the center points of each census-tract. Distance variables were also included to access the impact of individual nodes on growth rates in the selected study areas.

A forward stepwise regression was employed to determine the variables that are relevant in explaining percentage change in the dependent variables. The variable criterion was set at the 95% confidence level. A total of 8 multiple regression models were tested to explain variation in growth rates by census-tract for the time period examined.

Note that the stepwise regression for percentage change in commercial area in the Tampa study area did not select any independent variables, thus a multiple regression
analysis of the study area could not be conducted. The 8 remaining multiple regression models will be discussed in turn.

The key components examined in the multiple regression analyses were the regression (or beta) coefficients, the t-Values, and identified transaction types defined by Economic Base Theory concepts (the variables had one or more of the following functions: basic function, nonbasic function, and/or a transfer of income function). The sign of the beta coefficient determined the nature of the independent variable’s impact on the dependent variable. The greater the t-Value associated with an independent variable, the greater impact on the dependent variable (growth rate). The identifier listed in the transaction type column explains the independent variable’s role on the study area’s economic base. The adjusted R-square was an indicator of the model’s goodness of fit. Finally, normality tests and plots of error terms were examined to determine if the error structure was normally distributed, and whether there were any random outliers. If outliers were found, they were removed and the models re-ran without them. However, if the new results caused greater difficulties the original model was retained and the outlier highlighted in the discussion section.

**Jacksonville NAS Study Area Regression Analyses Results**

Three multiple regression analyses were conducted for the Jax NAS study area, one for each of the dependent variables. Each model will be briefly discussed.

The stepwise regression results for the dependent variable percentage change in commercial area selected 10 independent variables with beta coefficients that were significantly different from zero. Table 4-1 lists the results of the multiple regression analysis for percentage change in commercial area. The initial regression analyses revealed an outlier in census-tract 304, which is adjacent to the Orange Park commercial
node in census-tract 306. Before the removal of the outlier, the model failed to meet the normality assumptions. On removal of the outlier the model met the standard criterion for normality.

The estimated coefficients for selected independent variables rejected the hypothesis that the beta values were not statistically different from zero at the 95% confidence level. An examination of the results revealed that locational accessibility variables and distance variables did not play a role in explaining variation in commercial growth rates as these variables were not selected. Thus, the results of the regression analysis explained the role of certain demographic variables on the impact of commercial growth rates. The positive variables suggested that an increase in the demographic variability resulted in a decrease in commercial growth in our study area. An opposite effect was observed with negative variables, which suggested a decrease in demographic variability result in an increase in commercial growth for the same study area. Three independent variables with positive beta coefficients and very high t-Values (greater than 4.2) reflected an impact on commercial growth rates through nonbasic economic activity and/or transfer income (Table 4-1). The positive beta coefficients suggested a positive association between various demographic variables and commercial growth rates. However, two independent variables had negative beta coefficients with high negative t-Values (-3.7) suggesting a negative association on commercial growth rates. The negative beta coefficients suggested decrease in commercial growth rates as either the number of persons born out of state, service employment, or vacant housing increases.

The adjusted R-squared value was high, suggesting that the nine variables selected accounted for approximately 83% of the variation in commercial growth rates by census-tracts. The three normality tests were accepted. The scatterplot revealed a random pattern
between residuals and predicted values. The probability plot also revealed the remaining variables lie within range of normality.

The regression model revealed no discernible evidence of the military-base having a significant impact on the commercial growth rates in our study area for the period examined. If the base had any impact on the commercial growth rates in our study area, the impact was negligible or very minor.

The stepwise regression for the dependent variable percentage change in median household income for the Jax NAS study area selected five independent variables for the multiple regression analysis. Of greater interest, a distance variable (Straight-Line Distance to Commercial Area in Census-tract 167.01) was selected for this model indicating that a possible relationship in percentage change for the dependent variable and distance in the localized area may be present. However, extreme outliers were present in the model and after the removal of the outliers (associated with census-tracts 7, 5, 11, and 12) the model was left with three variables and the distance variable was removed (Table 4-2). Interestingly, the outliers were in census-tracts that are proximal to the CBD (census-tracts 11 and 12 are part of the CBD).

The multiple regression model produced relatively weak results in comparison to the model reexamined earlier with an adjusted R-Square value that falls below 0.30. An interesting variable selected was the commercial area in 2000. The negative beta coefficient suggested the decrease in commercial area had a positive impact on the percentage change of median household income growth rates. The positive beta associated with median gross rent between 1980 and 2000 suggested a positive impact on the growth of median household income during time period examined.
Similar to the regression results for the percentage change in commercial area, the normality assumption was verified. Unlike the previous regression model discussed for our study area, the three normality tests were not accepted until after the removal of the outliers. Once again, this regression model failed to uncover a discernible impact of the base on the economic growth rates as neither the distance to base variable nor the locational accessibility variables were selected by the stepwise procedure.

The stepwise regression results for the percentage change in residential area for the Jax NAS study area selected 21 independent variables including the intercept. Of greater importance was the selection of an accessibility index variable and a distance variable. The initial regression results identified five outliers (census-tracts 8, 124, 167.02, 304, and 309). Interestingly, two of the outliers were proximal to the CBD (8 and 124); two were proximal to the Orange Park commercial node (304 and 309); and one was proximal to the military-base (167.02).

The multiple regression results (Table 4-3) revealed that the distance variable had a positive beta coefficient suggesting that as distance from the CBD increases residential growth rates increase. Thus, the residential growth rates tend to be lower near the CBD. Also, the t-Value (20.0136) was substantially higher than the t-critical value (|2.06|), which suggested that the distance variable had a substantial role in the positive impact on residential growth rates. The accessibility index variable also had a positive beta coefficient, but the t-value was substantially smaller than the distance t-Value (4.6755). The inclusion of the accessibility variable suggested that there was a discernible impact of the prominent nodes (including the base) on the economic growth within our study area. Specifically, as locational accessibility to the prominent nodes increased so did the residential growth rate. Note that the calculation of the locational accessibility index
included the location of the base, suggesting that the base was an important node in explaining residential growth rates. The model revealed a large F-ratio and a better overall goodness of fit (with an adjusted R-Square of 0.992), with a low root mean square error.

The normality tests indicated that the error terms were normal. Overall, the results supported the hypothesis that the base had a statistically significant impact on the residential growth rates, although its’ individual impact was unknown given that the locational accessibility bundles the impact of all prominent nodes in the study region. While it was shown that the base and the CBD had a significant impact on the residential growth rates, the result did not imply that the base was the most influential node in our study region. Furthermore, in all three cases examined distance to the base, as a stand-alone variable (distance to the base) did not test to be significant. Only when distances to all prominent nodes were considered in a bundled accessibility index did it prove significant. In short, the base played a role in explaining variation in residential growth rates, however, its’ overall impact was non-separable from the other prominent nodes.

**Mayport NS Study Area Regression Analyses Results**

Three multiple regression models were run for the Mayport Naval Station study area. The same three dependent variables that were analyzed for the Jax NAS study area were also used for the Mayport NS study area.

The stepwise regression conducted for percentage change in commercial area for the Mayport NS study area selected four independent variables including the intercept (Table 4-4). The initial regression results revealed two outliers (associated with census tracts 149.01 and 149.02), however, the removal of both outliers created severe complications with the ongoing model’s results, particularly continual removal of
variables until a model was non-existent. The removal of the residual outlier (149.01) did not complicate the model’s ability to meet goodness of fit criteria and did not hinder the acceptance of the assumptions of normality (the scatterplot still shows the predicted outlier in census-tract 149.02). The model results suggested that the base did not have a discernible impact on the commercial growth rates in the Mayport area. Unlike the previous model discussed (Table 4-3), there were no distance or locational accessibility variables selected, implying that the location of the base offers no explanatory power in accounting for variation in commercial growth rates. However, the variables that were selected suggested that a positive impact was observed because of two demographic variables with positive beta values and significant t-Values. The results suggested that population and residential growth were the factors which account for commercial growth in the area.

The stepwise regression for percentage change in median household income produced seven significant independent variables (Table 4-5). Unlike the previous regression models, the multiple regression analysis for percentage change in median household income did not reveal extreme outliers. This regression model included a distance variable. Although the distance variable had both a positive beta coefficient and significant t-Value (6.4893), the distance variable was not directly associated with the military-base, but represents the distance of census-tracts to a specified commercial node in census-tract 143.01. Also, census-tract 143.01 was adjacent to the census-tracts containing both Jacksonville Beach and Neptune Beach (census-tracts 140 and 141). Thus, the beta coefficient indicated that as distance increases from the commercial node an increase could be observed in median household income. More importantly, the results
revealed that the location of the military-base did not have a discernible impact on the growth rate of median household income.

Other implications were seen in the model’s remaining demographic variables. The percentage change in population between 1980 and 2000, the dependent ratio in 2000, and the percentage change in persons residing in the same county between 1980 and 2000 had high negative t-Values. The beta coefficients for these variables suggested the decrease in each variable resulted in an increase in the growth rates of median household income. Whereas the betas for the percentage change in self employed persons between 1980 and 2000 and the percentage change in median gross rent between 1980 and 2000 suggested the increase in each variable resulted in a decrease in the growth rates of median household income. However, the implications seen in these variables did not reveal any evidence that would suggest an impact on the growth rates of median household income from the base. Overall the model was very good, with an adjusted R-Square of approximately 0.84.

The stepwise regression for percentage change in residential area selected 10 independent variables including the intercept. Only one distance variable was selected (Table 4-6). The initial regression results revealed two outliers (census-tract 19 and 143.02) in the model. After the removal of the two outliers the model kept the distance variable for census-tract 143.02. However, the most significant variables observed in the model were employment variables (educational services in 2000 and percentage change in employment in the production, repair, and labor industries between 1980 and 2000). Of great importance was the location of the census-tract 143.02: proximal to the base and beach. The positive coefficients suggested that as distance increases from the base and beach, there was a decrease in percentage change of residential area growth rates (Figure
The employment variables suggested that increases in those industries had a significantly positive impact on the residential growth rates. The model revealed that a significantly positive impact had occurred on the residential growth rates, but the base played a small and limited role with the commercial node in census-tract 143.02. Furthermore, the residential pattern of growth observed near the base and CBD may be related to other factors such as real estate values near the beach areas and CBD. Thus, there was virtually no statistical evidence that the base had an impact on the residential growth rates during the period in question. Note that the model met the assumption of normality and independence of the error terms. The results for the Mayport NS study area suggested the base has a negligible impact on the economic growth in the study area.

**MacDill AFB Study Area Regression Analyses Results**

Only two multiple regression models were analyzed for the Tampa study area. As stated earlier, the stepwise regression for the dependent variable percentage change in commercial area did not select any independent variables; therefore, the model was not considered.

The stepwise regression for percentage change in median household income selected 20 independent variables including the intercept. Of great importance was the selection of the accessibility variable (Table 4-7). The initial regression results revealed an extreme outlier in census-tract 51 located in the heart of the Tampa CBD. After the outlier was removed and the stepwise regression conducted again, only 12 independent variables were selected. However, the accessibility variable remained in the model.

The accessibility variable (without the Air Force Base) suggested once again that the base did not have a significant impact on commercial growth rates. The CBD and other commercial nodes did have significance in the impact on commercial growth in the
area. The beta coefficient associated with this variable suggested that the variable had a positive impact on the median household income growth. That is, increasing accessibility to prominent nodes was associated with higher growth rates. Moreover, since the variable excluded the base, the impact was predominantly the result of accessibility through transportation corridors between the CBD, commercial nodes, and the census-tracts. Thus, the positive coefficient suggested that as locational accessibility of census-tracts to the CBD and commercial nodes increased, so did median household income. However, the base may have had a minor role in the impact from the CBD because of the proximity of the base to the CBD. Also, the increase in distance from the CBD and base should reveal a decrease in growth (Figure 3-20), and lesser growth on the fringes of our study area. The difference may be because of the other major commercial nodes in the region, such as the St. Petersburg and Clearwater CBDs. Other independent variables selected with significant positive beta coefficients were Persons Employed in the Wholesale Trade Industry in 1990, Persons Employed by the Federal Government in 2000, Percentage Change in Median Gross Rent Between 1980 and 2000 and Percentage Change in Mean Housing Values Between 1980 and 2000. The demographic variable for federal employees suggested that the base may have had a contributing role to growth rates in the area. Negative beta coefficients were associated with the commercial area variable and renter occupied housing. The most significant negative beta coefficient observed was the Percentage Change of Dependent Ratio Between 1980 and 2000 variable. Not only was this variable the most significant negative variable, it had the largest t-Value in the model (-10.7063). The variable suggested that the “dependency ratios” had a negative impact on the percentage change of median household income growth rates. The negative beta coefficient for commercial area also suggested a negative impact on the median
household income growth rates. Furthermore an examination of the transaction types of variable producing negative coefficients suggested a trend in impact of basic economic activity. The model results revealed that the base did not have a discernible impact on the median household income growth rates. The model indicated a strong goodness of fit with an adjusted R-square value above 0.84. The assumption of normality and independence of error were also accepted.

Once again, there was no evidence to support the contention that proximity to the base played a significant role in explaining variation in percentage change in median household income. The proximity of the base to the CBD, however, made it difficult to assess its underlying impact or importance.

The stepwise regression for the dependent variable percentage change in residential area selected 15 independent variables including the intercept. Unlike the previous model, both a distance and accessibility index variable were not selected, and the one predicted outlier (census-tract 51) eventually caused more problems with its removal. However, the outlier can be explained because of its location in the heart of the CBD. Once again the distance between the base and the CBD was minimal and could account for the non-selection of these variables. The limited amount of land for land use change between the base and CBD could also account for the non-selection of these variables. Although distance and accessibility index variables were not selected, travel time to work variables were selected (Table 4-8).

Of great significance was the very high positive beta coefficient observed for the Percentage Change of Persons Residing in the Same House Between 1975 and 1995. Furthermore, the t-Value was the highest amongst the positive demographic variables. The variable revealed positive impact on residential growth rates within the localized
area. Three other variables also supported a positive impact on residential growth rates; *Persons with a Household Income of $50,000 or More in 1980*, *Percentage Change in Persons with a Household Income of $50,000 or More Between 1980 and 2000*, and *Persons Paying Gross Rent of $500.00 or More in 1990*. Several indicators could suggest the positive impact on the residential growth rates within the study area. The first indicator was the gentrification of the CBD may have forced an increase in the cost of rent as well as an increase in real estate values. The second indicator was the proximity of the base to the CBD. Finally, the third indicator was the possibility of high turnover with military members and their families transferring in and out of the area. Finally, as mentioned before, the limited amount of space prevented large increases in commercial and industrial growth. Therefore, any new developments in residential area would occur with the redevelopment of existing residential areas. Thus, an increase in relative costs for new housing or rent may occur.

Further explanation for this occurrence was seen in the negative beta coefficients. Particularly, the variable explaining median owner’s cost. Median owner’s cost had the highest negative t-Value (-11.2738) and suggested that the upkeep cost of housing had a negative impact on residential growth rates. An assumption can be made that the redevelopment of some areas had forced current housing to “keep up with the Joneses” and thus the explanation, the subsequent increase in the costs of housing maintenance. However, there were more coefficients with a negative value than variables with a positive value. A review of the spatial analysis for percentage change in residential area revealed that the trend in growth was observed along a transportation corridor between the base and the CBD. The majority of census-tracts that were located on the Interbay Peninsula revealed very little or no growth. More significantly, the model revealed that
the base did not appear to have any impact on the residential growth rates in the area. Overall, the model was better than the median household income model according to the goodness of fit criteria. Most of which was explained by economic and demographic variables.

Once again, the regression results suggest that the base has no discernible impact on percentage change in median household income. Also, the model that includes an accessibility variable excludes the base. However, the spatial relationship between the base and the CBD (i.e., their proximity) may explain why the base is insignificant in terms of accounting for variations in residential growth rates within the study region.

Table 4-1. Jacksonville NAS study area regression results for percentage change in commercial area between 1973 and 2000.

<table>
<thead>
<tr>
<th>Regression Equation Section</th>
<th>Independent Variable</th>
<th>Beta Coefficient.</th>
<th>T-Value (Ho: B=0)</th>
<th>Prob. Level</th>
<th>Decision (5%)</th>
<th>Transaction Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td></td>
<td>-255.7974</td>
<td>-2.4514</td>
<td>0.018694</td>
<td>Reject Ho</td>
<td>n/a</td>
</tr>
<tr>
<td>Persons Born Out of the State in 1990</td>
<td>-0.1065</td>
<td>-3.9158</td>
<td>0.000342</td>
<td>Reject Ho</td>
<td></td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Persons Residing in the Same County in 1975</td>
<td>0.1978</td>
<td>3.3902</td>
<td>0.001582</td>
<td>Reject Ho</td>
<td></td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Percentage Change in Persons Residing in the Same County Between 1975 and 1995</td>
<td>2.3996</td>
<td>5.6203</td>
<td>0.000002</td>
<td>Reject Ho</td>
<td></td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Persons Using Public Transportation in 1980</td>
<td>0.772</td>
<td>4.1696</td>
<td>0.000159</td>
<td>Reject Ho</td>
<td></td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Persons Employed in the Agricultural, Fishing, Forestry, and Mining Industries in 2000</td>
<td>5.9254</td>
<td>2.5746</td>
<td>0.013842</td>
<td>Reject Ho</td>
<td></td>
<td>BE, NBE, &amp; Transfer Income</td>
</tr>
</tbody>
</table>
Table 4-1. Continued

<table>
<thead>
<tr>
<th>Independent Variable.</th>
<th>Beta Coefficient.</th>
<th>T-Value (Ho: B=0)</th>
<th>Prob. Level</th>
<th>Decision (5%)</th>
<th>Transaction Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persons Employed in the Services, Entertainment, and Recreation Industries in 2000</td>
<td>-1.3965</td>
<td>-3.7934</td>
<td>0.000493</td>
<td>Reject Ho</td>
<td>BE, NBE, &amp; Transfer Income</td>
</tr>
<tr>
<td>Vacant Housing in 1980</td>
<td>-0.8899</td>
<td>-2.8986</td>
<td>0.006057</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Persons Paying Gross Rent of $500 Per Month or More in 1990</td>
<td>1.3535</td>
<td>10.3618</td>
<td>0.000001</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Median Gross Rent in 2000</td>
<td>0.643</td>
<td>3.1518</td>
<td>0.003071</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
</tbody>
</table>

T-Critical \( |2.021075| \)

### Analysis of Variance Section

<table>
<thead>
<tr>
<th>Source</th>
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<th>RSS</th>
<th>Mean Square</th>
<th>F-Ratio</th>
<th>Prob. Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1</td>
<td>2158367.4898</td>
<td>2158367.4898</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>9</td>
<td>5585325.054</td>
<td>620591.6727</td>
<td>28.3795</td>
<td>0.000001</td>
</tr>
<tr>
<td>Error</td>
<td>40</td>
<td>874703.3843</td>
<td>21867.5846</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Root Mean Square Error = 147.876923847963
R-Squared = 0.8646
Coefficient of Variation = 0.711742196868125
Adjusted R-Squared = 0.8341

### Normality Tests Section

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Value</th>
<th>Probability</th>
<th>Decision (5%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skewness</td>
<td>0.7307</td>
<td>0.464951</td>
<td>Accepted</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-0.8299</td>
<td>0.406605</td>
<td>Accepted</td>
</tr>
<tr>
<td>Omnibus</td>
<td>1.2227</td>
<td>0.542630</td>
<td>Accepted</td>
</tr>
</tbody>
</table>

### Plots Section

- **Histogram**
- **Probability Plot**
- **Scatterplot**

#### Note:
1973 land use data used since 1980 land use data not available. The acronyms in the regression equation section are: BE = Basic Economic Activity and NBE = Nonbasic Economic Activity.
Table 4-2. Jacksonville NAS study area regression results for percentage change in median household income between 1980 and 2000.

<table>
<thead>
<tr>
<th>Regression Equation Section</th>
<th>Independent Variable.</th>
<th>Beta Coefficient</th>
<th>T-Value (Ho: B=0)</th>
<th>Prob. Level</th>
<th>Decision (5%)</th>
<th>Transaction Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intercept</td>
<td>110.197</td>
<td>7.9473</td>
<td>0.000001</td>
<td>Reject Ho</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Percentage Change in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NBE &amp; Transfer</td>
</tr>
<tr>
<td></td>
<td>Median Gross Rent</td>
<td>0.3091</td>
<td>3.1782</td>
<td>0.002711</td>
<td>Reject Ho</td>
<td>Income</td>
</tr>
<tr>
<td></td>
<td>between 1980 and 2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BE, NBE &amp; Transfer Income</td>
</tr>
<tr>
<td></td>
<td>Commercial Area in</td>
<td>-1.64E-06</td>
<td>-2.6915</td>
<td>0.010019</td>
<td>Reject Ho</td>
<td>Income</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| T-Critical                  | 2.015368              |                  |                  |             |               |                 |

<table>
<thead>
<tr>
<th>Analysis of Variance Section</th>
<th>Source</th>
<th>DF</th>
<th>RSS</th>
<th>Mean Square</th>
<th>F-Ratio</th>
<th>Prob Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intercept</td>
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<td>903660.7186</td>
<td>903660.7186</td>
<td>9.3755</td>
<td>0.000406</td>
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<tr>
<td></td>
<td>Model</td>
<td>2</td>
<td>14711.6239</td>
<td>7355.8119</td>
<td>0.076346</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Error</td>
<td>44</td>
<td>34521.2664</td>
<td>784.5742</td>
<td>0.158480</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total (Adjusted)</td>
<td>46</td>
<td>49232.8903</td>
<td>1070.2802</td>
<td></td>
<td></td>
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</tbody>
</table>

- Root Mean Square Error = 28.0102523574346
- R-Squared = 0.2988
- Adjusted R-Squared = 0.2669

<table>
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<tr>
<th>Normality Tests Section</th>
<th>Assumption</th>
<th>Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Skewness</td>
<td>-0.7370</td>
<td>0.461099</td>
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<tr>
<td></td>
<td>Kurtosis</td>
<td>-1.7723</td>
<td>0.076346</td>
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<tr>
<td></td>
<td>Omnibus</td>
<td>3.6843</td>
<td>0.158480</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plots Section</th>
<th>Histogram</th>
<th>Probability</th>
<th>Scatterplot</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Histogram of Residuals of PCTDMD_HHLD_INC_80</td>
<td>Probability Plot of Residuals of PCTDMD_HHLD_I</td>
<td>Residuals vs Predicted</td>
</tr>
<tr>
<td>Independent Variable</td>
<td>Beta Coefficient</td>
<td>T-Value (Ho: B=0)</td>
<td>Prob. Level</td>
</tr>
<tr>
<td>-----------------------------------------------------------</td>
<td>------------------</td>
<td>-------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Intercept</td>
<td>-91.3334</td>
<td>-18.4307</td>
<td>0.000001</td>
</tr>
<tr>
<td>Persons Under the Age of 16 in 2000</td>
<td>-7.61E-03</td>
<td>-3.8322</td>
<td>0.000761</td>
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<tr>
<td>Percentage Change in Persons Residing in the Same House Between 1975 and 1995</td>
<td>-0.0206</td>
<td>-3.7323</td>
<td>0.000982</td>
</tr>
<tr>
<td>Persons Working at Home in 1980</td>
<td>0.4728</td>
<td>7.4418</td>
<td>0.000001</td>
</tr>
<tr>
<td>Persons Employed in Retail Trade Industry in 2000</td>
<td>0.103</td>
<td>8.9234</td>
<td>0.000001</td>
</tr>
<tr>
<td>Persons Employed in Public Administration Industry in 1980</td>
<td>-0.1695</td>
<td>-9.0124</td>
<td>0.000001</td>
</tr>
<tr>
<td>Percentage Change in Persons Employed in the Public Administration Industry Between 1980 and 2000</td>
<td>7.84E-02</td>
<td>6.1238</td>
<td>0.000002</td>
</tr>
<tr>
<td>Percentage Change in Self Employed Persons Between 1980 and 2000</td>
<td>0.22</td>
<td>26.7689</td>
<td>0.000001</td>
</tr>
<tr>
<td>Percentage Change in Median Household Income Between 1980 and 2000</td>
<td>-8.41E-02</td>
<td>-3.7235</td>
<td>0.001004</td>
</tr>
<tr>
<td>Median Income in 1990</td>
<td>-2.37E-03</td>
<td>-10.4601</td>
<td>0.000001</td>
</tr>
<tr>
<td>Median Income in 2000</td>
<td>2.23E-03</td>
<td>8.3239</td>
<td>0.000001</td>
</tr>
<tr>
<td>Vacant Housing in 2000</td>
<td>0.1256</td>
<td>12.1922</td>
<td>0.000001</td>
</tr>
<tr>
<td>Independent Variable.</td>
<td>Beta Coefficient</td>
<td>T-Value (Ho: B=0)</td>
<td>Prob. Level</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------------</td>
<td>-------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Housing Used for Recreation in 1990</td>
<td>-0.9578</td>
<td>-9.9349</td>
<td>0.000001</td>
</tr>
<tr>
<td>Percentage Change in Housing Used for Recreation Between 1980 and 2000</td>
<td>-2.59E-02</td>
<td>-4.8793</td>
<td>0.000051</td>
</tr>
<tr>
<td>Persons Paying Gross Rent of $500 Per Month or More in 1980</td>
<td>0.9866</td>
<td>11.4547</td>
<td>0.000001</td>
</tr>
<tr>
<td>Persons Paying Gross Rent of $500 Per Month or More in 2000</td>
<td>-0.0115</td>
<td>-2.9341</td>
<td>0.007069</td>
</tr>
<tr>
<td>Median Gross Rent in 1980</td>
<td>0.108</td>
<td>4.5607</td>
<td>0.000116</td>
</tr>
<tr>
<td>Mean Housing Values in 2000</td>
<td>-9.3E-05</td>
<td>-5.9772</td>
<td>0.000003</td>
</tr>
<tr>
<td>Accessibility Index with Naval Air Station in 1990</td>
<td>3.7501</td>
<td>20.0136</td>
<td>0.000001</td>
</tr>
<tr>
<td>Distance to Commercial Area in Census-tract 309</td>
<td>0.7546</td>
<td>4.6755</td>
<td>0.000086</td>
</tr>
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</table>

**T-Critical** | **2.059539**

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>RSS</th>
<th>Mean Square</th>
<th>F-Ratio</th>
<th>Prob Level</th>
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</thead>
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<tr>
<td>Intercept</td>
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<td>1221.1959</td>
<td>1221.1959</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>20</td>
<td>96293.3891</td>
<td>4814.6695</td>
<td>282.6090</td>
<td>0.000001</td>
</tr>
<tr>
<td>Error</td>
<td>25</td>
<td>425.9126</td>
<td>17.0365</td>
<td></td>
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</tr>
<tr>
<td>Total (Adjusted)</td>
<td>45</td>
<td>96719.3017</td>
<td>2149.3178</td>
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</tr>
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**Root Mean Square Error** = 4.12753006517063  
**R-Squared** = 0.9956  
**Adjusted R-Squared** = 0.9921

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Value</th>
<th>Probability</th>
<th>Decision (5%)</th>
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<tbody>
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<td>Skewness</td>
<td>0.4743</td>
<td>0.635308</td>
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</tr>
<tr>
<td>Kurtosis</td>
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<td>0.148451</td>
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<tr>
<td>Omnibus</td>
<td>2.3130</td>
<td>0.314581</td>
<td>Accepted</td>
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Table 4-3. Continued

<table>
<thead>
<tr>
<th>Plots Section</th>
<th>Probability Plot</th>
<th>Scatterplot</th>
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</thead>
<tbody>
<tr>
<td>Histogram</td>
<td>rmal Probability Plot of Residuals of PCTDRES73_RES2K</td>
<td>Residuals vs Predicted</td>
</tr>
</tbody>
</table>

* Note: 1973 land use data used since 1980 land use data not available.
Table 4-4. Mayport NS study area regression results for percentage change in commercial area between 1973 and 2000.

### Regression Equation Section

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Beta Coefficient</th>
<th>T-Value</th>
<th>Prob. Level</th>
<th>Decision (5%)</th>
<th>Transaction Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>254.1904</td>
<td>5.7252</td>
<td>0.000001</td>
<td>Reject Ho</td>
<td>n/a</td>
</tr>
<tr>
<td>Percentage Change in Population Between 1980 and 1990</td>
<td>4.2206</td>
<td>-3.3820</td>
<td>0.001711</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Percentage Change in Persons Under 16 Years Old Between 1980 and 2000</td>
<td>5.9165</td>
<td>5.5476</td>
<td>0.000003</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Percentage Change in Residential Area Between 1973 and 2000</td>
<td>1.8013</td>
<td>3.5362</td>
<td>0.00112</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
</tbody>
</table>

### T-Critical

| T-Critical | 2.026192 |

### Analysis of Variance Section

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>RSS</th>
<th>Mean Square</th>
<th>F-Ratio</th>
<th>Prob Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1</td>
<td>2091038.0809</td>
<td>2091038.0809</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>3</td>
<td>20340538.9603</td>
<td>6780179.6534</td>
<td>181.4573</td>
<td>0.000001</td>
</tr>
<tr>
<td>Error</td>
<td>37</td>
<td>1382510.4771</td>
<td>37365.1480</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (Adjusted)</td>
<td>40</td>
<td>21723049.4374</td>
<td>543076.2359</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Root Mean Square Error**: 193.30066742981
- **R-Squared**: 0.9364
- **Adjusted R-Squared**: 0.9312

### Normality Tests Section

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Value</th>
<th>Probability</th>
<th>Decision (5%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skewness</td>
<td>0.3881</td>
<td>0.697911</td>
<td>Accepted</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>0.0538</td>
<td>0.957086</td>
<td>Accepted</td>
</tr>
<tr>
<td>Omnibus</td>
<td>0.1535</td>
<td>0.926098</td>
<td>Accepted</td>
</tr>
</tbody>
</table>

### Plots Section

- **Histogram**
- **Probability Plot**
- **Scatterplot**

*Note: 1973 land use data used since 1980 land use data not available.*
Table 4-5. Mayport NS study area regression results for percentage change in median household income between 1980 and 2000.

<table>
<thead>
<tr>
<th>Regression Equation Section</th>
<th>Independent Variable</th>
<th>Beta Coefficient</th>
<th>T-Value (Ho: B=0)</th>
<th>Prob. Level</th>
<th>Decision (5%)</th>
<th>Transaction Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intercept</td>
<td>55.1629</td>
<td>2.7273</td>
<td>0.009914</td>
<td>Reject Ho</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Percentage Change in Population Between 1980 and 2000</td>
<td>-2.5716E-01</td>
<td>-5.3313</td>
<td>0.000006</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td></td>
<td>Dependent Ratio in 2000</td>
<td>-103.4834</td>
<td>-5.7125</td>
<td>0.000002</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td></td>
<td>Percentage Change in Persons Residing in the Same County Between 1980 and 2000</td>
<td>-0.220632</td>
<td>-5.3487</td>
<td>0.000006</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td></td>
<td>Percentage Change in Self Employed Persons Between 1980 and 2000</td>
<td>0.365847</td>
<td>6.3257</td>
<td>0.000001</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td></td>
<td>Percentage Change in Median Gross Rent Between 1980 and 2000</td>
<td>0.542015</td>
<td>5.1965</td>
<td>0.000009</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td></td>
<td>Distance to Commercial Area in Census-tract 14301</td>
<td>7.69655</td>
<td>6.4893</td>
<td>0.000001</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td></td>
<td>T-Critical</td>
<td></td>
<td></td>
<td></td>
<td>2.030108</td>
<td></td>
</tr>
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</table>

Analysis of Variance Section

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>RSS</th>
<th>Mean Square</th>
<th>F-Ratio</th>
<th>Prob Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1</td>
<td>946418.8213</td>
<td>946418.8213</td>
<td>946418.8213</td>
<td>946418.8213</td>
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<tr>
<td>Model</td>
<td>6</td>
<td>112159.8406</td>
<td>18693.3068</td>
<td>35.9677</td>
<td>0.000001</td>
</tr>
<tr>
<td>Error</td>
<td>35</td>
<td>18190.3833</td>
<td>519.7254</td>
<td>3179.2739</td>
<td>R-Squared = 0.8604</td>
</tr>
<tr>
<td>Total (Adjusted)</td>
<td>41</td>
<td>130350.2288</td>
<td>3179.2739</td>
<td>3179.2739</td>
<td>R-Squared = 0.8604</td>
</tr>
<tr>
<td>Root Mean Square Error</td>
<td></td>
<td>22.797486</td>
<td>22.797486</td>
<td>22.797486</td>
<td>Adjusted R-Squared = 0.8365</td>
</tr>
<tr>
<td>Coefficient of Variation</td>
<td></td>
<td>0.151869</td>
<td>0.151869</td>
<td>0.151869</td>
<td>0.151869</td>
</tr>
</tbody>
</table>

Normality Tests Section

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Value</th>
<th>Probability</th>
<th>Decision (5%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skewness</td>
<td>-0.1604</td>
<td>0.872574</td>
<td>Accepted</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>0.013</td>
<td>0.989609</td>
<td>Accepted</td>
</tr>
<tr>
<td>Omnibus</td>
<td>0.0259</td>
<td>0.987136</td>
<td>Accepted</td>
</tr>
</tbody>
</table>
Note: 1973 land use data used since 1980 land use data not available. The acronyms in the regression equation section are: BE = Basic Economic Activity and NBE = Nonbasic Economic Activity.
Table 4-6. Mayport NS study area regression results for percentage change in residential area between 1973 and 2000.

<table>
<thead>
<tr>
<th>Regression Equation Section</th>
<th>Independent Variable</th>
<th>Beta Coefficient</th>
<th>T-Value (Ho: B=0)</th>
<th>Prob. Level</th>
<th>Decision (5%)</th>
<th>Transaction Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intercept</td>
<td>-107.7941</td>
<td>-6.8176</td>
<td>0.000001</td>
<td>Reject Ho</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Percentage Change in Persons Using Other Types of Transportation Between 1980 and 2000</td>
<td>0.417</td>
<td>4.9898</td>
<td>0.000024</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td></td>
<td>Persons Employed in the Educational Services Industry in 2000</td>
<td>0.3217</td>
<td>11.8797</td>
<td>0.000001</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td></td>
<td>Percentage Change in Employment in Productivity, Repair, and Labor Industries Between 1980 and 2000</td>
<td>0.6865</td>
<td>8.7656</td>
<td>0.000001</td>
<td>Reject Ho</td>
<td>BE, NBE, &amp; Transfer Income</td>
</tr>
<tr>
<td></td>
<td>Persons with an Income Less Than $25,000 in 1980</td>
<td>-2.39E-02</td>
<td>-2.7402</td>
<td>0.010240</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td></td>
<td>Percentage of Persons with an Income Less Than $25,000 Between 1980 and 2000</td>
<td>-0.8151</td>
<td>-4.9575</td>
<td>0.000026</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td></td>
<td>Percentage of Persons with an Income Between $25,000 and $50,000 Between 1980 and 2000</td>
<td>0.011</td>
<td>4.1303</td>
<td>0.000267</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td></td>
<td>Total Commercial Area in 1973</td>
<td>4.62E-06</td>
<td>4.1508</td>
<td>0.000252</td>
<td>Reject Ho</td>
<td>BE, NBE, &amp; Transfer Income</td>
</tr>
<tr>
<td></td>
<td>Total Commercial Area in 2000</td>
<td>-7.23E-06</td>
<td>-6.6718</td>
<td>0.000001</td>
<td>Reject Ho</td>
<td>BE, NBE, &amp; Transfer Income</td>
</tr>
<tr>
<td></td>
<td>Straight-Line Distance to Commercial Area in Census-tract 14302</td>
<td>7.6038</td>
<td>4.6693</td>
<td>0.000059</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
</tbody>
</table>

T-Critical: |2.042272|
Table 4-6. continued

Analysis of Variance Section

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>RSS</th>
<th>Mean Square</th>
<th>F-Ratio</th>
<th>Prob Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1</td>
<td>2144.4933</td>
<td>2144.4933</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>9</td>
<td>122534.7924</td>
<td>13614.9769</td>
<td>56.1112</td>
<td>0.000001</td>
</tr>
<tr>
<td>Error</td>
<td>30</td>
<td>7279.2835</td>
<td>242.6429</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (Adjusted)</td>
<td>39</td>
<td>129814.0759</td>
<td>3328.5661</td>
<td></td>
<td></td>
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<tr>
<td>Root Mean Square Error</td>
<td>= 15.576995317206</td>
<td>R-Squared = 0.9439</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Coefficient of Variation</td>
<td>= 2.12741069368163</td>
<td>Adjusted R-Squared = 0.9271</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Normality Tests Section

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Value</th>
<th>Probability</th>
<th>Decision (5%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skewness</td>
<td>-1.6673</td>
<td>0.095450</td>
<td>Accepted</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>0.7077</td>
<td>0.479121</td>
<td>Accepted</td>
</tr>
<tr>
<td>Omnibus</td>
<td>3.2808</td>
<td>0.193899</td>
<td>Accepted</td>
</tr>
</tbody>
</table>

Plots Section

<table>
<thead>
<tr>
<th>Histogram</th>
<th>Probability Plot</th>
<th>Scatterplot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Histogram of Residuals of PCTDRES73_RES2K</td>
<td>Normal Probability Plot of Residuals of PCTDRES73</td>
<td>Residuals vs Predicted</td>
</tr>
</tbody>
</table>

Note: 1973 land use data used since 1980 land use data not available.
<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Beta Coefficient</th>
<th>T-Value (Ho: B=0)</th>
<th>Prob. Level</th>
<th>Decision (5%)</th>
<th>Transaction Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>113.9096</td>
<td>7.8188</td>
<td>0.000001</td>
<td>Reject Ho</td>
<td>n/a</td>
</tr>
<tr>
<td>Percentage Change of Dependent Ratio Between 1980 and 2000</td>
<td>-1.7222</td>
<td>-10.7063</td>
<td>0.000001</td>
<td>Reject Ho</td>
<td>Transfer Income</td>
</tr>
<tr>
<td>Persons Employed in the Wholesale Trade Industry in 1990</td>
<td>0.4067</td>
<td>3.8235</td>
<td>0.000360</td>
<td>Reject Ho</td>
<td>BE, NBE, &amp; Transfer Income</td>
</tr>
<tr>
<td>Percentage of Persons Employed in the Financial, Insurance, and Real Estate Industries Between 1980 and 2000</td>
<td>-5.13E-02</td>
<td>-2.2037</td>
<td>0.032085</td>
<td>Reject Ho</td>
<td>BE, NBE, &amp; Transfer Income</td>
</tr>
<tr>
<td>Persons Employed in the Business and Repair Industries in 1990</td>
<td>-0.4018</td>
<td>-4.2155</td>
<td>0.000102</td>
<td>Reject Ho</td>
<td>BE, NBE, &amp; Transfer Income</td>
</tr>
<tr>
<td>Persons Employed by the Federal Government in 2000</td>
<td>0.3353</td>
<td>3.6652</td>
<td>0.000589</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Percentage of Persons Below the Poverty Level Between the Age of 15 and 64 Between 1980 and 2000</td>
<td>-8.04E-02</td>
<td>-5.8722</td>
<td>0.000001</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Renter Occupied Housing in 1990</td>
<td>-2.92E-02</td>
<td>-3.2146</td>
<td>0.002267</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Percentage Change in Median Gross Rent between 1980 and 2000</td>
<td>0.3389</td>
<td>4.9597</td>
<td>0.000008</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Percentage Change in Mean Housing Values between 1980 and 2000</td>
<td>0.2219</td>
<td>5.5003</td>
<td>0.000001</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Commercial Area in 1980</td>
<td>-1.88E-06</td>
<td>-2.4517</td>
<td>0.017681</td>
<td>Reject Ho</td>
<td>BE, NBE, &amp; Transfer Income</td>
</tr>
<tr>
<td>Straight-Line Distance Accessibility Index without Air Force Base</td>
<td>6.8677</td>
<td>3.2286</td>
<td>0.002178</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
</tbody>
</table>

T-Critical: 2.007584
Table 4-7. continued

Analysis of Variance Section

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>RSS</th>
<th>Mean Square</th>
<th>F-Ratio</th>
<th>Prob Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1</td>
<td>2102905.3596</td>
<td>2102905.3596</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>11</td>
<td>261398.5491</td>
<td>23763.5045</td>
<td>31.9065</td>
<td>0.000001</td>
</tr>
<tr>
<td>Error</td>
<td>51</td>
<td>37984.1042</td>
<td>744.7864</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (Adjusted)</td>
<td>62</td>
<td>299382.6533</td>
<td>4828.7525</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Root Mean Square Error = 27.2907742199947  
R-Squared = 0.8731  
Coefficient of Variation = 0.149374432129979  
Adjusted R-Squared = 0.8458

Normality Tests Section

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Value</th>
<th>Probability</th>
<th>Decision (5%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skewness</td>
<td>0.9835</td>
<td>0.325363</td>
<td>Accepted</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-1.2070</td>
<td>0.227428</td>
<td>Accepted</td>
</tr>
<tr>
<td>Omnibus</td>
<td>2.4241</td>
<td>0.297580</td>
<td>Accepted</td>
</tr>
</tbody>
</table>

Plots Section

Histogram  
Probability Plot  
Scatterplot

Note: The acronyms in the regression equation section are: BE = Basic Economic Activity and NBE = Nonbasic Economic Activity.
Table 4-8. MacDill AFB study area regression results for percentage change in residential area between 1980 and 1999.

<table>
<thead>
<tr>
<th>Regression Equation Section</th>
<th>Beta Coefficient</th>
<th>T-Value (Ho: B=0)</th>
<th>Prob. Level</th>
<th>Decision (5%)</th>
<th>Transaction Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>8276.7958</td>
<td>13.1567</td>
<td>0.000001</td>
<td>Reject Ho</td>
<td>n/a</td>
</tr>
<tr>
<td>Persons Under the Age of 16 in 2000</td>
<td>-2.1512</td>
<td>-4.3659</td>
<td>0.000065</td>
<td>Reject Ho</td>
<td>Transfer Income</td>
</tr>
<tr>
<td>Percentage Change in Persons Residing in the Same House Between 1975 and 1995</td>
<td>44.6239</td>
<td>13.1549</td>
<td>0.000001</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Percentage Change in Persons Working at Home Between 1980 and 2000</td>
<td>2.0663</td>
<td>3.7363</td>
<td>0.000488</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Persons Employed in the Manufacturing Industry in 2000</td>
<td>-4.8495</td>
<td>-3.1012</td>
<td>0.003193</td>
<td>Reject Ho</td>
<td>BE, NBE, &amp; Transfer Income</td>
</tr>
<tr>
<td>Percentage Change in Persons Employed in Transportation, Communications, and Public Utilities Industries Between 1980 and 2000</td>
<td>-6.235</td>
<td>-11.2613</td>
<td>0.000001</td>
<td>Reject Ho</td>
<td>BE, NBE, &amp; Transfer Income</td>
</tr>
<tr>
<td>Persons Employed in the Wholesale Trade Industry in 1980</td>
<td>-12.6776</td>
<td>-4.2096</td>
<td>0.000109</td>
<td>Reject Ho</td>
<td>BE, NBE, &amp; Transfer Income</td>
</tr>
<tr>
<td>Percentage Change in Persons Employed in Personal Services, Entertainment, and Recreational Industries Between 1980 and 2000</td>
<td>-4.5535</td>
<td>-4.1513</td>
<td>0.000131</td>
<td>Reject Ho</td>
<td>BE, NBE, &amp; Transfer Income</td>
</tr>
<tr>
<td>Percentage Change in Persons Employed in the Educational Services Industry Between 1980 and 2000</td>
<td>-2.2925</td>
<td>-3.6725</td>
<td>0.000594</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Independent Variable</td>
<td>Beta Coefficient</td>
<td>T-Value (Ho: B=0)</td>
<td>Prob. Level</td>
<td>Decision (5%)</td>
<td>Transaction Type</td>
</tr>
<tr>
<td>----------------------</td>
<td>------------------</td>
<td>-------------------</td>
<td>-------------</td>
<td>---------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Percentage Change in Persons with a Household Income Between $30,000 and $50,000 Between 1980 and 2000</td>
<td>-1.4696</td>
<td>-3.2359</td>
<td>0.002176</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Persons with a Household Income Between of $50,000 or More in 1980</td>
<td>14.6673</td>
<td>7.5936</td>
<td>0.000001</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Percentage Change in Persons with a Household Income of $50,000 or More Between 1980 and 2000</td>
<td>0.3703</td>
<td>5.1271</td>
<td>0.000005</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Persons Paying Gross Rent of $500 Per Month or More in 1990</td>
<td>4.75</td>
<td>6.5706</td>
<td>0.000001</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Percentage Change in Aggregate Housing Values Between 1980 and 2000</td>
<td>-1.1971</td>
<td>-4.3005</td>
<td>0.000081</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
<tr>
<td>Median Owner's Cost with Mortgage in 1980</td>
<td>-18.8658</td>
<td>-11.2738</td>
<td>0.000001</td>
<td>Reject Ho</td>
<td>NBE &amp; Transfer Income</td>
</tr>
</tbody>
</table>

T-Critical | 2.009575 |

<table>
<thead>
<tr>
<th>Analysis of Variance Section</th>
</tr>
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<tbody>
<tr>
<td>Source</td>
</tr>
<tr>
<td>Intercept</td>
</tr>
<tr>
<td>Model</td>
</tr>
<tr>
<td>Error</td>
</tr>
<tr>
<td>Total (Adjusted)</td>
</tr>
</tbody>
</table>

Root Mean Square Error = 891.903495438583 R-Squared = 0.9537
Coeficient of Variatio = 1.93799295632215 Adjusted R-Squared = 0.9404

<table>
<thead>
<tr>
<th>Normality Tests Section</th>
</tr>
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<tbody>
<tr>
<td>Assumption</td>
</tr>
<tr>
<td>Skewness</td>
</tr>
<tr>
<td>Kurtosis</td>
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<td>Omnibus</td>
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</table>
Table 4-8. continued

Plots Section

<table>
<thead>
<tr>
<th>Histogram Section</th>
<th>Probability Plot</th>
<th>Scatterplot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Histogram of Residuals of PCTDRES80_RES99</td>
<td>Normal Probability Plot of Residuals of PCTDRES80</td>
<td>Residuals vs Predicted</td>
</tr>
</tbody>
</table>

Note: 1999 land use data used since 2000 land use data not available.
CHAPTER 5
SUMMARY AND CONCLUSION

Summary

Our study revealed certain obstacles that had been problematic for Base realignment and Closures (BRACs) in the past 20 years. Consistent obstacles were congressional in-house arguments over BRAC, grass-roots efforts in prevention of BRAC, political interference outside of Congress’ control, congressional and Department of Defense (DoD) debates over selected bases and/or areas of impact, and legislators gloom-and-doom debates over economic impact. The ability to overcome these obstacles appeared to be problems that face future BRACs. However, several possibilities could assist BRAC implementation, the most obvious would be educating the public about the results of previous impact studies of economic growth rates after BRAC has occurred. Ideally, an impact study at the smallest geographical scale may possibly reveal the greatest impact possible for the economic growth rates for a local area. Thus far, previous research has been conducted that revealed the results of impact for economic growth rates at larger geographical scales (county, regional, and greater scales). Our study was also consistent with previous research and the geographical scale (census-tract level) applied may also be considered equivalent to the regional level. Future research should consider a smaller geographical scale (census block groups).

Urban population size and labor force considerations should be a consideration in future research. The percentage of military personnel and civilian contracted employees out of the total population in previous research was normally between a range of less than
1% to approximately 3%. The percentage was normally equivalent to the percentage of the initial negative impact on economic growth rates observed in our study areas. If the percentages of population were found to be higher at a smaller geographical scale (census block groups), then perhaps the impact at a more localized level may be observed. Unlike previous results found in research at greater geographical scales, one advantage that can be used in future research that was utilized in our study was the inclusion of distance and accessibility variables. The selection of areal units should include distance and accessibility to major transportation corridor variables. For example, the study areas chosen for our study could be the basis for a new study with changes only to the geographical scale in the research being conducted. The spatial analyses and regression models may change because of the change in geographical scale. A possible indication in the change in results could be explained by a simple change in variables. For instance, the stepwise regressions never selected military population variables for the regression models but military population variables may be selected in some models at a smaller geographical scale. Particularly if census block groups have a tendency to reveal higher percentages for military employment out of the total population within the census block groups. A significant result in previous research may be explained because of the extremely low percentage of military employees out of the total population at the geographical scale chosen. Again, the results of our research were negligible for all cases, just as the percentage of total population employed by the military appeared to be negligible.

Another observation revealed in our study that should be mentioned in future research is the gross waste of taxes and money used to prevent BRAC. Government offices spend millions to hundreds of millions of dollars in efforts to find a method for
preventing BRAC. Unfortunately once the decision to close a base has been rendered, the money spent is lost and any efforts were wasted. Instead of using the money to prevent BRAC, the money should be used in assisting planning commissions in those areas that may be affected in preparation to overcome an impact in the most expedient and efficient means possible. Also, educational tools should be implemented to prepare the local population for the upcoming possibility of closure and expedite the transition from military employment to future possibilities if needed. The Florida grass-roots movement in our study may explain the importance of redirection of funds. Our study mentioned the possibility of BRAC for MacDill AFB, since our study was completed the DoD has announced some BRAC activity. The most significant effect that will be felt by Florida will actually take place in Mayport NS: by the end of this year (2005) the carrier USS John F. Kennedy (JFK) will be decommissioned. The JFK is stationed at Mayport NS. Several possibilities may occur with this decision: (1) a new carrier will be reassigned to Mayport NS and any other changes that occur with the reassignment will be a non-factor on the current economy, (2) a new carrier will not be assigned and only the remaining naval groups will remain leading to the possible closure of Jacksonville NAS (Jax NAS) because of the change in its mission status: no carrier – no need of aircraft, (3) the worst scenario would be a closure of Mayport NS and the resulting closure of Jax NAS. The possibility of MacDill AFB closing is still a possibility, and the most likely choice in the 2005 round of BRAC. The results found in our study revealed that the possibility of MacDill AFB being selected for BRAC could be profitable for the city of Tampa, however, a study at a smaller geographical scale could show a significant negative impact on the area if MacDill AFB is closed. The most significant outcome of all previous research showed a negligible impact on the economic-growth rates at the geographical
scales chosen, including our study. The importance of the results found in the previous research could be used as an advantage by planning commissions through implementing planning tools to overcome initial impact on economic growth rates. This could be accomplished by zoning for industry and residential areas that are made available by BRAC that would improve the local areas economic-growth rates and thus the economy of the area as a whole over time.

Eventually a diverse economic base for any metropolitan statistical area will include a number of factors that could explain the rate of economic growth. A list of the factors that could explain the rate of economic growth include those mentioned in the previous paragraphs in this section; geographical scale, population growth and density, and development along transportation corridors. Other factors that could explain the rate of economic growth are: gentrification, the relative location of the CBD, local impact of commercial and financial nodes, zoning, and economic diversity to name a few. The latter factors listed play an integral role in the MSAs economic growth. Gentrification has recently been a necessary action with many major cities in improving real estate values of land located proximally to the major city’s CBD. Improvement in land use includes the removal of decrepit and condemned buildings and replacing the buildings with newer and more aesthetic structures or new zoning of land use for parks and recreation. The relative location of the CBD and the local impact of commercial and financial nodes are self-explanatory. The CBD should impact the economic-growth rate because the CBD is the economic heart of any community. The local impact seen from the commercial and financial nodes should reflect the growth that is revealed by the activity of the nodes; i.e., if the nodes have a healthy and robust growth because of increasing economic activity, then the economic growth rates should reveal a positive impact. However, if a negative
growth trend is seen in the nodal activity in the local community, a negative impact should be observed. Economic diversity may explain the results for most of the previous research conducted for BRAC impact on economic growth rates. Research has shown that economic diversity plays a vital role in regional economic growth and development. It may be reasonable, therefore, to assume that areas with little economic diversity, especially places that are heavily reliant on a military-base as an income generating industry, could be devastated economically from a base closure. Eventually, zoning also has a function on economic growth rates. For instance if a zoning commission were to select an area for commercial zoning in which there are only tertiary roads, then growth in the commercial area may suffer because of insufficient traffic volume. The most pressing concern for zoning is to benefit the local area by creating zones for land use that will improve real estate values and the potential for future economic-growth. More importantly, zoning could be one of the factors that could play a major role in future BRAC; preplanning by zoning land use of available land from BRAC could reduce and possibly remove any initial negative impact felt by the local community in the event of BRAC.

**Concluding Remarks**

The literature concerning base impact on economic growth at the regional level revealed that a base’s influence on a local economy might be negligible when the economy is large and diverse. Concern of future base closures is continuously debated amongst the Department of Defense (DoD) and Congress, there are conflicting opinions on the likely impact of closure. Both sides have legitimate arguments concerning base closures. The DoD is continuously looking for methods to reduce budget costs because of budget cuts (before 2001) the DoD experienced. Congress has argued that base closures
are detrimental to a healthy local economy. The latter may be true in some cases where bases in small communities are the predominant industry. Although small communities such as Jacksonville, NC and Manhattan, KS rely solely on the base for economic growth, bases in large cities or metropolitan areas have a diverse economy and the base in those areas have a negligible impact on the economic growth in those areas.

Previous research rejected the hypothesis that military bases have a negative impact on economic-growth rates at regional levels. Although the initial impact had negative connotations, economic recovery was usually quick and positive economic growth rates eventually were observed. Our study was consistent with previous research results and also rejected the hypothesis that military bases had a discernible impact on economic growth rates at a geographical scale (census-tract level) because of proximal distances and accessibility along transportation corridors between the base and major commercial and financial nodes at the 95% confidence level.

Thus, the geographical scale is the first factor that should be considered in future research concerning BRAC. However, the rate of economic-growth could be explained by a number of factors, such as population growth and density, the relative location of the Central Business District (CBD), development along transportation corridors, local impact of commercial and financial nodes, gentrification, economic diversity, zoning, and other factors that are essentially non-base related. Spatial analysis should reveal the impact on economic growth rates because of the diversity of factors aforementioned. Although the observed results from BRAC impact was negligible in all regression models of our study, a smaller geographical scale (census block groups) may reveal different results.
The spatial analyses revealed that economic growth occurred in most of our study areas. However, the impact on economic growth could have been caused by a number of factors, such as the CBD, transportation corridors between the CBD, base, and commercial nodes, gentrification, and other certain elements that can impact the economic-growth of our study area. Of great importance was the understanding that spatial analysis did not reject or fail to reject theory on economic growth indicators. Spatial analysis only offers a visual representation of spatial data. In the case of our study, the spatial analyses offered visual representations of the dependent variables used for determining the possibility of base impact on economic growth rates of our study areas. Although the spatial analyses revealed certain growth patterns near the bases in some cases, there was no discernible evidence that the bases were responsible for the impact on economic-growth rates. Instead, the bases may have played a minor role in economic-growth rates through inclusion with the CBD and other commercial nodes.

The regression analyses revealed the results of data testing to determine the causes for either a positive or negative impact on the economic-growth of our study areas. The significance of base impact on economic growth rates in our study areas was found to be negligible in all cases. Only one case revealed the base having a minor role and the dominant force on economic growth rates in the study area involved the locational accessibility between the base, CBD, and commercial nodes. Thus, the impact on economic-growth rates was not by the base, but by the CBD. Whereas, transfer income from the base assisted the CBD and commercial nodes impact on the local economy.

Our study was consistent with previous research and studies with similar results that supported the contention that the impact of a military-base may be negligible or non-discernible in economies that are large and diverse. The implications (if assertion is
correct): base closures in large and diversified economies might have a limited negative impact and would likely be replaced with land use activities that would lessen the overall impact of base closure and the associated loss of transfer income. Overall, all cases rejected the hypothesis that military bases have a discernible impact on economic growth rates at a geographical scale (census-tract level) because of proximal distances and accessibility along transportation corridors between the base and major commercial and financial nodes at the 95% confidence level. The explanation for the rejection of the hypothesis may be explained through the geographical scale and/or the relatively small percentage of the total population of each study area employed at the military bases.

The research results should only be applied to the study areas in our study. The results of our study revealed that the three military bases in the Tampa and Jacksonville MSAs did not have a discernible impact on local economic-growth rates over the periods examined. This was possible because of the size and diversity of these economies and/or the geographical and temporal scales at which the analysis was conducted. Furthermore, the results of our study revealed no evidence of localized spillover effects from the military bases to census-tracts surrounding the three bases included in our study. Future research should consider a comparative study between geographical scales (regional through census block groups) and greater temporal scales (greater than ten to twenty-year periods over possibly thirty or forty years minimum) in determining discernible impact on economic-growth rates at each level.
APPENDIX
KEY TO INDEPENDENT VARIABLES

Table A-1. Key to Independent Variables.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Census-tract Identification</td>
<td>The census-tract identification for the Jacksonville study areas in Duval and Clay Counties and the Tampa study area in Hillsborough and Pinellas Counties.</td>
</tr>
<tr>
<td>Total population</td>
<td>The total population of the tract for that set of census data.</td>
</tr>
<tr>
<td>Percentage Change in Population</td>
<td>The percentage change between the given populations by years (e.g., 80_90 is the percentage change of population between 1980 and 1990).</td>
</tr>
<tr>
<td>Total population Under Age 16</td>
<td>The sum of all persons under the age of 16.</td>
</tr>
<tr>
<td>Total population Age 16 to 64</td>
<td>The sum of all persons between the ages of 16 and 64.</td>
</tr>
<tr>
<td>Percentage Change in Persons Between the Ages 16 and 64 Between 1980 and 2000</td>
<td>The percentage change in population of persons between the ages of 16 and 64 between 1980 and 2000.</td>
</tr>
<tr>
<td>Total population Over Age 64</td>
<td>The sum of all persons over the age of 64.</td>
</tr>
<tr>
<td>Percentage Change in Persons Over Age 64 Between 1980 and 2000</td>
<td>The percentage change in population of persons over the age of 64 between 1980 and 2000.</td>
</tr>
<tr>
<td>Dependent Ratio</td>
<td>The dependency ratio for given years.</td>
</tr>
<tr>
<td>Total Households</td>
<td>The total number of households reported in the census-tract.</td>
</tr>
<tr>
<td>Percentage Change in Households Between 1980 and 2000</td>
<td>The percentage change in total number of households between 1980 and 2000.</td>
</tr>
<tr>
<td>Born In State</td>
<td>The number of people reported that were born in Florida.</td>
</tr>
<tr>
<td>Percentage Change of Persons Born in State Between 1980 and 2000</td>
<td>The percentage change of the number of people reported that were born in Florida between 1980 and 2000.</td>
</tr>
<tr>
<td>Born Out Of State</td>
<td>The number of people reported that were not born in Florida but were born in the United States.</td>
</tr>
<tr>
<td>Table A-1. continued</td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td></td>
</tr>
<tr>
<td>Percentage Change of Persons Born Out of State Between 1980 and 2000</td>
<td>The percentage change in the number of people reported that were not born in Florida but were born in the United States between 1980 and 2000.</td>
</tr>
<tr>
<td>Resided In Same House</td>
<td>The number of people reported that lived in the same house during 5 years before the census data.</td>
</tr>
<tr>
<td>Percentage Change of Persons that Resided In Same House Between 1975 and 1995</td>
<td>The percentage change in the number of people reported that lived in the same house during 5 years before the census data between 1975 and 1995.</td>
</tr>
<tr>
<td>Resided In Same County</td>
<td>The number of people reported that lived in the same county during 5 years before the census data.</td>
</tr>
<tr>
<td>Percentage Change of Persons that Resided In Same County Between 1975 and 1995</td>
<td>The percentage change in the number of people reported that lived in the same county during 5 years before the census data between 1975 and 1995.</td>
</tr>
<tr>
<td>Resided In Florida</td>
<td>The number of people reported that lived in Florida during 5 years before the census data.</td>
</tr>
<tr>
<td>Percentage Change of Persons that Resided In Florida Between 1975 and 1995</td>
<td>The percentage change in the number of people reported that lived in Florida during 5 years before the census data between 1975 and 1995.</td>
</tr>
<tr>
<td>Worked In County</td>
<td>The number of people that worked in the county of their residence.</td>
</tr>
<tr>
<td>Percentage Change of Persons that Worked In County Between 1980 and 2000</td>
<td>The percentage change in the number of people that worked in the county of their residence between 1980 and 2000.</td>
</tr>
<tr>
<td>Drive Alone</td>
<td>The number of people that drive a car, truck or van to work without other passengers.</td>
</tr>
<tr>
<td>Percentage Change of Persons that Drive Alone Between 1980 and 2000</td>
<td>The percentage change in the number of people that drive a car, truck or van to work without other passengers between 1980 and 2000.</td>
</tr>
<tr>
<td>Carpool</td>
<td>The number of people that carpool to work.</td>
</tr>
<tr>
<td>Percentage Change of Persons that Carpool Between 1980 and 2000</td>
<td>The percentage change in the number of people that carpool to work between 1980 and 2000.</td>
</tr>
<tr>
<td>Public Transportation</td>
<td>The number of people that use public transportation as a means of going to and returning from work.</td>
</tr>
<tr>
<td>Percentage Change of Persons that Used Public Transportation Between 1980 and 2000</td>
<td>The percentage change in the number of people that use public transportation as a means of going to and returning from work between 1980 and 2000.</td>
</tr>
<tr>
<td>Other Transportation</td>
<td>The number of people that use a bicycle, motorcycle, moped, or other means than previously mentioned as a means of travel to and from work.</td>
</tr>
<tr>
<td>Category</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Percentage Change of Persons that Used Other Transportation Between 1980 and 2000</td>
<td>The percentage change in the number of people that use a bicycle, motorcycle, moped, or other means than previously mentioned as a means of travel to and from work between 1980 and 2000.</td>
</tr>
<tr>
<td>Work At Home</td>
<td>The number of people that work at home.</td>
</tr>
<tr>
<td>Percentage Change of Persons that Worked At Home Between 1980 and 2000</td>
<td>The percentage change in the number of people that work at home between 1980 and 2000.</td>
</tr>
<tr>
<td>Travel Less Than 10 Minutes</td>
<td>The number of people that require less than 10 minutes of travel time to their work.</td>
</tr>
<tr>
<td>Percentage Change of Persons that Travel Less Than 10 Minutes Between 1980 and 2000</td>
<td>The percentage change in the number of people that require less than 10 minutes of travel time to their work between 1980 and 2000.</td>
</tr>
<tr>
<td>Travel Between 10 to 19 Minutes</td>
<td>The number of people that require between 10 and 19 minutes to travel to their work.</td>
</tr>
<tr>
<td>Percentage Change of Persons that Travel Between 10 to 19 Minutes Between 1980 and 2000</td>
<td>The percentage change in the number of people that require between 10 and 19 minutes to travel to their work between 1980 and 2000.</td>
</tr>
<tr>
<td>Travel Between 20 to 29 Minutes</td>
<td>The number of people that require between 20 and 29 minutes to travel to their work.</td>
</tr>
<tr>
<td>Percentage Change of Persons that Travel Between 20 to 29 Minutes Between 1980 and 2000</td>
<td>The percentage change in the number of people that require between 20 and 29 minutes to travel to their work between 1980 and 2000.</td>
</tr>
<tr>
<td>Travel 30 Minutes or More</td>
<td>The number of people that require more than 30 minutes to travel to their work.</td>
</tr>
<tr>
<td>Percentage Change of Persons that Travel 30 Minutes or More Between 1980 and 2000</td>
<td>The percentage change in the number of people that require more than 60 minutes to travel to their work between 1980 and 2000.</td>
</tr>
<tr>
<td>Veterans</td>
<td>The number of people reported that they are military veterans.</td>
</tr>
<tr>
<td>Percentage Change in Veterans Between 1980 and 2000</td>
<td>The percentage change in the number of people reported that they are military veterans between 1980 and 2000.</td>
</tr>
<tr>
<td>Non-Veterans</td>
<td>The number of people reported that they are not military veterans.</td>
</tr>
<tr>
<td>Percentage Change in Non-Veterans Between 1980 and 2000</td>
<td>The percentage change in the number of people reported that they are not military veterans between 1980 and 2000.</td>
</tr>
<tr>
<td>Armed Forces</td>
<td>The number of people reported that are currently serving in the United States military and living in the census-tract.</td>
</tr>
<tr>
<td>Table A-1. continued</td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Percentage Change in</td>
<td>The percentage change in the number of people reported that are currently serving in the United States military and living in the census-tract between 1980 and 2000.</td>
</tr>
<tr>
<td>Armed Forces Between</td>
<td>The number of people reported that are currently employed but not with the military.</td>
</tr>
<tr>
<td>1980 and 2000</td>
<td>The percentage change in the number of people reported that are currently employed but not with the military between 1980 and 2000.</td>
</tr>
<tr>
<td>Civilian Employees</td>
<td>The number of people reported working in the Agriculture, Forestry, Fishing, or Mining industries.</td>
</tr>
<tr>
<td>Percentage Change in</td>
<td>The percentage change in the number of people reported working in the Agriculture, Forestry, Fishing, or Mining industries between 1980 and 2000.</td>
</tr>
<tr>
<td>Civilian Employees</td>
<td>The number of people reported working in the Construction industry.</td>
</tr>
<tr>
<td>Between 1980 and 2000</td>
<td>The percentage change in the number of people reported working in the Construction industry between 1980 and 2000.</td>
</tr>
<tr>
<td>Agriculture, Fishing,</td>
<td>The number of people reported working in the manufacturing industry.</td>
</tr>
<tr>
<td>Forestry, and Mining</td>
<td>The percentage change in the number of people reported working in the manufacturing industry between 1980 and 2000.</td>
</tr>
<tr>
<td>Industries</td>
<td>The number of people reported working in the Transportation, Communications, or Public Utilities industries.</td>
</tr>
<tr>
<td>Percentage Change in</td>
<td>The percentage change in the number of people reported working in the Transportation, Communications, or Public Utilities industries between 1980 and 2000.</td>
</tr>
<tr>
<td>Agriculture, Fishing,</td>
<td>The number of people reported working in the Wholesale Trade industry.</td>
</tr>
<tr>
<td>Forestry, Fishing, or</td>
<td>The percentage change in the number of people reported working in the Wholesale Trade industry between 1980 and 2000.</td>
</tr>
<tr>
<td>Mining Industries</td>
<td>The number of people reported working in the Retail Trade industry.</td>
</tr>
</tbody>
</table>
Table A-1. continued

<table>
<thead>
<tr>
<th>Industry</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage Change in</td>
<td>The percentage change in the number of people reported working in the Retail Trade industry between 1980 and 2000.</td>
</tr>
<tr>
<td>Retail Trade Industry Between 1980 and 2000</td>
<td></td>
</tr>
<tr>
<td>Financial, Insurance, and Real Estate Industries</td>
<td>The number of people reported working in the Financial, Insurance, or Real Estate industries.</td>
</tr>
<tr>
<td>Percentage Change in</td>
<td>The percentage change in the number of people reported working in the Financial, Insurance, or Real Estate industries between 1980 and 2000.</td>
</tr>
<tr>
<td>Financial, Insurance, and Real Estate Industries Between 1980 and 2000</td>
<td></td>
</tr>
<tr>
<td>Business and Repair Services Industries</td>
<td>The number of people reported working in the Business or Repair Services industries.</td>
</tr>
<tr>
<td>Percentage Change in</td>
<td>The percentage change in the number of people reported working in the Business or Repair Services industries between 1980 and 2000.</td>
</tr>
<tr>
<td>Business and Repair Services Industries Between 1980 and 2000</td>
<td></td>
</tr>
<tr>
<td>Personal Services, Entertainment, and Recreation industries</td>
<td>The number of people reported working in the Personal Services, Entertainment, or Recreation Services industries.</td>
</tr>
<tr>
<td>Percentage Change in</td>
<td>The percentage change in the number of people reported working in the Personal Services, Entertainment, or Recreation Services industries between 1980 and 2000.</td>
</tr>
<tr>
<td>Personal Services, Entertainment, and Recreation industries Between 1980 and 2000</td>
<td></td>
</tr>
<tr>
<td>Health Services Industries</td>
<td>The number of people reported working in the Health Services industry.</td>
</tr>
<tr>
<td>Percentage Change in</td>
<td>The percentage change in the number of people reported working in the Health Services industry between 1980 and 2000.</td>
</tr>
<tr>
<td>Health Services Industries Between 1980 and 2000</td>
<td></td>
</tr>
<tr>
<td>Education Services Industries</td>
<td>The number of people reported working in the Educational Services industry.</td>
</tr>
<tr>
<td>Percentage Change in</td>
<td>The percentage change in the number of people reported working in the Educational Services industry between 1980 and 2000.</td>
</tr>
<tr>
<td>Education Services Industries</td>
<td></td>
</tr>
<tr>
<td>Other Professional Services Industries</td>
<td>The number of people reported working in other professional services not mentioned in the other reported industries.</td>
</tr>
<tr>
<td>Percentage Change in</td>
<td>The percentage change in the number of people reported working in other professional services not mentioned in the other reported industries between 1980 and 2000.</td>
</tr>
<tr>
<td>Other Professional Services Industries Between 1980 and 2000</td>
<td></td>
</tr>
<tr>
<td>Public Administration</td>
<td>The number of people reported working in the Public Administration industry.</td>
</tr>
<tr>
<td></td>
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</tr>
</tbody>
</table>
Table A-1. continued

<table>
<thead>
<tr>
<th>Percentage Change in Public Administration Between 1980 and 2000</th>
<th>The percentage change in the number of people reported working in the Public Administration industry between 1980 and 2000.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment in Management, Business or Financial Professionals, and Sales Occupations</td>
<td>Employment in Management, Business or Financial Professionals, or Sales.</td>
</tr>
<tr>
<td>Employment in Private or Protective Services and Other Professional Services Occupations</td>
<td>Employment in the Private or Protective Services, or Other Personal Services.</td>
</tr>
<tr>
<td>Percentage Change in Employment for Private or Protective Services and Other Professional Services Occupations Between 1980 and 2000</td>
<td>The percentage change in the employment for Private or Protective Services, or Other Personal Services between 1980 and 2000.</td>
</tr>
<tr>
<td>Employment in Production, Repair, and Labor Occupations</td>
<td>Employment in Production, Repair, or Labor.</td>
</tr>
<tr>
<td>Wages and Salary Employees</td>
<td>The number of people reported working for a salary or wages.</td>
</tr>
<tr>
<td>Percentage Change in Wages and Salary Employees Between 1980 and 2000</td>
<td>The percentage change in the number of people reported working for a salary or wages between 1980 and 2000.</td>
</tr>
<tr>
<td>Federal Government Employees</td>
<td>The number of people reported working for the Federal Government.</td>
</tr>
<tr>
<td>Description</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>State Government Employees The number of people reported working for the State Government.</td>
<td>Percentage Change in State Government Employees Between 1980 and 2000 The percentage change in the number of people reported working for the State Government between 1980 and 2000.</td>
</tr>
<tr>
<td>Local Government Employees The number of people reported working for the Local Government.</td>
<td>Percentage Change in Local Government Employees Between 1980 and 2000 The percentage change in the number of people reported working for the Local Government between 1980 and 2000.</td>
</tr>
<tr>
<td>Self Employed The number of people reported that are self-employed.</td>
<td>Percentage Change in Self Employed Between 1980 and 2000 The percentage change in the number of people reported that are self-employed between 1980 and 2000.</td>
</tr>
<tr>
<td>Household Income Less Than $10000 Per Year The number of people reported having a household income less than $10,000 per year.</td>
<td>Percentage Change in Household Income Less Than $10000 Per Year Between 1980 and 2000 The percentage change in the number of people reported having a household income less than 10,000 dollars per year between 1980 and 2000.</td>
</tr>
<tr>
<td>Household Income Between $10000 and $30000 Per Year The number of people reported having a household income between 10,000 and 30,000 dollars per year.</td>
<td>Percentage Change in Household Income Between $10000 and $30000 Per Year Between 1980 and 2000 The percentage change in the number of people reported having a household income between 10,000 and 30,000 dollars per year between 1980 and 2000.</td>
</tr>
<tr>
<td>Household Income Between $30000 and $50000 Per Year The number of people reported having a household income between 30,000 and 50,000 dollars per year.</td>
<td>Percentage Change in Household Income Between $30000 and $50000 Per Year Between 1980 and 2000 The percentage change in the number of people reported having a household income between 30,000 and 50,000 dollars per year between 1980 and 2000.</td>
</tr>
<tr>
<td>Household Income Greater Than $50000 Per Year The number of people reported having a household income greater than 50,000 dollars per year.</td>
<td>Percentage Change in Household Income Greater Than $50000 Per Year Between 1980 and 2000 The percentage change in the number of people reported having a household income greater than 50,000 dollars per year between 1980 and 2000.</td>
</tr>
<tr>
<td>Median Household Income The median household income reported for the census-tract.</td>
<td></td>
</tr>
<tr>
<td>Table A-1. continued</td>
<td>Definition</td>
</tr>
<tr>
<td>----------------------</td>
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<tr>
<td>Percentage Change in Median Household Income Between 1980 and 2000</td>
<td>The percentage change in the median household income reported for the census-tract between 1980 and 2000.</td>
</tr>
<tr>
<td>Median Family Income</td>
<td>The median family income reported for the census-tract.</td>
</tr>
<tr>
<td>Percentage Change in Median Family Income Between 1980 and 2000</td>
<td>The percentage change in the median family income reported for the census-tract between 1980 and 2000.</td>
</tr>
<tr>
<td>Income Less Than $25000 Per Year</td>
<td>The number of people reported having an income less than $25,000 per year.</td>
</tr>
<tr>
<td>Percentage Change in Income Less Than $25000 Per Year Between 1980 and 2000</td>
<td>The percentage change in the number of people reported having an income less than 25,000 dollars per year between 1980 and 2000.</td>
</tr>
<tr>
<td>Income Between $25000 and $50000 Per Year</td>
<td>The number of people reported having an income between 25,000 and 50,000 dollars per year.</td>
</tr>
<tr>
<td>Percentage Change in Income Between $25000 and $50000 Per Year Between 1980 and 2000</td>
<td>The percentage change in the number of people reported having an income between 25,000 and 50,000 dollars per year between 1980 and 2000.</td>
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<tr>
<td>Household Income Greater Than $50000 Per Year</td>
<td>The number of people reported having an income greater than 50,000 dollars per year.</td>
</tr>
<tr>
<td>Percentage Change in Household Income Greater Than $50000 Per Year Between 1980 and 2000</td>
<td>The percentage change in the number of people reported having an income greater than 50,000 dollars per year between 1980 and 2000.</td>
</tr>
<tr>
<td>Median Income</td>
<td>The median income reported for the census-tract.</td>
</tr>
<tr>
<td>Percentage Change in Median Income Between 1980 and 2000</td>
<td>The percentage change in the median income reported for the census-tract between 1980 and 2000.</td>
</tr>
<tr>
<td>Above Poverty Level Ages 15 to 64 Years</td>
<td>The number of people between the ages of 15 and 64 years reported as being above the poverty level.</td>
</tr>
<tr>
<td>Percentage Change in Above Poverty Level Ages 15 to 64 Years Between 1980 and 2000</td>
<td>The percentage change in the number of people between the ages of 15 and 64 years reported as being above the poverty level between 1980 and 2000.</td>
</tr>
<tr>
<td>Above Poverty Level Ages Over 64 Years</td>
<td>The number of people 65 years and older reported as being above the poverty level.</td>
</tr>
<tr>
<td>Percentage Change in Above Poverty Level Ages Over 64 Years Between 1980 and 2000</td>
<td>The percentage change in the number of people 65 years and older reported as being above the poverty level between 1980 and 2000.</td>
</tr>
<tr>
<td>Below Poverty Level Ages 15 to 64 Years</td>
<td>The number of people between the ages of 15 and 64 years reported as being below the poverty level.</td>
</tr>
</tbody>
</table>
Table A-1. continued

<p>| Percentage Change in Below Poverty Level Ages 15 to 64 Years Between 1980 and 2000 |
| The percentage change in the number of people between the ages of 15 and 64 years reported as being below the poverty level between 1980 and 2000. |
| Total Housing Units Percentage Change in Total Housing Units Between 1980 and 2000 |
| The total number of housing units in the census-tract. |
| Occupied Housing Units Percentage Change in Occupied Housing Units Between 1980 and 2000 |
| The number of occupied housing units in the census-tract. |
| Vacant Housing Units Percentage Change in Vacant Housing Units Between 1980 and 2000 |
| The number of vacant housing units in the census-tract. |
| Housing Units For Recreational Use Percentage Change in Housing Units For Recreational Use Between 1980 and 2000 |
| The number of housing units that are only used seasonally or for recreation purposes in the census-tract. |
| Owner Occupied Housing Units Percentage Change in Owner Occupied Housing Units Between 1980 and 2000 |
| The number of housing units that occupied by the owner. |
| Renter Occupied Housing Units Percentage Change in Renter Occupied Housing Units Between 1980 and 2000 |
| The number of housing units that are occupied by renters. |
| Gross Rent Greater Than $500 Per Month Percentage Change in Gross Rent Greater Than $500 Per Month Between 1980 and 2000 |
| The number of people reported that their gross rent is 500 or more dollars per month. |
| Median Gross Rent |
| The median gross rent reported for the census-tract. |</p>
<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage Change in Median Gross Rent Between 1980 and 2000</td>
<td>The percentage change in the median gross rent reported for the census-tract between 1980 and 2000.</td>
</tr>
<tr>
<td>Aggregate Value of Housing Units</td>
<td>The aggregate value of all housing units in the census-tract.</td>
</tr>
<tr>
<td>Name</td>
<td>Description</td>
</tr>
<tr>
<td>Percentage Change in Aggregate Value of Housing Units Between 1980 and 2000</td>
<td>The percentage change in the aggregate value of all housing units in the census-tract between 1980 and 2000.</td>
</tr>
<tr>
<td>Median Owner Costs with Mortgage</td>
<td>The median owner cost with mortgage per month reported for the census-tract.</td>
</tr>
<tr>
<td>Percentage Change in Median Owner Costs with Mortgage Between 1980 and 2000</td>
<td>The percentage change in the median owner cost with mortgage per month reported for the census-tract between 1980 and 2000.</td>
</tr>
<tr>
<td>Mean Value of Housing Units</td>
<td>The mean value for housing units reported in the census-tract.</td>
</tr>
<tr>
<td>Percentage Change in Mean Value of Housing Units Between 1980 and 2000</td>
<td>The percentage change in the mean value for housing units reported in the census-tract between 1980 and 2000.</td>
</tr>
<tr>
<td>Total Square Feet of Commercial Land use by Designated Year</td>
<td>The total area in square feet calculated for the commercial land use designated area(s) in the census-tract.</td>
</tr>
<tr>
<td>Percentage Change in Total Square Feet of Commercial Land use Between 1980 and 2000</td>
<td>The percentage change in the total area in square feet calculated for the commercial land use between 1980 and 2000.</td>
</tr>
<tr>
<td>Total Square Feet of Residential Land use by Designated Year</td>
<td>The total area in square feet calculated for the residential land use designated area(s) in the census-tract.</td>
</tr>
<tr>
<td>Percentage Change in Total Square Feet of Residential Land use Between 1980 and 2000</td>
<td>The percentage change in the total area in square feet calculated for the residential land use between 1980 and 2000.</td>
</tr>
<tr>
<td>Road Distance with Accessibility Index to AFB</td>
<td>The road distance Accessibility Index with the value of the distance to the AFB added.</td>
</tr>
<tr>
<td>Road Distance without Accessibility Index to AFB</td>
<td>The road distance Accessibility Index without the value of the distance to the AFB added.</td>
</tr>
<tr>
<td>Road Distance with Accessibility Index to NAS</td>
<td>The road distance Accessibility Index with the value of the distance to the NAS added.</td>
</tr>
<tr>
<td>Table A-1. continued</td>
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<td>----------------------</td>
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</tr>
<tr>
<td>Road Distance without Accessibility Index to NAS</td>
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<tr>
<td>Road Distance with Accessibility Index to NS</td>
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<tr>
<td>Road Distance without Accessibility Index to NS</td>
<td>The road distance Accessibility Index without the value of the distance to the NS added.</td>
</tr>
<tr>
<td>Straight-Line Distance with Accessibility Index to AFB</td>
<td>The straight-line distance Accessibility Index with the value of the distance to the AFB added.</td>
</tr>
<tr>
<td>Straight-Line Distance without Accessibility Index to AFB</td>
<td>The straight-line distance Accessibility Index without the value of the distance to the AFB added.</td>
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<tr>
<td>Straight-Line Distance with Accessibility Index to NAS</td>
<td>The straight-line distance Accessibility Index with the value of the distance to Jax NAS added.</td>
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<tr>
<td>Straight-Line Distance without Accessibility Index to NAS</td>
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<tr>
<td>Straight-Line Distance with Accessibility Index to NS</td>
<td>The straight-line distance Accessibility Index with the value of the distance to Mayport NS added.</td>
</tr>
<tr>
<td>Straight-Line Distance without Accessibility Index to NS</td>
<td>The straight-line distance Accessibility Index without the value of the distance to Mayport NS added.</td>
</tr>
<tr>
<td>Britton Plaza</td>
<td>Britton Plaza in Tampa (census-tract 67).</td>
</tr>
<tr>
<td>Sports Complex</td>
<td>Location of Legend’s Field and Raymond James Stadium, Tampa (Census-tract 26).</td>
</tr>
<tr>
<td>Westshore Mall</td>
<td>The Westshore Mall in Tampa (census-tract 46).</td>
</tr>
<tr>
<td>Center Mall</td>
<td>The location of Tampa Bay Center Mall (census-tract 27).</td>
</tr>
<tr>
<td>Commercial Area with Census-tract ID and the Year</td>
<td>CMR designates the commercial area. The numerical id in parenthesis identifies the census-tract that the commercial area is located. The number following the underscore is the year that the data is given for the commercial area.</td>
</tr>
</tbody>
</table>
LIST OF REFERENCES


Forkenbrock D., Road Investment to Foster Local Economic Development, Iowa University Public Policy Center, Iowa City, Iowa, 1990


BIOGRAPHICAL SKETCH

Born in Elizabethtown, Kentucky, on March 8, 1962, I moved to Frankfort, Kentucky at age 15. I graduated from Franklin County High School in May 1980. I enlisted in the Kentucky Army National Guard in 1981 and began an 11-year career in the military. In December 1982, I enlisted in the United States Army where I began my active military career. Over the next 10 years I was stationed in various military installations beginning in Fort Carson, Colorado; West Germany (FRG); Sam Houston, Texas; Fort Drum, New York; and ending my military career in Kansas City, Missouri in 1992. My duties in the Army encompassed several leadership positions with an emphasis as a medical specialist with flight training. While in the Army my first two children were born including Rachel Anne Hawkins (born on March 26, 1986 in Stuttgart, FRG); and Beatrice Rose (born on September 29, 1989 in Watertown, New York). After my divorce in 1994, I managed several retail establishments and returned to college to complete a degree that I had begun in 1980.

During this time, I met my current wife; and my third child, Quinton Zachary Vitelli-Hawkins, was born on August 25, 1999. In May 2000, I graduated from Tennessee State University, Summa Cum Laude, with a B.A. in History with licensure to teach. In the summer of 2001, I was selected as a Teacher Educator for the US Space Program at the US Space and Rocket Center in Huntsville, Alabama. I was awarded a Master of Science degree in geography (with emphasis on geographic technologies) from the University of Florida in May 2005.