Our Students and Alumni:
Where Do They Come From and Where Do They Go

Prepared for:
The Intellectual Capital Partnership Program
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Prepared by:
William J. Drummond
City Planning Program
Georgia Institute of Technology

Jan L. Youtie
Center for Economic Development Services
Economic Development Institute
Georgia Institute of Technology

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Preface

Georgia Tech has long played a significant role in the economic development of Georgia. This report represents one of a series of ongoing research efforts designed to identify ways to increase utilization of the state's resources and to target new industries that can profitably use the state's resource base.

This economic development research program operates through the Governor's Office with state funding. Its goal is to enhance the development opportunities in counties and communities throughout Georgia—with greatest attention given to underdeveloped areas—by pinpointing significant investment possibilities based on a particular area's comparative advantage. The program also strives to assist policy decision-making and to help governmental organizations carry out their missions through in-depth research.

Criteria for project selection include:

- requestor commitment to participate in the analysis and implement the results
- ability to impact economic development in the short term
- ability to show measurable benefits from the research, e.g., jobs, investment
- ability to spread the benefits over a multi-county area.

Economic development is by nature and necessity a team endeavor. The combined skills and energies of Georgia Tech researchers and engineers, state and local officials, and resource development specialists will complement existing efforts to foster a healthier economy and to better the quality of life for all of Georgia.

Questions and comments concerning this report should be directed to Jan Youtie, Principal Research Associate, Economic Development Services, Economic Development Institute, Georgia Institute of Technology, Atlanta, GA 30332; (404) 894-6111. Questions about the Economic Development Research Program (EDRP) should be directed to Robert Lann, Project Director, Center for Economic Development Services, Economic Development Institute, Georgia Institute of Technology, Atlanta, GA 30332; (404) 894-3475.

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ECONOMIC DEVELOPMENT RESEARCH PROGRAM

Center for Economic Development Services
Georgia Institute of Technology
205 O'Keefe Building
Atlanta, GA 30332

Advisory Board

Foreword

The report for each study conducted under the Economic Development Research Program has a standard organizational format. The main body of the report is preceded by a summary of major findings. A list of references follows the main body of the report. These references are organized alphabetically. When it is necessary to cite a specific reference, the author and date corresponding to the citation in the reference list are included in parenthesis at the end of the sentence where the reference is cited, for example (Clark 1997) would cite a 1997 publication by an author whose last name is Clark. Arranging the reference list alphabetically makes citations easier to find. Also, some of the entries in the reference list may not be cited in the text.

Items such as survey questionnaires, lengthy lists or tables, and other supporting research materials are normally included in an appendix at the end of the report.

Acknowledgements

The authors gratefully acknowledge the following individuals for their assistance with this project. The Georgia Department of Labor's Workforce Information and Analysis Unit was vital to obtaining employment security information for University System alumni. This was the first-ever effort to link administrative records from the University System and the Georgia Department of Labor. Assistant Commissioner Amelia Butts and her staff at the Georgia Department of Labor and Assistant Vice Chancellor Annie Hunt Burriss, Associate Vice Chancellor Cathie Mays Hudson, and their staff at the Board of Regents made the idea of this linked database a reality.

Raw information can be useful, but it becomes much more useful when it is supplemented with good interpretation. Efforts to understand the meaning behind the numbers were greatly assisted by insights from Chancellor Stephen R. Portch, Senior Vice Chancellor Daniel S. Papp, and Assistant Vice Chancellor Annie Hunt Burriss. In addition, valuable comments were obtained from the members of the Board of Regents at the March 6, 2001 meeting. Nevertheless, the judgments in this report reflect those of the authors, and not necessarily those of the Georgia Institute of Technology or the sponsor.

Executive Summary

For the past five years, the Board of Regents of the University System of Georgia (USG) through the Intellectual Capital Partnership Program (ICAPP) has asked Georgia Tech to examine the relationship between the demand for workers in various occupations and the supply of postsecondary institutional program graduates. This report seeks to address these issues by concentrating on two fundamental questions: (1) Where do our graduates come from and where do they go to take jobs? and (2) Are there enough USG graduates in high-demand occupations?

USG student origins and employment were obtained by matching graduate records from the 1993-1997 time period with employment information from the Georgia Department of Labor's ES-202 database system in 1998. At least 72 percent of USG graduates from 1993 to 1997 were located in the Georgia workforce database in 1998.

The GIS analysis showed that most graduates came from metro Atlanta and returned there for employment, where a majority of the state's population and employment is located. However, most USG institutions also served the economies of well-defined local regions. As much as 85 percent of all USG graduates working in one local region attended a single USG institution. Without the presence of the local USG institution, a modest segment of in-migrants might have left the area, as might some of the students of local origin who stayed to work in the region.

The analysis also found that certain institutions served broader regional or statewide geographic areas. These institutions tend to concentrate on certain technological instructional programs or attract students of certain backgrounds, and these concentrations are reflected in their missions. On a statewide or regional basis, there appears to be a high enough concentration of students with the particular background or educational interests to justify a USG institution with a more specialized mission, whereas a sufficient concentration may not existing in a given locally. The cross-migration analysis confirmed the policy decisions of the Board of Regents about the distinctive missions of these specialized USG institutions.

Regarding high-demand occupations, the occupational shortfall analysis showed that USG was doing a good job of supplying the employment needs of a wide range of occupations. Very few occupations requiring college educations were projected to have significant numbers of unfilled openings.

The information technology (IT) area was the exception. The analysis estimated annual shortfalls of nearly 1,400 systems analysts, computer programmers, and systems engineers from 1996 to 2006. This is a national problem, notwithstanding the recent decline in the dot-com sector, because information technology has become integrated into the business strategies of "old economy" firms as well as high-tech firms.

University System graduates filled half of the state's systems analyst openings on average from 1997 to 1999 and a sizable minority in the other two occupations. Nevertheless, positive net migration into Georgia has filled a significant share of employment demand, particularly in the computer programming and systems analyst areas. Although out-of-state workers migrate along with companies opening new facilities in Georgia, it is possible that Georgia is relying on out-of-state workers and their continued interest in moving to Georgia to fill critical IT job openings. The relationship between job openings and out-of-state migrants should be monitored.

Section 1

The Human Capital Investment Problem

Universities can be viewed as engines of economic development. Feiock and Storm (1996) found that increased state appropriations for higher education have positive long-term effects on wages, personal income, and gross state product. Bardo (1999) has enumerated several ways that universities contribute to economic development, including human resource development, advanced technology development, applied research, technology transfer, and business development.

Despite the significance of the higher education-economic development link, economic development is rarely used to benchmark and guide higher educational institution curriculum decisions. Individual departments and institutions make decisions to add or expand instructional programs. Economic development has not traditionally been a major factor in these considerations.

The labor shortages and rise of the knowledge economy of the last several years have placed attention on the role of curriculum decisions in the university-regional economy relationship. Examining the importance of an educated workforce to the economy is not new. Schultz (1961) and Becker (1964) popularized the notion of human capital in demonstrating how investing in an individual's education and training is similar to business investments in equipment. Romer (2000) has made much of the significance of human capital in the knowledge economy, proposing that universities subsidize the supply of science and engineering graduates.

Human Capital and Information Technology Shortages: the Studies

Recent human capital issues have focused on the shortage of IT specialists, although the lack of certain teaching and nursing occupations has at one time or another also been raised. The degree to which labor shortages—especially shortages of IT specialists—are more severe than normal has been controversial. Most of the debate took place against the framework of political conflict over the proposed expansion of the H-1B temporary visa program for foreigners in specialty occupations. Industry associations such as the Information Technology Association of America (ITAA) furnished information about the high demand for IT workers. An ITAA-sponsored survey of 685 IT managers projected a shortfall of 425,000 positions in 2001 (half the size of the previous year's figure) out of a total of 900,000 IT positions. (ITAA 2001) Much of the demand in

sheer numbers came from "old economy" firms, which accounted for 74 percent of the 425,000-worker gap. Similarly, the U.S. Department of Commerce's Office of Technology Policy (OTP 1997), drawing in part on previous ITAA surveys and data from the U.S. Bureau of Labor Statistics, also found a shortfall of 95,000 computer scientists and engineers, systems analysts, and computer programmers between 1994 and 2005.

A major point in these studies was that colleges and universities have failed to supply enough graduates to keep pace with the rising demand for IT workers. The OTP study identified a 40 percent drop in U.S. students earning bachelor's degrees in computer and information sciences, which, along with rising wages and vacancy rates, led to the conclusion that there was a shortage of IT workers. Platzer (1998) argued on behalf of the American Electronics Association that there was a 29 percent decline in the number of high-tech degrees conferred by U.S. educational institutions between 1985 and 1995, in contrast to a projected doubling of demand for IT specialists from 1996 to 2006.

Methodological Critiques

The methodologies used in these studies have been subjected to rigorous review. Weinstein (1998) criticized the focus on the lack of supply and its underlying argument about the demographics of the smaller "baby bust" generation. Freeman and Aspray (1999) questioned the emphasis on degree requirements in addition to the inadequacy of non-governmental surveys, lack of timeliness of federal government data, and poor occupational descriptions. Lerman (1998) also argued that the seriousness of the IT shortage was inconclusive in part because these studies did not consider other sources for filling IT positions besides degree requirements. The U.S. General Accounting Office (1998) cited the need for further information to corroborate an IT worker shortage, including alternative supply sources. However, while many of the critiques emphasized that computer and information sciences degrees are not mandatory for becoming an IT professional, by far the largest percentage of IT workers had bachelor's degrees or higher in computer science, with the next largest shares coming from related degrees in business and engineering.

The Role of Geographic Mobility

While the national debate centered on the supply of foreign immigrants, some states have targeted workers in other areas of the country and encouraged them to migrate. For example, the Atlanta Chamber of Commerce advertised for high-tech workers in media in Boston and Chicago, and in turn Greater Louisville Inc. set up events to recruit Atlanta area high-tech workers back to Louisville, Kentucky. (Lewis 2000, Poole 2001)

Do college and university graduates, especially those with IT degrees, stay or leave the regional workforce? The Oklahoma State Regents for Higher Education (2000) reported that 75 percent of 1993-1994 graduates remained in the state labor force five years after graduation, but this percentage was higher for education majors (87 percent) than for computer science majors (62 percent). Tornatzky et al. (1998), comparing interstate migration rates across all 50 states, found substantial disparities across states. Science and engineering graduates of colleges and universities took jobs in or moved to other states at rates ranging from 16 percent to 90 percent depending on the state in which the college/university is located. (Georgia was found to have less than 33 percent out-migration of science and engineering graduates.)

Recent downturns in the economy in general and the technology sector in particular raise additional concerns about whether further investments in IT instructional programs are necessary. Many dot-com companies have folded and even more established technology-oriented companies such as Motorola and Cisco have announced massive layoffs. Is there a real human capital shortage or was it a function of a temporary, albeit longer-than-average, expanding economy? Although workforce needs are not the only reason for making instructional programming investments, if shortages do exist, how can such shortages be monitored to guide instructional programming investments? And in which geographic locations around Georgia should these investments be made in a way that will retain the value of these investments after graduation?

Two Fundamental Questions

This report seeks to address these issues by concentrating on two fundamental questions:

1. Where do our graduates come from and where do they go to take jobs?
2. Are there enough graduates in high-demand occupations?

For the past five years, the Board of Regents of the University System of Georgia (University System) through the Intellectual Capital Partnership Program (ICAPP) has asked Georgia Tech to examine the relationship between the demand for workers in various occupations and the supply of postsecondary institutional program graduates. (Drummond and Youtie 1997, 1999) Each report has sought to improve on the methodology used in the previous report by adding information about other suppliers of higher educational graduates (such as the Georgia Department of Technical and Adult Education) and making estimates about net-migration of employees into Georgia.

This report incorporates regional projections into the analysis. It enables an examination of movement of graduates within the state to determine whether students do stay to take jobs near the institution from which they graduated. While previous reports could only validly show a statewide view of supply and demand, this study furnishes a regional perspective.

Report Organization

Section 2 addresses the question of intra-state student migration to and from USG institutions through geographic information analysis (GIS). Section 3 examines the relationship between supply and demand, with a particular emphasis on the information technology programs and occupations. Regional supply-demand imbalances are also presented. Section 4 concludes by reflecting on answers to the aforementioned two fundamental questions.

Section 2

Student-Employee Cross-Migration Analysis

What Is Cross-Migration Analysis

Cross-migration analysis examines the movement of college graduates from home to USG institution and from USG institution to employer. (Goetz 1999) It addresses questions such as do a USG institution's students come from around the state or from the school's local area? When they graduate, do they take jobs near their former college or university?

The cross-migration analysis uses two main information sources: alumni student records and employment records. Basic information about USG alumni was obtained from the University System's Student Information Reporting System (SIRS) database. It was then matched with employment records in the Georgia Department of Labor's ES-202 database. The Georgia Department of Labor provided ES-202 data from the last quarter of 1997 to the first quarter of 1999. However, only quarterly data from 1998 was included in this analysis because of the need for a complete year of information. Student records after 1997 were eliminated as well to avoid examining persons not yet in the workforce full time. Also excluded were records for students graduating before 1993 because they were likely in a different stage of their career than those in the 1993-1997 time frame.

At least 72 percent of USG alumni graduating in the 1993-1997 time period (116,351 graduates) were found in the Department of Labor database as working in Georgia in 1998. The percentage of alumni located in the ES-202 database varied considerably across institutions, ranging from 47 percent to 88 percent.

In reality, the percentage of USG alumni working in Georgia during 1998 was higher than 72 percent, but limitations of the ES-202 database precluded the inclusion of an unknown number of additional workers in the analysis. By definition and law, the ES-202 system excludes self-employed persons, small and self-employed farmers, members of the armed forces, employees covered by railroad unemployment insurance system, some state/local workers, certain domestic workers, some non-profits (e.g., religious organizations), stay-at-home parents, and out-of-state employees. It contains records from private firms with at least one employee, most state and local public employees, agricultural firms with over nine employees, and certain domestic workers. Nationwide,

the ES-202 system covers more than 96 percent of wage and salary jobs and 92 percent of national income, but there are state-by-state variations.

It should be noted that the ES-202 system contains a small amount of basic information. Only employer name, address, industrial classification, and wages can be obtained. Although this limits the inferences that can be made from the data, (White et al. 1990, Haltiwanger et al. 1998) it does enable geographic tracking of USG graduates from their county of origin to their place of employment.

How Draw and Service Areas Were Defined

Each of the 34 institutions in the University System of Georgia tends to attract higher numbers of students from some areas of the state and lower numbers from other areas. For the purposes of this analysis, each institution's *draw area* can be defined as the subset of Georgia's 159 counties that contributes a "substantial" number of the incoming students who will later become graduates of that institution. Because of the great variety of institutional sizes and missions, it would be very difficult, if not impossible, to establish a single standard for what constitutes a "substantial" number. It is also important to note that the draw area analyses conducted for this report include all graduates of an institution, but not all students. Students who do not graduate have been excluded to maximize compatibility between the student-to-institution draw area analysis, and the institution-to-job service area analysis.

Three major factors will affect the location and shape of each institution's draw area. The first is the mission of the institution. Some institutions target students in their local areas, others within broader regions, and still others have a statewide mission. Some institutions target a particular type of student, such as those who wish to major in engineering or agriculture. Some institutions have a special demographic target, such as the state's historically black colleges and universities.

The second factor affecting an institution's draw area is the overall distribution of the state's population, in particular the number and quality of high school graduates. Georgia's five largest counties, Fulton, DeKalb, Cobb, Gwinnett, and Clayton, are all in the Atlanta area, and together total over 2.9 million persons, more than 35 percent of the entire state's population. At the other extreme, 32 of Georgia's counties have populations

of fewer than 10,000 persons, and the smallest (Taliaferro) has only 2,077 (U.S. Census, 2000). Because of this disparity, every institution's draw area will, to a greater or lesser extent, tend to reflect the overall distribution of the state's population.

The third factor is the location of the institution itself. For reasons too numerous to detail, even those institutions with specialized, regional, or statewide missions will tend to draw more students from local areas than they do from similar, but more distant ones.

Because of these complexities, the draw areas for each of the 34 institutions are represented on two separate thematic maps. The first map shows the actual number of an institution's graduates that was drawn from each of the 159 counties. Not surprisingly, the larger the institution and the greater the geographic area targeted by the institution's mission, the more strongly this map will reflect the overall distribution of the state's population of high school graduates.

The second map takes the number of the institution's graduates drawn from each county and converts it to a percentage of the total number of all USG graduates drawn from that county. Some individual institutions, for example, draw over 50 percent of all USG students from certain counties, and from the perspective of a high school graduate in one of those counties, that institution tends to dominate student preferences within institutions the University System of Georgia. These maps show, county by county, the relative importance of individual USG institutions from the viewpoint of a high school senior. Together, the two maps show the importance of each county for a specific institution, in terms of both actual numbers and relative importance.

Each institution's *service area* can be defined as the subset of Georgia's 159 counties within which a "substantial" number of an institution's graduates go to work after graduation. Again, due to the great variation in the size and mission of the 34 USG institutions, no single definition of "substantial" is proposed.

The location and shape of each institution's service area will depend upon four factors: (1) the overall spatial distribution of job openings for recent college graduates across the state, (2) the specific spatial distribution of jobs in the occupations that may be targeted by institutions with specialized missions, (3) the geographic location of the

institution, and (4) the predominant areas of origin for the institution's individual students.

Each institution's service area is described by two thematic maps similar to the draw area maps. The first shows the raw number of the institution's 1993-1997 graduates found to be employed in each of Georgia's 159 counties during 1998. The second maps the number of graduates employed in each county, divided by the total number of all USG graduates employed in that county. The first map shows the influence of the overall statewide distribution of employment, while the second map depicts the relative importance of the graduates an individual institution for the local economy.

Together, the four maps for an institution provide the tools to answer the questions, where do an institution's graduates come from, and where do they go to work after graduation.

Findings

Atlanta Dominates Draw and Service Areas

The analysis reflected the dominance of Atlanta in the state's population and employment bases. In sheer numbers, Atlanta served as a primary draw area for most of the 34 USG institutions' graduates in the 1993-1997 time period, and it also employed a large number of these institutions' graduates in 1998.

No one institution had a dominant share of USG-educated students from Atlanta and no one institution supplied the lion's share of graduates to Atlanta's labor pool in 1998. Georgia State University (GSU), as a downtown commuter school, came the closest to having served and placed the largest share of USG graduates in metropolitan Atlanta. GSU educated 30 to 45 percent of USG institution graduates from Fulton and DeKalb counties. And GSU placed 15 to 26 percent of USG institution graduates in jobs in Fulton, DeKalb, Cobb, Gwinnett, and Clayton counties. Given metropolitan Atlanta's size and the fact that eight USG institutions are located in metro Atlanta counties, it was clear that no single institution serves as the primary provider of graduates to metropolitan Atlanta.

Most USG Institutions Serve Defined Local Economies

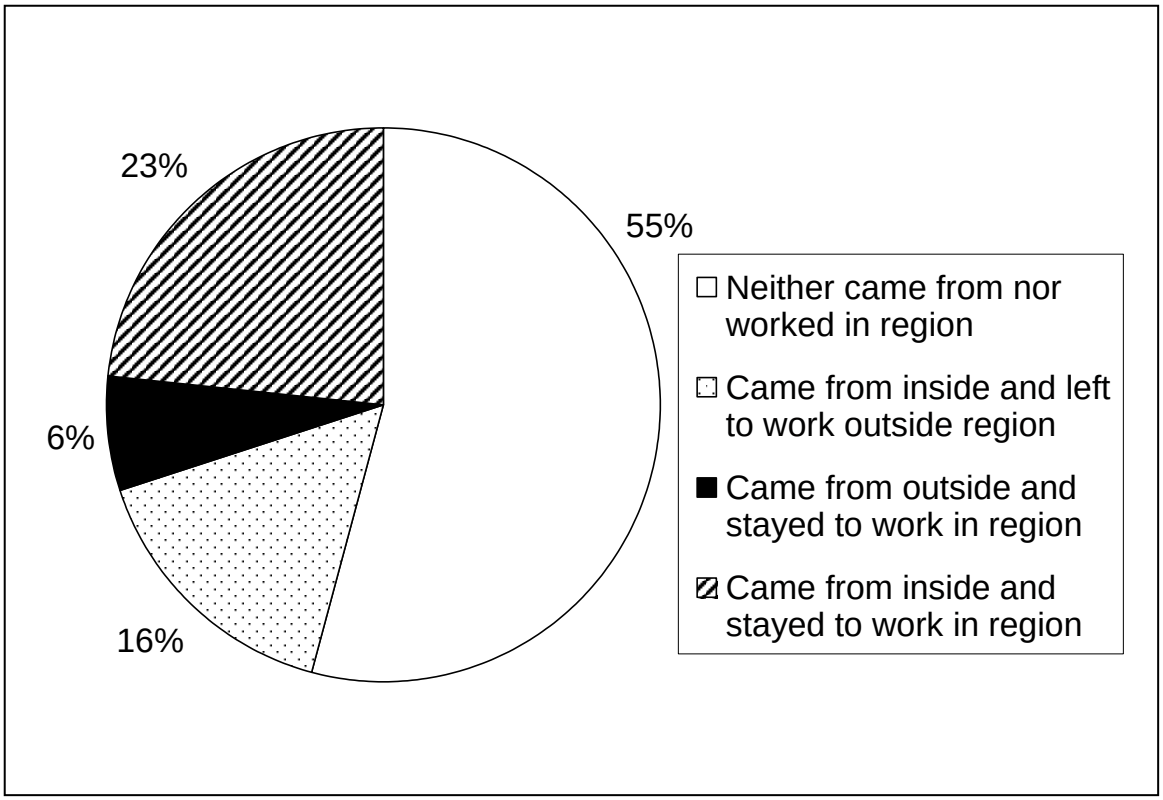
In many instances, however, the geographic location of the institution made a difference. Most institutions have strong connections to their local region. We have illustrated this cross-migration pattern through a GIS analysis of Georgia Southern University's graduates. A second pattern concerns institutions with distinctive statewide dealings; Southern Polytechnic State University is an example of this broader cross-migration pattern. It is also worth looking at the cross-migration patterns associated with the two land-grant institutions—University of Georgia and Fort Valley State University. The results of these four GIS analyses are described below.

Georgia Southern University represents the majority of USG institutions that serve a defined regional economy. Although many Georgia Southern students came from Atlanta, there was a critical draw area composed of 19 counties in southeastern Georgia where at least 25 percent of the USG graduates in those counties went to Georgia Southern. A similar pattern emerged when looking at where Georgia Southern's graduates went to work. Georgia Southern's influence was particularly strong in seven of the 19 counties. More than half of all USG institution graduates from these seven counties went to Georgia Southern, and likewise more than half of all USG institution graduates working in these seven counties were Georgia Southern alumni. Overall, the 19 southeastern counties can be thought of as the local area where Georgia Southern graduates have a significant economic impact. (See Maps 1-4.)

Do students migrating from metropolitan Atlanta and elsewhere to go to school at Georgia Southern stay in the 19-county southeastern Georgia region to take jobs? A more detailed analysis of Georgia Southern students suggests that the university had a modest, but not insignificant, effect on keeping students employed in the region. The analysis examined more than 9,500 Georgia Southern students who graduated in the 1993-1997 time frame and who were located by the Georgia Department of Labor in the 1998 workforce. Graduates were divided into four categories: (1) those who came from outside the 19-county region who left the region to take jobs, (2) those who came from outside the region and stayed to take jobs, (3) those who came from inside the region and left to take jobs, and (4) those coming from and staying in the region. (See Figure 2.1).

On the surface, these numbers do not appear comforting for advocates of the "if they come, they will stay" hypothesis, because locals who left outnumbered outsiders who stayed by over two to one. However, the raw numbers do not tell the whole story, because if Georgia Southern had been located elsewhere, the region would probably have lost many of those 612 in-migrants, as well as some of the 2,230 students of local origin who stayed to work in the region. A more practical way of looking at the numbers is to focus on Georgia Southern alumni working in the local area. Of those 2,842 alumni, one in five came from outside the 19-county region. This finding suggests that Georgia Southern did have some impact on retaining a segment of out-of-area students, although further analysis (e.g., logistic regression controlling for distances and numbers of job openings) could improve ability to distinguish the effects of county of origin and institutional location.

Figure 2.1. Georgia Southern Graduates 1993-1997 Working in 1998: County of Origin vs. County of Work
(9,507 graduates in the Georgia Department of Labor Database)



Most USG institutions have draw and service area patterns similar to those of Georgia Southern. The number of counties in the draw and service areas may be smaller or larger and the intensity of the institution's presence may vary. Nevertheless, it is clear that, in addition to the "Atlanta" effect, USG institutions largely draw from and serve distinct local regions.

Institutions with Technological Missions Draw and Serve Students Statewide

Among the exceptions to this local economy association are Southern Polytechnic State University (SPSU) and Georgia Tech. SPSU is located in Cobb County north of Atlanta, but it really has a statewide draw and service area. SPSU's students graduating in the 1993-1997 time frame tended to come from all over the state, with some concentrations in the Atlanta area, northwest Georgia, and the other next-tier metropolitan cities (e.g., Augusta, Macon). Similarly, SPSU-educated employees were working all around the state and not concentrated in any one region. In other words, SPSU accounted for fewer than 5 percent of the USG institution graduates originating from and working in any single Georgia county (Towns County excepted). Georgia Tech also followed this pattern. Georgia Tech accounted for fewer than 14 percent of any one county's originating graduates and fewer than 11 percent of any one county's USG institution-educated employees. SPSU and Georgia Tech fulfill technical educational and employment needs of a select number of students who are scattered throughout the state.

Land-grant Institutions Have Distinctive Migration Patterns

The state's two land-grant institutions, University of Georgia and Fort Valley State University, demonstrated noteworthy cross-migration patterns. Fort Valley State University, with a mission to serve primarily the educational needs of black students, drew graduates from the majority of counties in middle Georgia along the historic cotton belt, and similarly served the employment needs of these counties, although some students also came from and went to metropolitan Atlanta. Fort Valley's importance to this broader set of counties was less intense, however, with percentages of USG graduates and employees ranging from 9 to 43 percent; only two of these counties had percentages of Fort Valley graduates in the 22-to-43 percent range. The GIS analysis on

the whole shows that Fort Valley's distinctive mission gives it a broader service area than most of the other USG institutions have.

In contrast, the University of Georgia had a surprising regional flavor to its draw and service areas. While large numbers of its students came from and took jobs in metropolitan Atlanta counties (and to a lesser extent, other metropolitan areas in Georgia), the university was very important to the economies of counties in northeastern Georgia. Fourteen counties in northeastern Georgia sent at least one-third of their USG institution-bound students (who graduated in the 1993-1997 time period) to the University of Georgia and employed (through local companies) at least one-third of their USG institution graduates from the University of Georgia. For four of the counties, the University of Georgia educated 60 to 85 percent of their USG institution-educated students and supplied 60 to 85 percent of employees with USG institution degrees. As the only USG institution in the region, University of Georgia is particularly important to these northeastern counties.

In summary, this analysis has showed that most USG institutions have important ties to their local region. Notwithstanding the dominance of Atlanta, most institutions draw and place many of their students locally. Certain institutions have broader regional or statewide missions, those with technological missions in particular, but on the whole, the location of the institution matters

Section 3

Occupational Shortfall Analysis

How Occupational Shortfall Analysis is Done

In a general sense, occupational shortfall analysis is methodologically straightforward. Occupational shortfall represents the number of projected job openings that will go unfilled in a given year. It comes come from a basic formula: occupational shortfall equals (1) projected demand (job openings in occupations estimated by the Georgia Department of Labor), (2) minus the number of available Georgia postsecondary institution graduates by major, (3) plus net migration (the number of migrants into the state less the number leaving the state). This analysis is subject to certain limitations, described in this chapter. Despite these shortcomings it does provide a potentially valuable tool for planning and managing USG curriculum programs.

How Occupational Demand Is Forecast

The particulars of the analysis are more involved. The aim of projected demand is to show long-range changes in future employment. While the projections do not pick up spikes or drops in business cycles and certain changes in policy, business practice, or technology, they do reflect persisting generational, demographic, and economic trends over a 10-year period.

Projected demand comes from sophisticated long-range models that include factors for the size and demographic composition of the labor force, the growth of the aggregate economy, final demand or gross domestic product (GDP), inter-industry relationships (input-output). The model estimates employment for 262 industries, then applies an industry-occupational staffing pattern matrix to produce projections for more than 800 occupational employment statistics (OES) codes. Surveys of employers every three years by the Georgia Department of Labor furnish information for this estimation process.

The projections provide base and projected year estimates as well as what is used for this analysis, annual openings. Annual openings are the number of job openings estimated yearly from the base to the project year, and they enable comparisons to be made with other annual data over the time period. Annual openings reflect economic growth and replacements, but do not cover persons leaving the state, persons leaving the labor force, and persons changing occupations.

What Is Counted in Occupational Supply

Occupational supply analysis considers the number of graduates by major from all postsecondary educational institutions in the state of Georgia. These institutions include USG institutions, private colleges and universities, the Georgia Department of Technical and Adult Education (DTAE), and nonprofit and proprietary technical institutions.

The Integrated Postsecondary Education Data System (IPEDS) serves as the primary data source for occupational supply analysis. Administered by the National Center for Educational Statistics (NCES) of the U.S. Department of Education, IPEDS includes national, state, and institution-level information (such as enrollment program completion, faculty, staff, finances, and academic libraries) from some 12,000 postsecondary institutions. The occupational supply analysis focuses on the classification of instructional programs (CIP). The CIP represents all primary fields of study leading to degrees or certificates. There are nearly 900 such classifications.

The supply of graduates from non-USG institutions was obtained from the 1997-1998 IPEDS national database, the most recent available year. The number of graduates from USG institutions was calculated from the USG SIRS database by averaging the graduates from 1997, 1998, and 1999. Not all graduates, however, actually enter the Georgia labor force. Some leave the state for jobs elsewhere while others may still reside in the state but choose, for a variety of reasons, not to work. If the shortfall analysis were to use the total number of graduates it would over-estimate the annual supply of graduates, and thereby underestimate potential shortfalls.

To overcome this problem, the full list of 1997 USG graduates was compared to the smaller list of 1998 USG graduates identified in the Georgia labor force, and the percentage of retained graduates was calculated for each of the 34 USG institutions. These percentages were then used to modify the actual number of graduates to reflect the varying retention rates among the 34 institutions. For non-USG institutions similar labor force retention information was not available. Instead, each USG and non-USG institution was classified by level of highest degree offered (doctorate, professional masters degree, etc.) and the retention percentage for all USG graduates from one class of USG institution were applied to all non-USG institutions of the same class, with eight exceptions. The Savannah College of Art and Design, Spelman College, Covenant

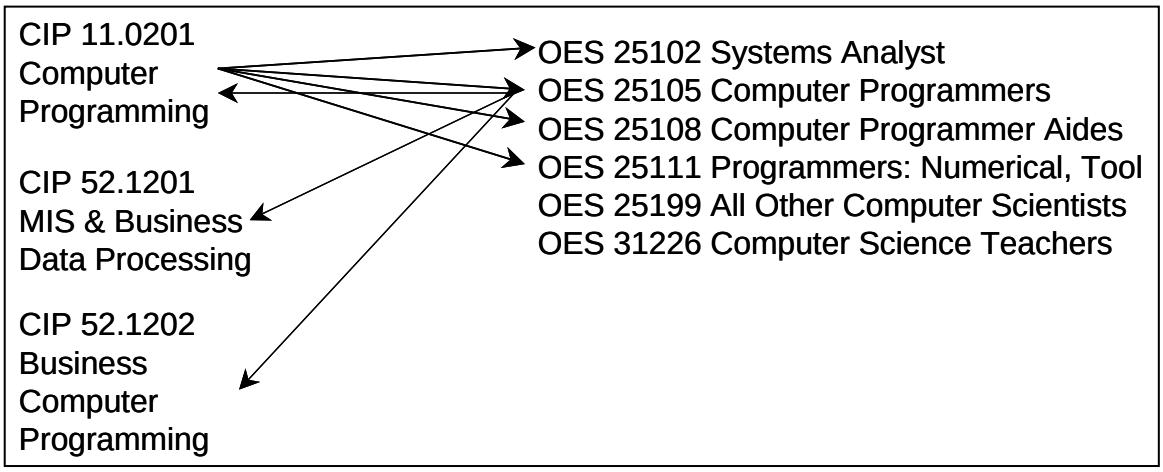
College, Morehouse College, Emory University, Toccoa Falls College, Bauder College, and Clark Atlanta University all obtain over 65 percent of their students from outside the state of Georgia. Within the USG institutions, the highest percentage of out-of-state students is only 35 percent (at the Georgia Institute of Technology). It would be unrealistic to apply USG retention rates (which include a substantial majority of Georgia students) to these eight schools, which have very low numbers of Georgia students. As a group, the eight outlier schools have 25 percent of their students from Georgia, so the analysis has used 25 percent as a more realistic estimate of their workforce retention rates, as opposed to the much higher rates for the USG institutions in the same class.

Postsecondary institution graduates do not fill all entry-level jobs associated with college degrees. People who move into the state (in-migrants) fill some of these jobs. This is critical for Georgia, which ranked second behind Florida in number of domestic net-migrants. (See Appendix 2.) We employ the concept of net-migration, which is the number of in-migrants less the number of out-migrants. Annual net-migration rates for each of the Census defined occupations were derived from the 1990 Census Public Use Microsample (PUMS) dataset and applied to the most recent Georgia Department of Labor occupational employment estimates. The rates were based on place of residence between 1985 and 1990 and apply to Standard Occupational Classification (SOC). The census SOC categories were then applied to the OES categories through a crosswalk database.

To link the major occupational and instructional classification systems used by the federal government, a crosswalk translation database from the National Crosswalk Service Center has been used. The crosswalk database contains a listing of all occupations served by each educational program. Some of these relationships are simple (one OES to one CIP), but some are more complex, having one-to-many or many-to-many relationships. Figure 3.1 shows an example of a many-to-many relationship. Computer programming majors are likely to take jobs as systems analysis as well as computer programmers. In turn, computer programmers, as well as MIS and business data processing majors and business computer programming majors, may attain computer programmer jobs. Quantitative information about how each program's graduates are distributed among the relevant occupations is not included in the crosswalk. This analysis

distributes graduates from each program in proportion to the total annual openings for each occupation.

Figure 3.1. Example of Crosswalk for Computer Programmers Occupation and Computer Programming Major



Findings

Most Occupations Have Few Unfilled Job Openings

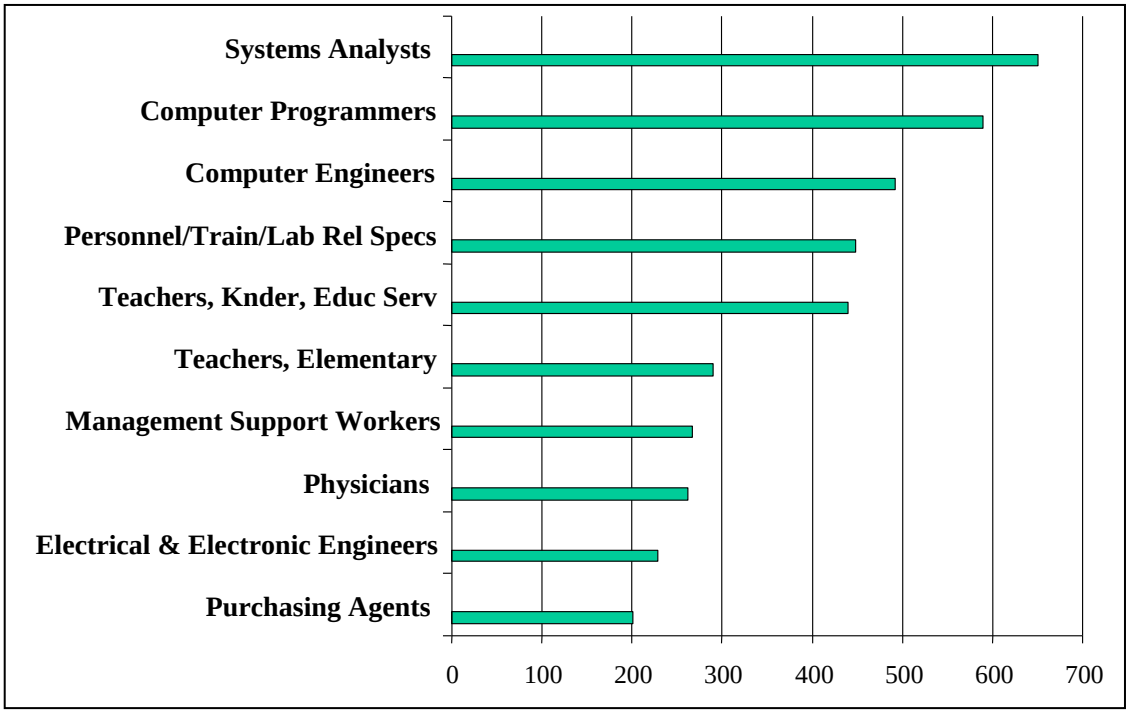
Figure 3.2 shows the results of the subtraction, that is, the estimated number of annual unserved openings by occupation for occupations with substantial numbers of such openings. (Table 3.1 shows a more extensive list of occupations with shortfalls.) The most obvious finding is that most of the occupations are not even listed in the chart because they are well served by USG, other postsecondary institutions, and net-migration. For a good number of occupations from 1996 to 2006, their job openings will likely be filled.

Certain IT Occupations Need Trained Specialists

The major exception to the lack of unfilled demand for college-associated occupations is the IT category. Consistently, and despite the university system's quick response efforts to ramp up IT programs, three IT occupations—computer programmers, computer engineers, and systems analysts—continue to show significant annual shortfalls. Together these three occupations have an estimated annual shortfall of nearly 1,400 unserved openings. What are these occupations? According to the U.S. Department

of Labor, computer programmers write, test, and maintain detailed instructions called code, programs, or software. Systems analysts serve as an interface between users and programmers to identify and solve business problems with hardware and software in various functional application areas such as financial or human resources using either new or off-the shelf products. Computer engineers design and build hardware and/or software prototypes to solve problems in functional application areas.

Figure 3.2 Occupations with Largest Annual Shortfalls



The annual shortfalls for systems analysts, computer programmers, and computer engineers are estimated at 652, 591, and 494, respectively. The shortfalls in these three occupations are ameliorated, in part, by an oversupply of 356 in the broader, related occupation of computer scientists, not otherwise classified (OES 25199). When all four of these closely related occupations are considered together, the total, annual shortfall is 1,381 positions.

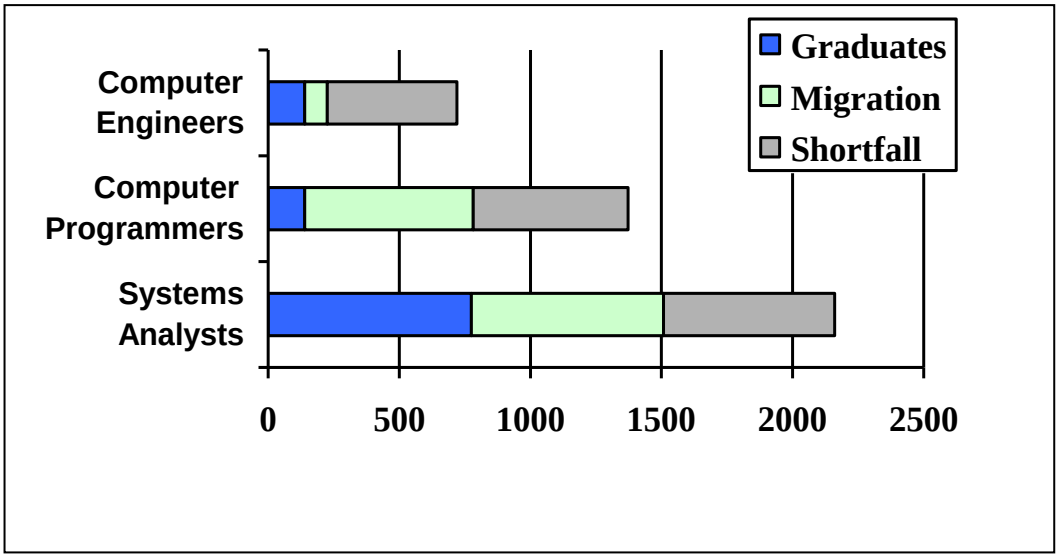
Table 3.1. Occupations with Statewide Shortfalls of More than 100

Occupational Title	Openings	Graduates	Inmigrants	Shortfall
Systems Analysts	2,161	775	733	652
Computer Programmers	1,373	140	642	591
Computer Engineers	720	139	87	494
Personnel/Train/Lab Rel Specs	722	102	169	451
Teachers, Knder, Educ Serv	940	13	485	442
Teachers, Elementary	2,235	1,149	794	292
Mgmt Support Workers, NEC	662	134	259	270
Physicians	794	197	333	264
Electrical & Electronic Engineer	535	205	99	231
Purch Agts, Ex Who/Ret/Farm	272	13	56	203
Physical Therapists	327	103	40	184
Public Relations Specialists	252	16	54	182
Designers, Ex Interior	384	76	136	171
Recreation Workers	424	185	71	168
Librarians, Professional	258	10	85	163
Medical Records Technicians	243	22	66	155
Employment Interviewers	213	15	45	153
Property & Real Estate Mgrs	375	24	204	147
Social Workers, Exc Med, Psych	419	167	106	146
Paralegals	275	89	48	138
Social Workers, Med & Psyc	269	107	25	137
Technical Writers	179	13	31	135
Dental Hygienists	287	156	3	128
Teachers & Instructors, NEC	370	5	240	125
Mechanical Engineers	211	119	(17)	109
Vets & Vet Inspectors	107	60	(57)	104

These shortfalls occurred even with a substantial increase in the number of new IT programs at USG institutions. The Board of Regents approved 21 new IT-related degree programs in 11 different institutions from 1996 to 2000. To further examine the estimates for the three main IT occupations, Figure 3.3 shows the main components of occupational supply and demand. It shows (1) annual demand (represented by the overall length of the bar chart), (2) supply of program graduates (the solid segment of the bar), and (3) net migration (the striped patterned segment of the bar), and (4) shortfall (depicted in the white segment). College graduates fill 36 percent of the systems analysts positions, 19 percent of computer engineering positions, and 10 percent of computer programming positions. Migration into Georgia from other states accounts for nearly half of all computer programming jobs, one-third of systems analysts jobs, and 12 percent of computer engineering jobs.

The chart suggests that Georgia has relied on migration from other states to fill a significant share of employment demand, particularly in the computer programming and systems analyst areas. Certainly some out-of-state workers migrate along with companies opening new facilities with new jobs in Georgia. Still, there is a possibility that Georgia is relying on out-of-state workers and their continued interest in moving to Georgia to fill critical IT job openings. The relationship between job openings and out-of-state migrants should be monitored.

Figure 3.3. Graduates, Net Migration, and Annual Shortfall for IT Occupations



In addition to the IT occupations, the shortfall analysis has implications for two other categories of jobs: health care and education. These are discussed below.

Health Care Occupations

The Georgia Health Care Workforce Technical Advisory Committee (2001) issued a recent report entitled "Code Blue: Workforce in Crisis." This report concludes "There is an insufficient number of nurses and other key health care professionals in the current workforce (p. 2)."

The statewide supply-demand analysis identified substantial annual shortfalls in the following health care occupations:

Table 3.2. Annual Shortfall for Health Care Occupations

Occupation	Shortfall
Physicians	264
Vets & Vet Inspectors	104
Physical Therapists	184
Dental Hygienists	128
Medical Records Technicians	155

In all likelihood, the shortfall in physicians is more apparent than real. Other regions of the country, such as New York State, are now reporting a significant oversupply of doctors, and migration from those areas can be expected to help meet any Georgia shortfall. In addition, because of the physician residency requirements and other unique occupational factors extending the period of time that doctors train for practice, the program graduation numbers understate the number of physicians that actually enter the Georgia workforce each year.

Among the health care occupations, the single most surprising finding was the lack of confirmation of a substantial shortfall of registered nurses. The supply-demand analysis shows annual openings for registered nurses to be 2,683, and the annual supply of nursing graduates to be 2,687, and after compensating for those graduates not entering the workforce, the estimated annual supply of registered nurses is 1,983. The final factor is an annual in-migration of 1,186 nurses per year. When demand is compared to supply, the analysis shows an oversupply (not shortage) of 486 registered nurses per year. In

contrast, the Code Blue report argues "Georgia already running a deficit in the RN workforce of 2,000 RNs, and that this shortfall is expected to grow over time (p. 6)." The two findings are not necessarily contradictory because the supply-demand analysis reveals whether each year's supply of graduates and in-migrants is larger or smaller than each year's new openings. It is a separate question whether there is an existing imbalance in the current workforce.

The situation in nursing is further complicated because of two additional factors. First, as the Code Blue report documents (pp. 16-17), wages and salaries for nurses have not increased (in real terms) since 1992. Second, under managed care, the trend has been to increase nursing workloads while nursing working conditions have deteriorated (pp. 17-18). These factors may go a long way in explaining how the supply-demand analysis can show a more-than-sufficient annual supply of new nurses, but in larger and larger numbers those nurses (and existing nurses) are choosing not to work in the nursing profession. If the issues of compensation and work environment are not addressed by the Georgia health care industry, it is unlikely that an increased supply of University System nursing graduates will address the problem.

Education Occupations

The statewide supply-demand analysis found significant teacher shortfalls in kindergarten and related educational services (OES 31304: 940 openings with a shortfall of 442) and elementary education (OES 31305: 2,235 openings with a shortfall of 292). In order to maintain consistency throughout the analysis, these two occupations have been reported separately. However, Georgia does not maintain separate educational programs to serve OES 31304, kindergarten teachers. The kindergarten shortfall and elementary shortfall should be considered together as a single kindergarten-elementary teacher annual shortfall of 734, out of a total of 3,175 openings. The recent and highly innovative "Teach for Georgia" program is addressing this shortfall, in part.

Regional Supply-Demand Analysis

The Georgia Department of Labor also estimates future occupational demand for each of the state's 12 economic sub areas, which are known as service delivery regions (SDRs). To replicate the statewide supply-demand analysis at the regional level requires that graduate supply information also be available by region. A major difficulty arises because the location of a University System institution in a specific region of the state does not mean that all the graduates of that institution will enter the workforce for that region. In fact, for most regions a majority of graduates from institutions in that region will choose to work in other regions of the state. To estimate program supply by region, there must be a way to estimate the flows of graduates from each institution to jobs in each region.

With the acquisition of the Department of Labor ES-202 database, these flows can be estimated for the first time. By identifying 1993 to 1997 University System graduates and locating the county in which they worked during 1998, each graduate's movement from institution to workplace can be tracked, and the percentage of each institution's graduates working in each of the 12 regions can be tabulated. Those percentages are then used to distribute each institution's graduates among the SDRs.

Unfortunately, comparable detailed tracking information was not available for the colleges outside of the University System. Instead, it was assumed that the general pattern of movement for private institutions would be similar to the overall pattern of University System graduates for the region in which the private institution was located. Each private institution's graduates were then distributed according to the aggregate region-to-region percentages calculated by aggregating all University System institutions in each region.

The results of the regional supply-demand analysis, not surprisingly, follow the general pattern of the statewide analysis. Table 3.2 reports all regional shortfalls over 20, except for the Atlanta area where only shortfalls over 100 are given.

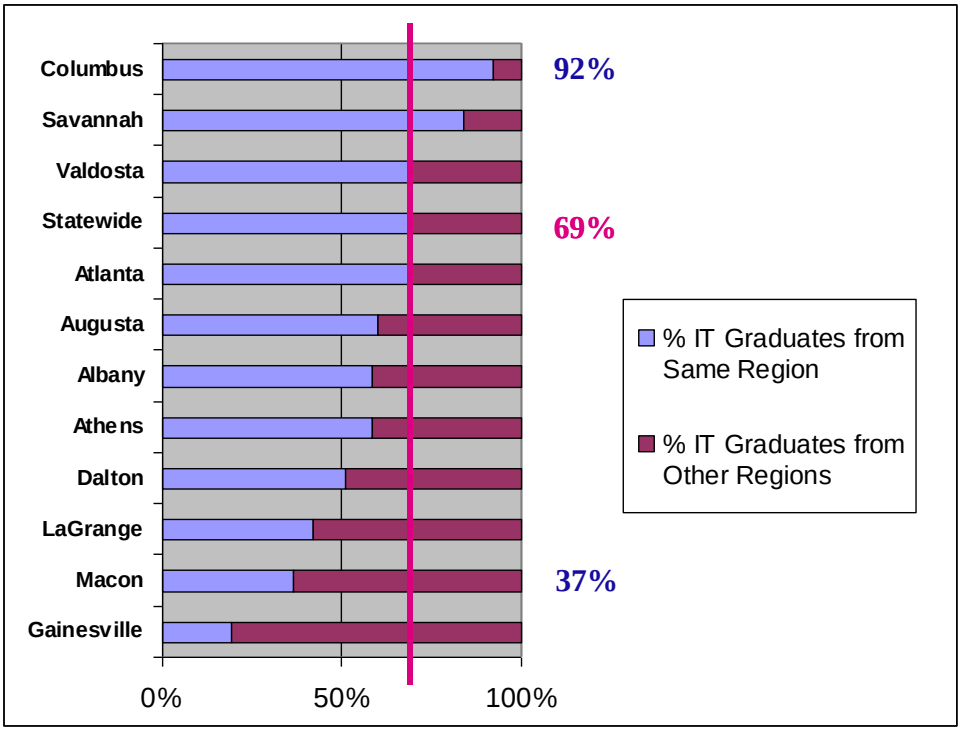
Table 3.3. Regional Supply-Demand Analysis

(table shows occupations with shortfalls over 20 except for Atlanta, Region 3 which shows occupations with shortfalls over 100)

Region	Title	Openings	Graduates	Inmigrants	Short-fall
Dalton, Region 1	Systems Analysts	83	26	31	25
Dalton, Region 1	Teachers, Knder, Educ Serv	59	0	28	31
Dalton, Region 1	Physicians	58	6	20	32
Gainesville, Region 2	Personnel/Train/Lab Rel Specs	34	6	7	22
Gainesville, Region 2	Electrical & Electronic Engineer	28	2	4	22
Gainesville, Region 2	Computer Engineers	32	2	3	27
Gainesville, Region 2	Systems Analysts	101	16	28	57
Gainesville, Region 2	Computer Programmers	68	3	24	41
Gainesville, Region 2	Teachers, Knder, Educ Serv	53	0	21	32
Gainesville, Region 2	Teacher Aides, Paraprof	76	1	54	21
Atlanta, Region 3	Employment Interviewers	140	9	28	103
Atlanta, Region 3	Personnel/Train/Lab Rel Specs	406	52	91	263
Atlanta, Region 3	Mgmt Support Workers, NEC	386	80	143	163
Atlanta, Region 3	Electrical & Electronic Engineer	327	169	58	100
Atlanta, Region 3	Computer Engineers	518	113	60	345
Atlanta, Region 3	Systems Analysts	1453	467	465	520
Atlanta, Region 3	Computer Programmers	972	78	435	459
Atlanta, Region 3	Recreation Workers	217	77	36	104
Atlanta, Region 3	Teachers, Knder, Educ Serv	496	7	234	255
Atlanta, Region 3	Teachers, Elementary	1054	566	334	154
Atlanta, Region 3	Physicians	341	89	141	110
Atlanta, Region 3	Public Relations Specialists	155	9	31	115
Athens, Region 5	Teachers, Knder, Educ Serv	47	0	26	21
Athens, Region 5	Teachers, Elementary	152	38	56	57
Macon, Region 6	Personnel/Train/Lab Rel Specs	33	3	9	21
Augusta, Region 7	Teachers, Elementary	116	21	54	40
Columbus, Region 8	Computer Engineers	27	1	3	22
Columbus, Region 8	Computer Programmers	50	4	25	21
Dublin, Region 9	Registered Nurses	120	45	48	27
Valdosta, Region 11	Physicians	44	3	16	25
Savannah, Region 12	Personnel/Train/Lab Rel Specs	46	1	12	33
Savannah, Region 12	Systems Analysts	92	28	38	26
Savannah, Region 12	Lawyers	43	7	15	21
Savannah, Region 12	Teachers, Knder, Educ Serv	70	1	37	32
Savannah, Region 12	Teachers, Elementary	174	30	59	85
Savannah, Region 12	Physicians	71	6	28	38

It was mentioned that USG institutions have ramped up their IT programs. The alumni tracking data can examine the extent to which IT employees in a region graduated from local USG universities and colleges. Figure 3.5 shows that 69 percent of USG alumni in IT-related occupations graduated from a USG institution in the region where they were working. These percentages varied widely across the state. The percentages were highest for the Columbus region, where ICAPP invested in IT programs to fill job openings in Columbus area companies. More than nine of 10 IT workers in the Columbus region graduated from a USG institution in that region. In contrast, only 37 percent of IT graduates in the Macon region matriculated from an institution in that area, although this percentage will likely rise with the new ICAPP investments in Macon State's IT programs.

Figure 3.5. Percentage of IT Employees Placed by USG Institutions in the Same Region



Occupational Shortfall Analysis Has Significant Limitations

The validity of the occupational shortfall analysis depends on how programs and occupations are defined and categorized, how they are linked through the crosswalk, how

well occupational employment projections hold true, and how much students are willing to take up a major or job associated with a shortfall.

The analysis is most readily interpretable when focusing on shortfalls. At the other end of the spectrum, there are too many factors that may produce apparent oversupplies. For example, many programs at USG institutions are ranked number one or near the top nationwide. These programs attract graduates from all over the world and should not be discouraged from working hard to have such a good reputation. Similarly, programs such as microbiology may appear to have more students than job openings when in actuality a large segment of such students go on to medical school. In the same way, the methodology is most valid for programs with direct occupational linkages. Employers indicate that they value well-rounded talent, (Youtie and Ford 1996) but programs such as general humanities, which contribute to well roundedness, have no direct occupational association. There are many valid reasons for instructional programs besides filling job openings, and misleading conclusions could come from focusing on misinterpreted oversupplies.

Occupational and employment definitions can hamper full characterization of the major-job relationship. Even students in programs with apparent direct occupational associations may not take jobs in these occupations despite this indication in the crosswalk. For example, Freeman and Asprey (1999) note that computer-engineering graduates do not necessarily wind up in jobs where they build prototypes.

Despite the long-range models used to make occupational employment projections, these projections are inevitably influenced by the economic, demographic, technological, and policy situations of the base year. If the base year is a recessionary one, projections for employment run the risk of being lower than actual demand and vice versa for expansionary economic years. In addition, the base year can seem stale by the time government agencies release public information. This analysis is using projections made in base year 1996 and ES-202 data from 1998.

These models cannot account for sporadic fluctuations such as recent layoffs by dot-coms and high-tech firms, for example. Similarly, while they may correctly predict the need for nursing-related specialists to serve aging populations' health needs, they cannot predict the preferences for educational qualifications—changes in policy and

business practices toward managed care systems have made it unclear whether registered nurses or lower-cost nurse practitioners would satisfy the need. These findings therefore must be interpreted with common sense and industry input.

It may seem obvious, but students have the freedom to choose majors. Good future job prospects alone may not lead students to major in an IT field. Studies show that many students actually avoid IT-related majors because these majors are viewed as too challenging. (National Science Foundation 1993) Likewise, graduates take jobs in certain places for a variety of lifestyle reasons. They may want to pursue a higher salary, live in a certain city, or engage in certain working conditions (e.g., regular hours, casual clothes, telecommuting). It cannot be presumed that graduates will take a certain job in a certain location just because it is open. For these reasons, supply can never be completely and directly tied to demand.

Section 4

Conclusions

Where Do Our Students Come From and Go To Work?

The analyses described in the previous sections were conducted to help answer the two fundamental questions posed at the beginning of the report. The first was, "Where do our students come from, and where do they go to work?" We found that student origins, work choices, and USG institutions had important geographic ties to the Georgia economy.

Many USG institutions served the economy of well-defined local regions. The GIS analysis did show that these institutions attracted many out-of-area students, largely from Atlanta, who subsequently left the local region for employment elsewhere. However, the assessment of Georgia Southern graduate records also suggested that without the presence of the local USG institution, a modest segment of in-migrants might have left the area, as might some of the students of local origin who wound up staying to work in the region.

The analysis also found that there were certain institutions that served missions with wider geographical appeal. For example, interest in technological degrees was scattered across the state. The GIS analysis showed that SPSU and Georgia Tech ended up with broadly distributed service areas and a relatively small percentage of USG graduates in any given county having attended or been placed by either institution. Fort Valley State University also exhibited a geographically broader mission-relevant region in middle Georgia's former cotton belt. Without these institutions, one could speculate that there might not be enough of a local concentration of students interested in the specialized areas within these institutions' missions to merit a local specialty institution.

The cross-migration analysis confirmed the policy decisions of the Board of Regents about the mission distinction of USG institutions. There is a need for institutions with distinctive local, regional, and statewide missions to adequately address the requirements of Georgia's economy for higher education.

Are There Shortfalls in Critical Occupations?

As to the question of whether there are critical occupational openings, the occupational shortfall analysis showed that USG was doing a good job of supplying the employment needs of a wide range of occupations. Very few occupations requiring (or

otherwise linked to) college educations were projected to have significant numbers of unfilled openings.

The IT area was the exception. The analysis estimated annual shortfalls of nearly 1,400 systems analysts, computer programmers, and systems engineers. The controversies around visas for foreign specialists with these skills underscore that this is a national problem. States have been shown to vie for talented technical graduates to enhance their economic development competitiveness.

But is there really a shortfall of IT specialists in Georgia in light of the economic downturn in the technology sector? The shortfall analysis acknowledged that there were serious limitations affecting the projections, including an inability to capture periodic economic downturns, delays in getting timely government data, tenuous links between instructional programs and occupations, and difficulties in directing students to certain majors and occupations. Furthermore, it takes time and resources to start up programs. The University System responded quickly in the IT area, as was evidenced by the 21 additional technology degree programs approved by the Board of Regents since 1996 and most especially the effect of the ICAPP investments in Columbus. It has been argued that given the time lag between student selection of majors and later job searches, higher educational institutions cannot address short-term supply and demand shifts for particular professions. (Rothstein 2000) Based on this argument, a case could be made to hold off on more investment in the IT area.

That said this study has furnished much support for continuing investments in IT instructional programs. First, this study has been repeated, albeit with methodological enhancements, regularly since 1997 and has consistently found IT-related shortfalls. Second, the analysis noted that a sizable number of openings were filled by in-migration. Notwithstanding the fact that companies locating in Georgia bring IT in-migrants with them, there is a possibility that if in-migration were to decline, Georgia businesses would rely even more on in-state talent. And third, almost all companies are incorporating IT into their business strategy and operations. Based on sheer numbers, IT worker needs of "old economy" companies swamp that of "new economy" companies as the ITAA survey has pointed out.

It would be extremely helpful have more timely information about occupational employment needs. One approach would be to regularly survey industry about employment needs. However, industry surveys face severe problems such as low response rates and lack of reliability of industrial predictions about future employment needs. A second, more viable approach would be to establish ongoing relationships with the Georgia Department of Labor for regular use of the ES-202 database. Alumni records could be matched with ES-202 employment records each quarter to monitor occupational migration and fulfillment of IT demand.

This study acknowledges that there are many issues and short-term fluctuations in employer demand for talent. Nevertheless, as computer applications continue to expand, the long-term outlook for information technology calls for continued attention to educational preparedness.

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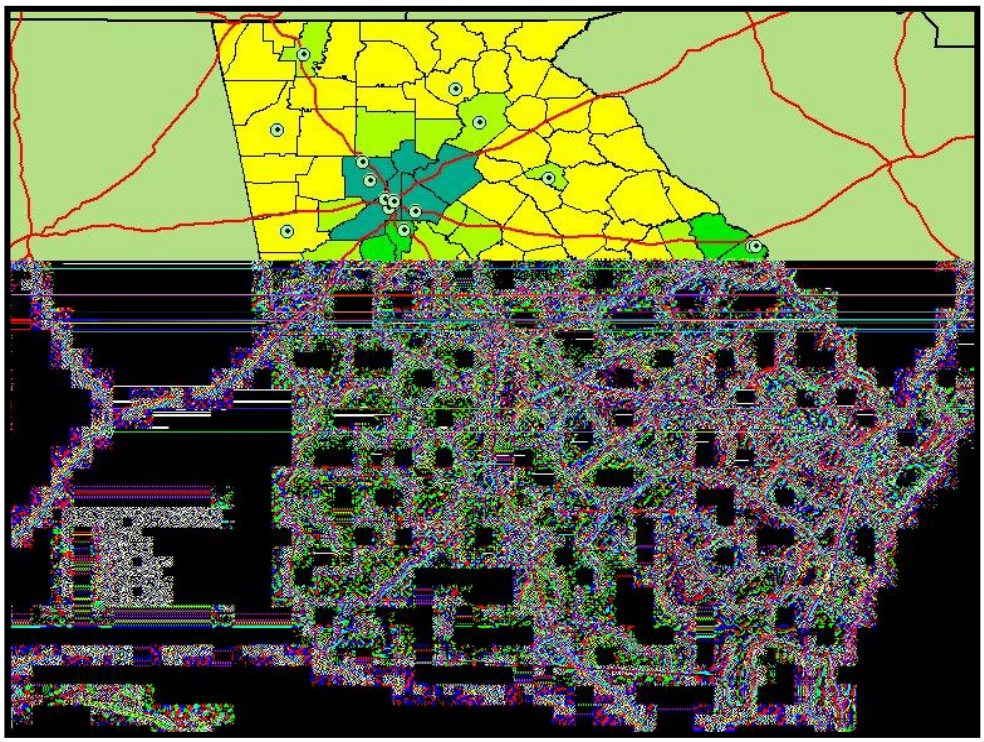
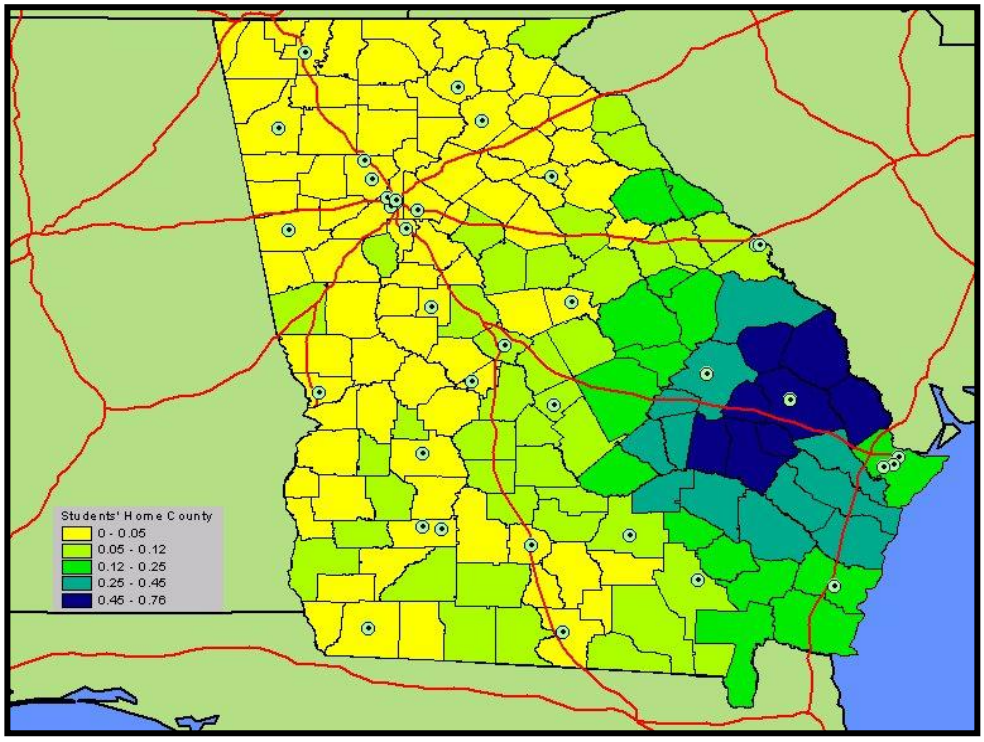
Appendix 1

Maps of Draw and Service Areas for USG Institutions

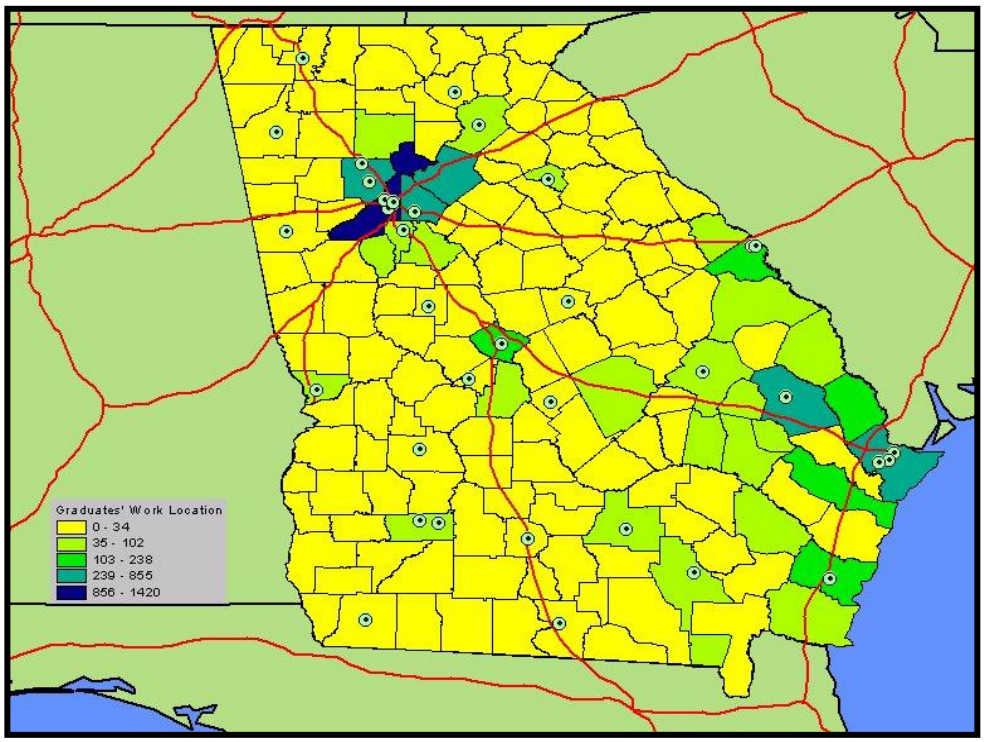
Georgia Southern University
Number of Students by County of Origin



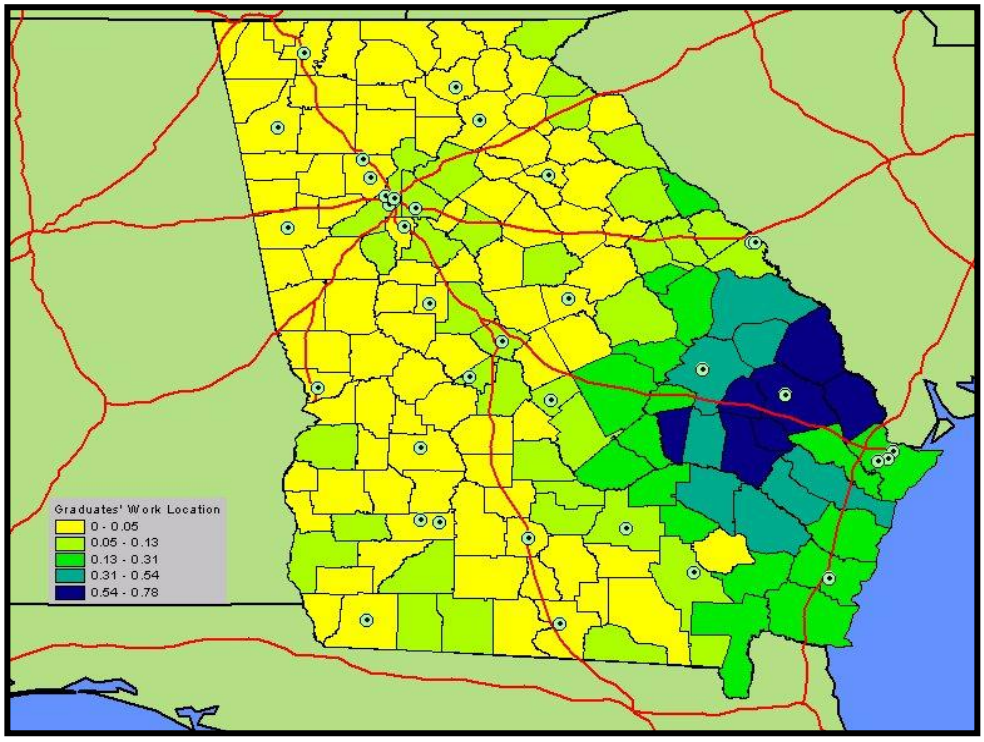
Georgia Southern University
Percent of USG Students by County of Origin



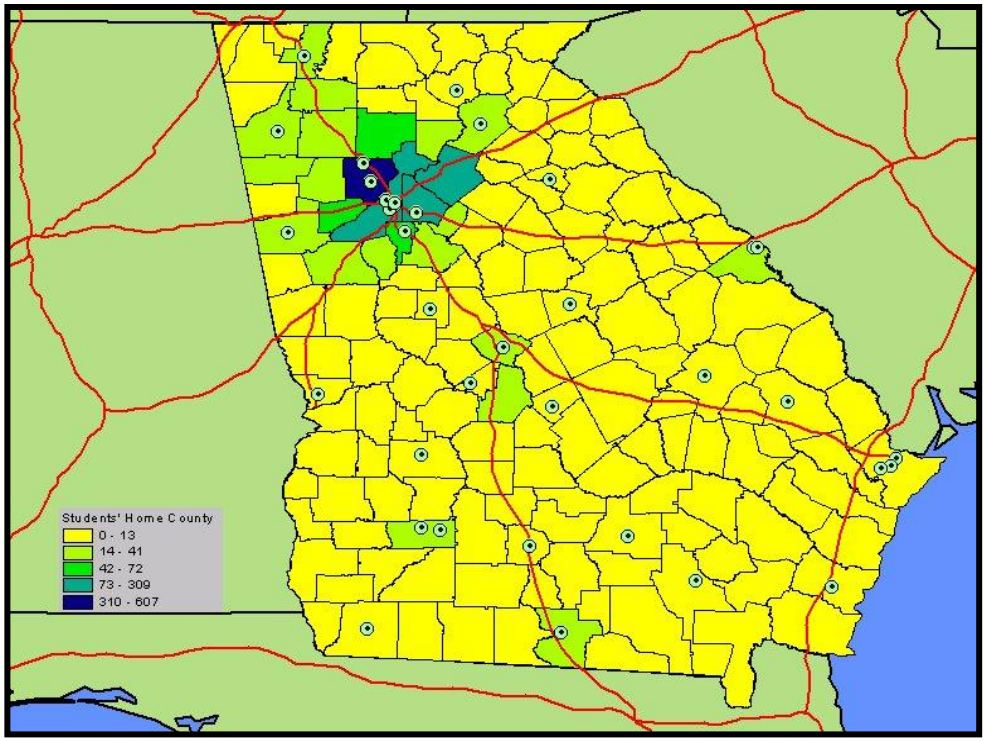
Georgia Southern University
Number of Graduates by County of Employment



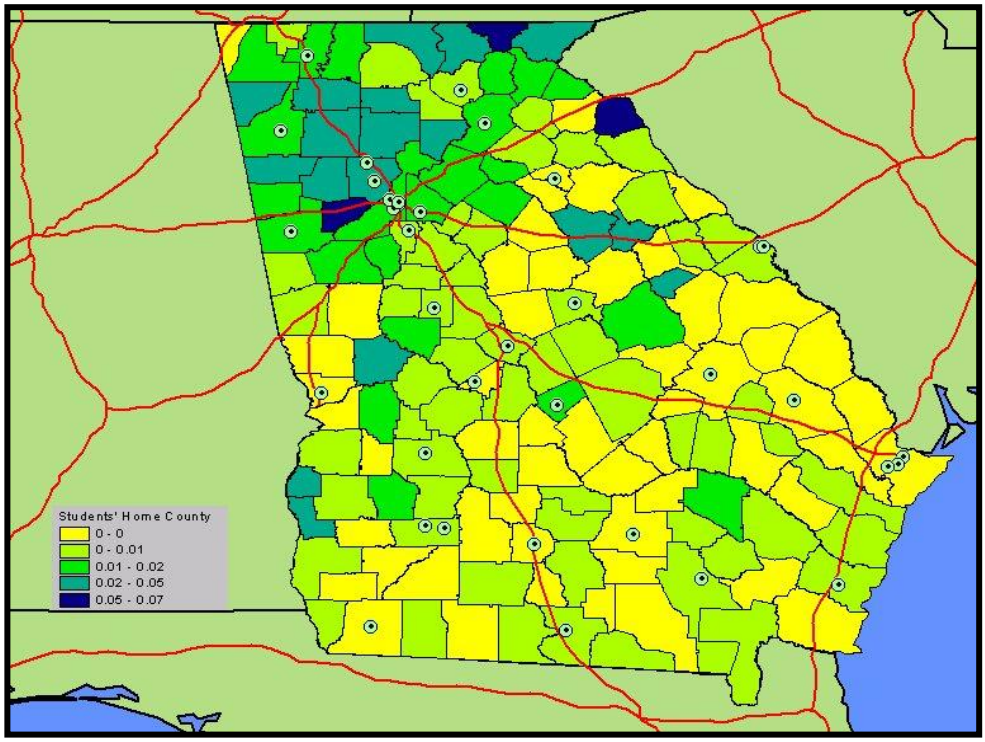
Georgia Southern University
Percent of USG Graduates by County of Employment



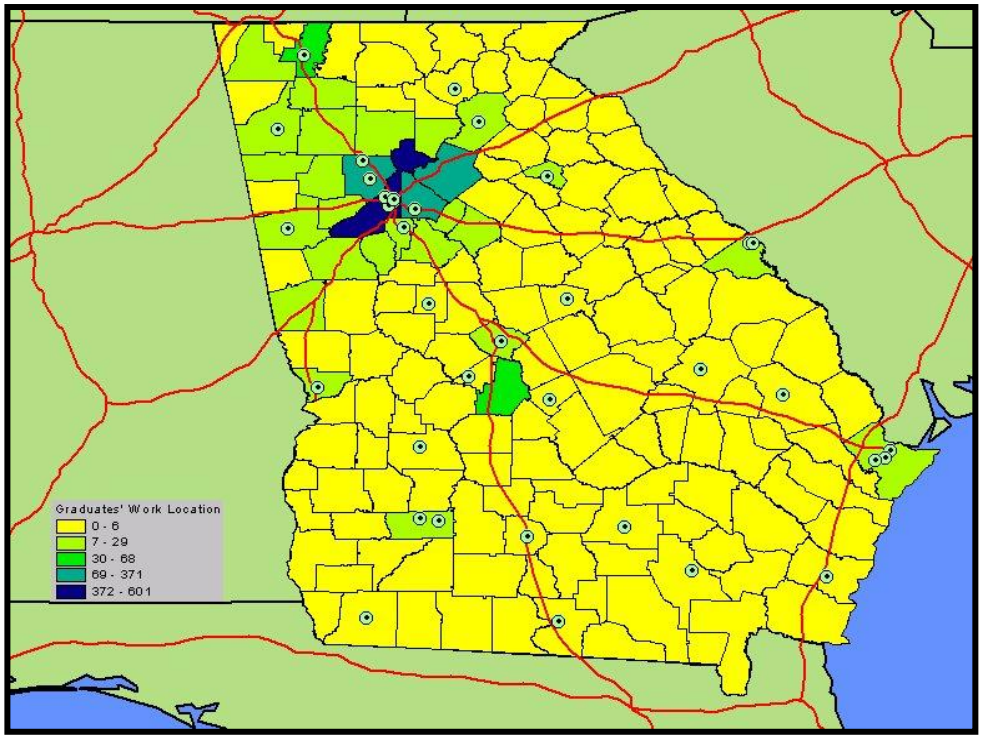
Southern Polytechnic State University
Number of Students by County of Origin



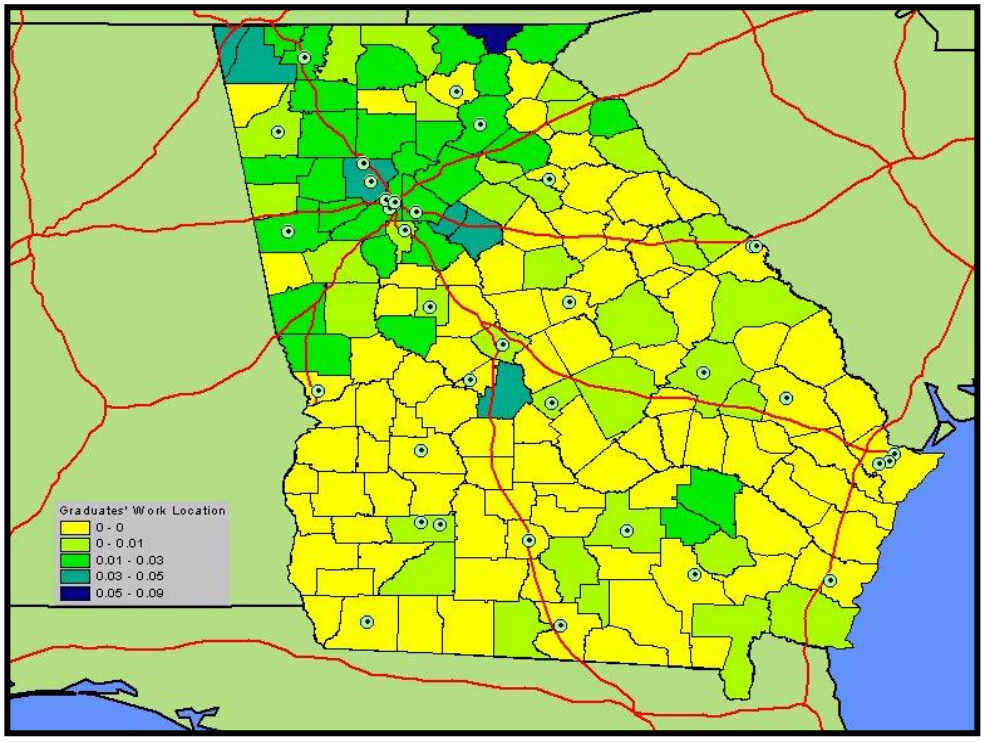
Southern Polytechnic State University
Percent of USG Students by County of Origin



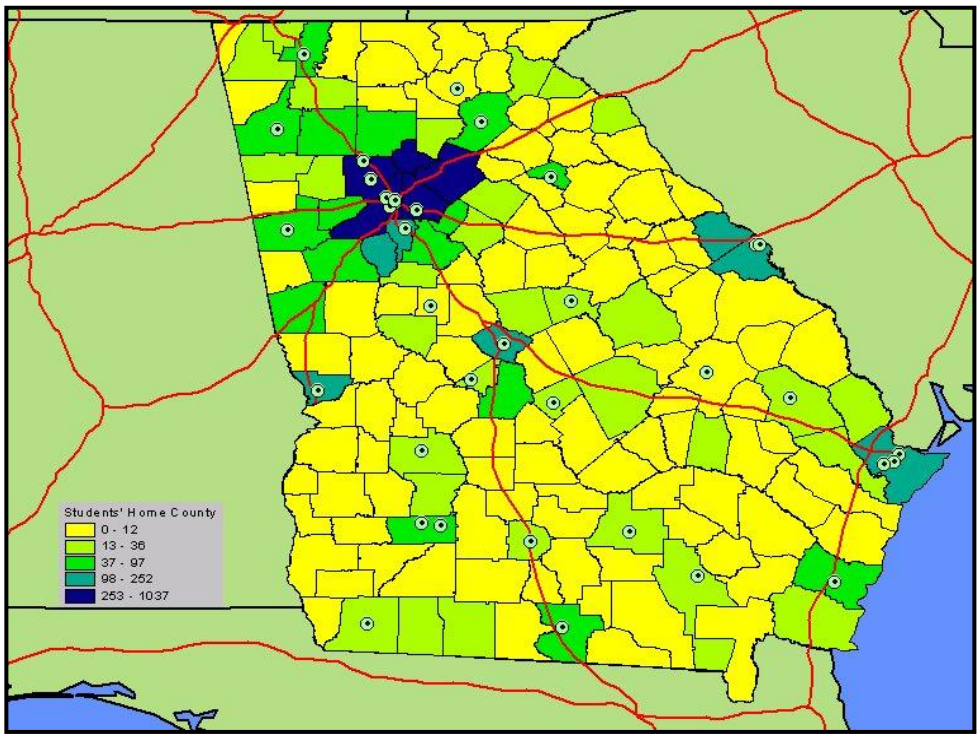
Southern Polytechnic State University
Number of Graduates by County of Employment



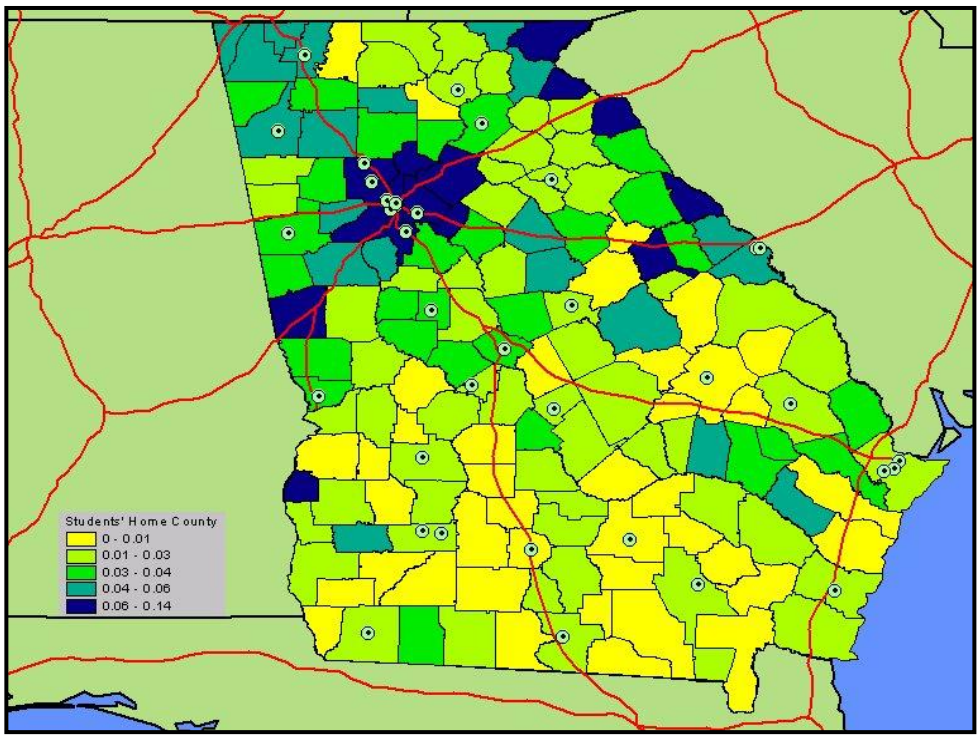
Southern Polytechnic State University
Percent of USG Graduates by County of Employment



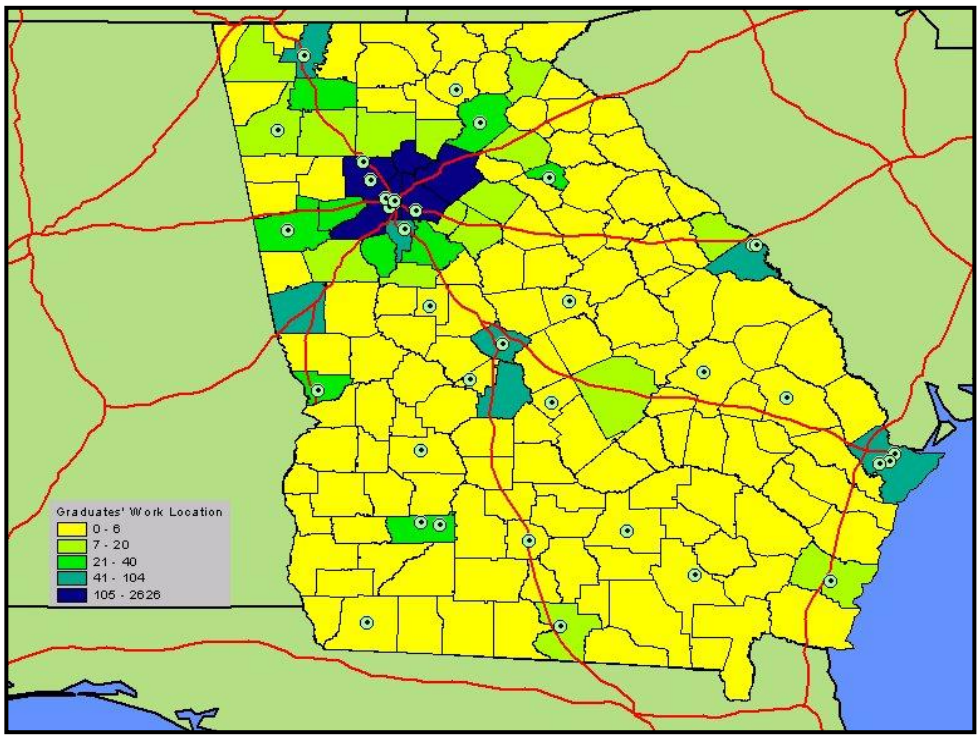
Georgia Institute of Technology
Number of Students by County of Origin



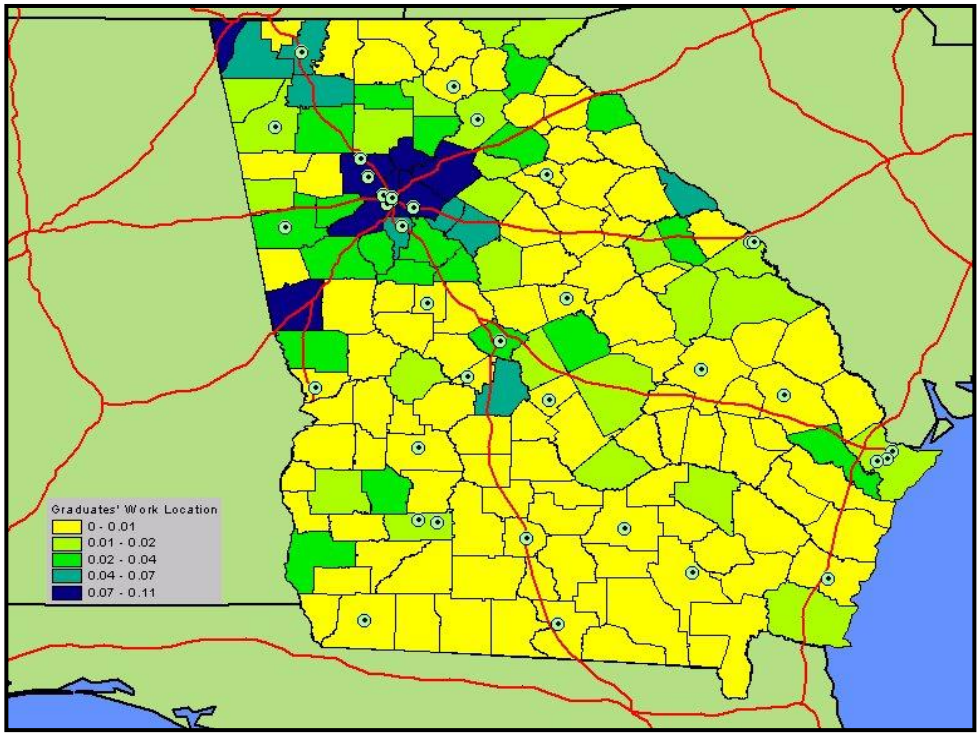
Georgia Institute of Technology
Percent of USG Students by County of Origin



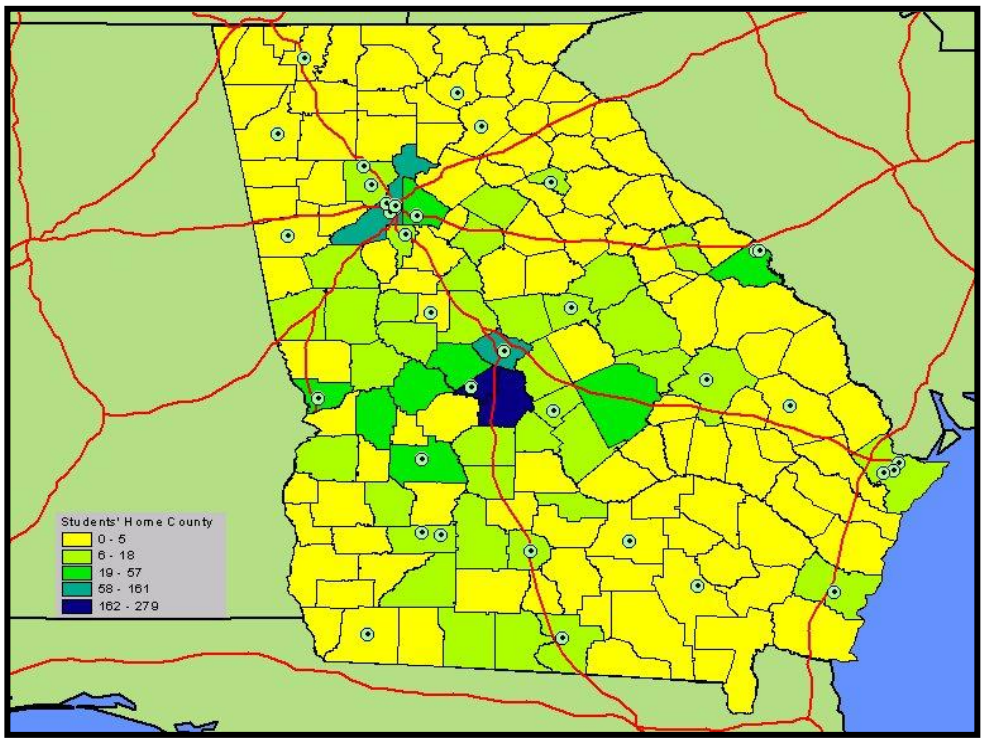
Georgia Institute of Technology
Number of Graduates by County of Employment



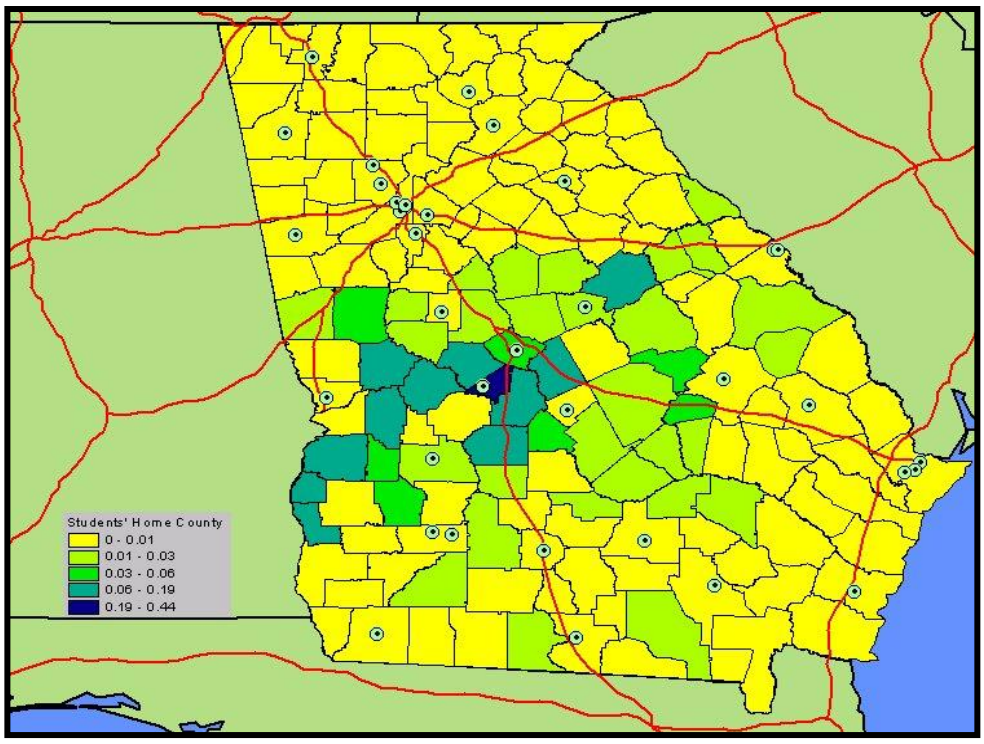
Georgia Institute of Technology
Percent of USG Graduates by County of Employment



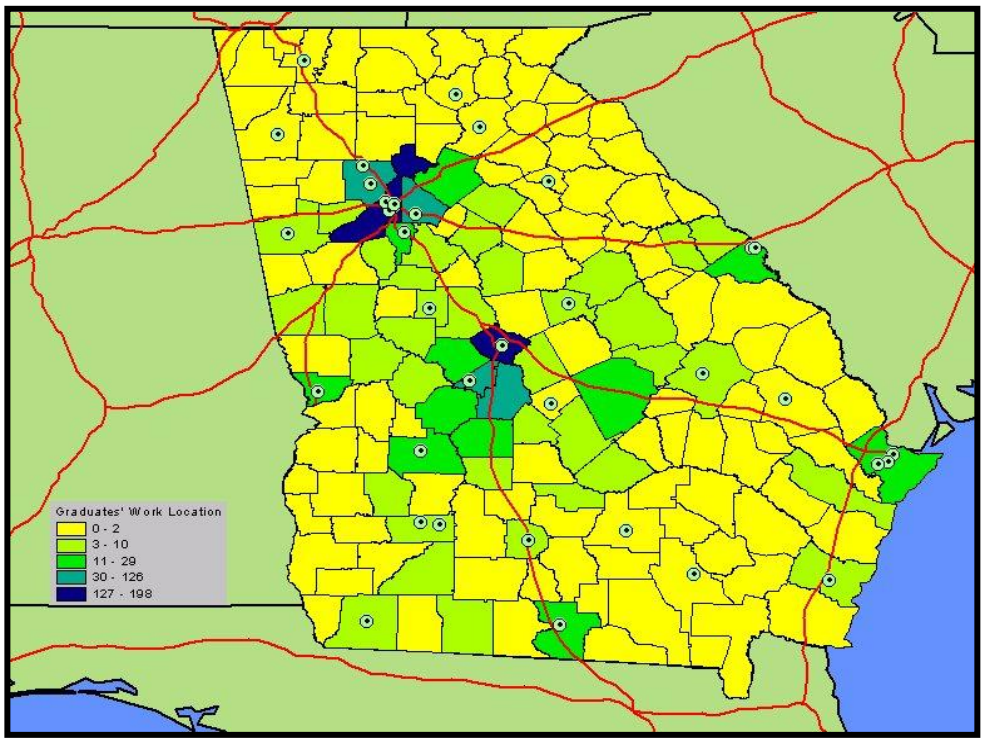
Fort Valley State University
Number of Students by County of Origin



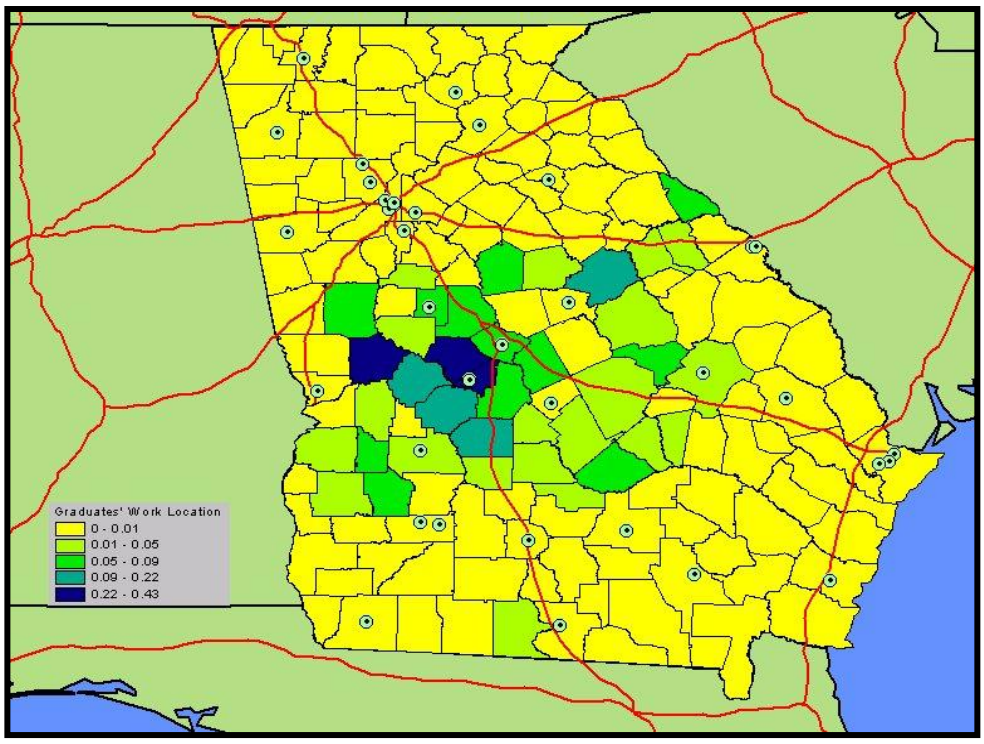
Fort Valley State University
Percent of USG Students by County of Origin



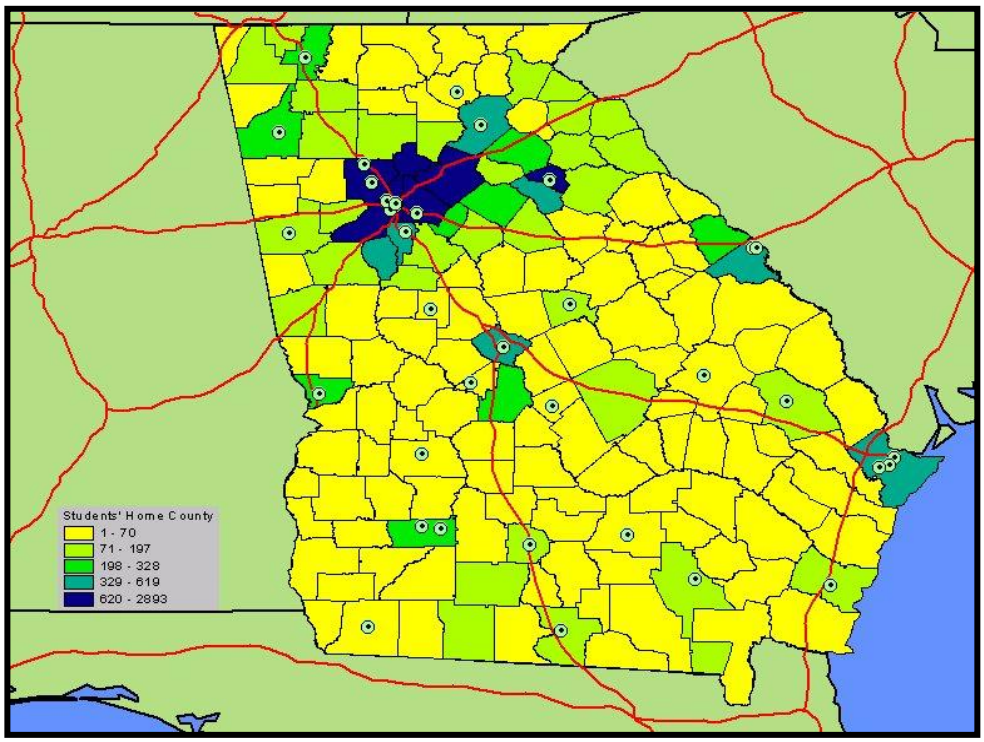
Fort Valley State University
Number of Graduates by County of Employment



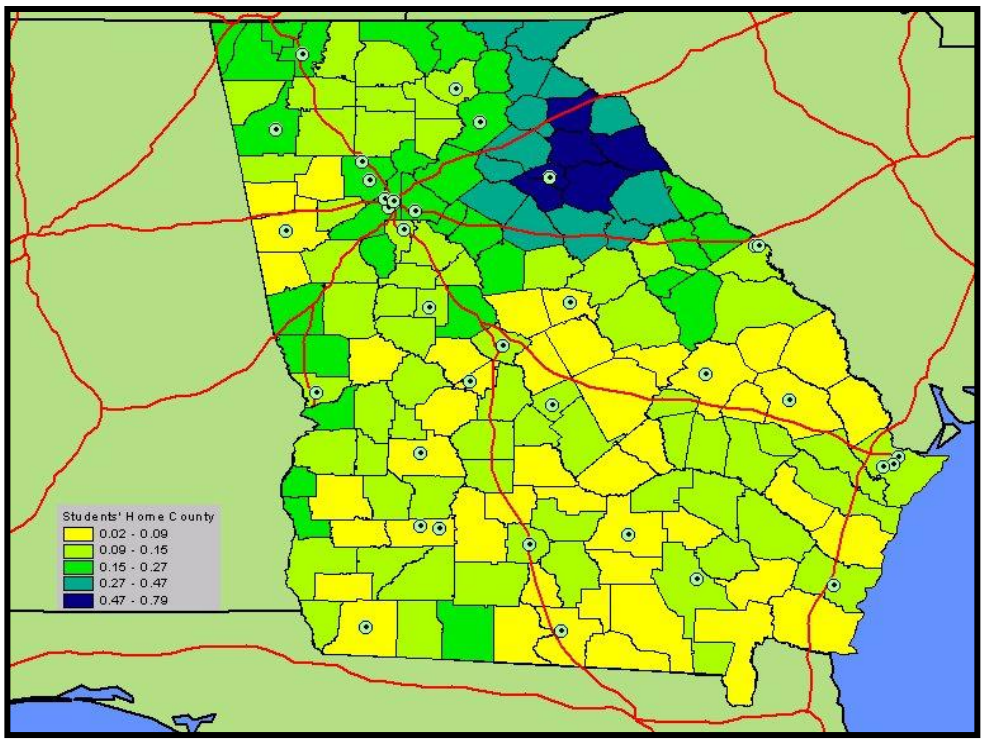
Fort Valley State University
Percent of USG Graduates by County of Employment



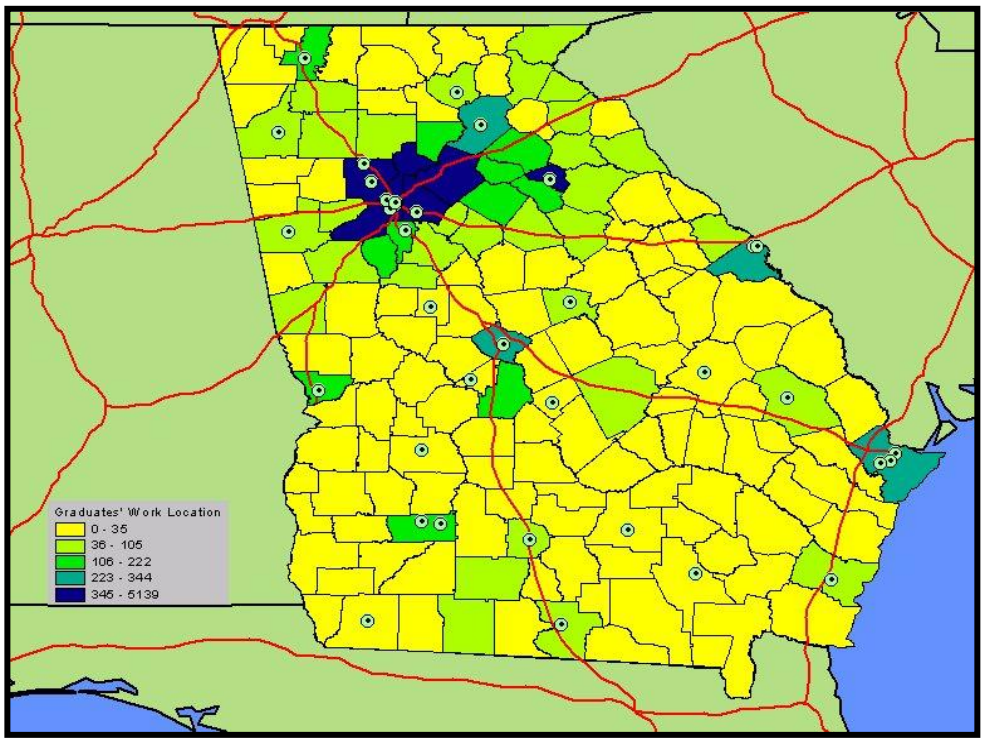
University of Georgia
Number of Students by County of Origin



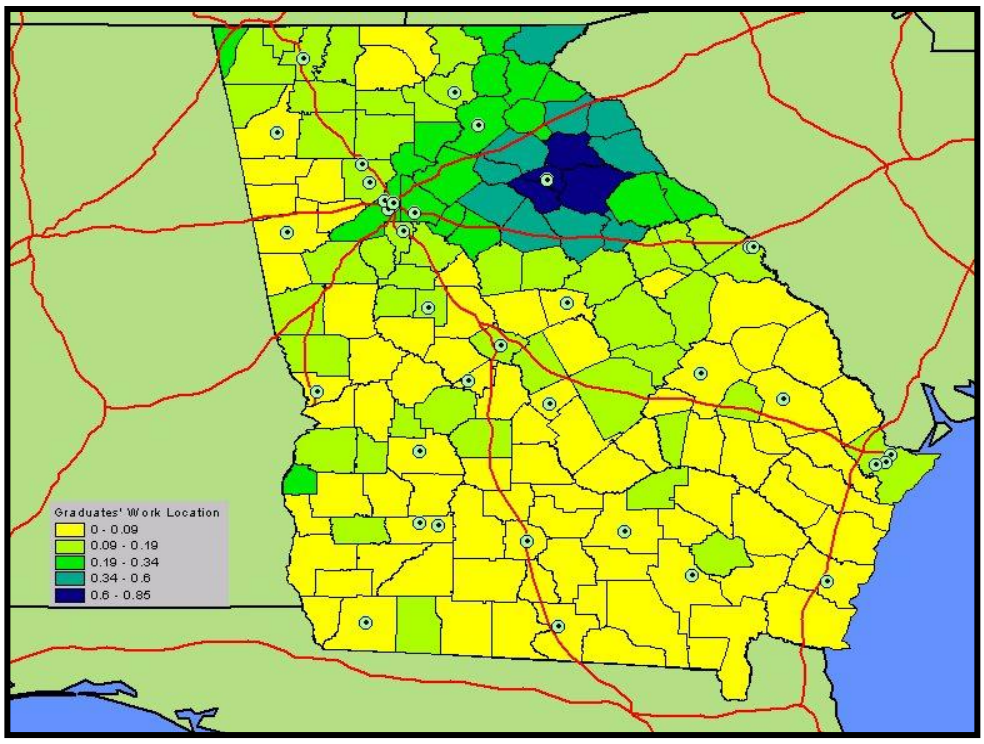
University of Georgia
Percent of USG Students by County of Origin



University of Georgia
Number of Graduates by County of Employment



University of Georgia
Percent of USG Graduates by County of Employment



Appendix 2

Domestic and International Migration by State

State	Net Domestic Migration Number	Rank	International Migration	1997 Population	1998 Population
Florida	86,511	1	80,463	15,111,244	14,908,230
Georgia	73,084	2	14,776	7,788,240	7,636,522
Arizona	59,196	3	11,634	4,778,332	4,667,277
North Carolina	52,806	4	8,261	7,650,789	7,545,828
Texas	47,471	5	81,934	20,044,141	19,712,389
Colorado	44,614	6	8,639	4,056,133	3,968,967
Nevada	40,912	7	9,097	1,809,253	1,743,772
South Carolina	24,995	8	2,458	3,885,736	3,839,578
Virginia	24,326	9	18,540	6,872,912	6,789,225
Tennessee	22,918	10	4,145	5,483,535	5,432,679
Minnesota	13,743	11	7,877	4,775,508	4,726,411
Washington	11,058	12	21,360	5,756,361	5,687,832
Oregon	10,592	13	8,126	3,316,154	3,282,055
New Hampshire	9,185	14	1,133	1,201,134	1,185,823
Kentucky	8,090	15	2,339	3,960,825	3,934,310
Idaho	7,457	16	2,866	1,251,700	1,230,923
Wisconsin	5,472	17	2,633	5,250,446	5,222,124
Missouri	5,414	18	5,266	5,468,338	5,437,562
Delaware	4,512	19	1,160	753,538	744,066
Maine	3,611	20	527	1,253,040	1,247,554
Arkansas	2,422	21	1,330	2,551,373	2,538,202
Mississippi	1,227	22	791	2,768,619	2,751,335
Vermont	715	23	928	593,740	590,579
Montana	249	24	231	882,779	879,533
Oklahoma	224	25	3,510	3,358,044	3,339,478
Alabama	(611)	26	1,590	4,369,862	4,351,037
Indiana	(659)	27	4,801	5,942,901	5,907,617
Rhode Island	(1,029)	28	1,553	990,819	987,704
South Dakota	(1,782)	29	790	733,133	730,789
Kansas	(2,915)	30	4,110	2,654,052	2,638,667
Wyoming	(3,007)	31	170	479,602	480,045
Iowa	(3,008)	32	3,398	2,869,413	2,861,025
Alaska	(4,076)	33	963	619,500	615,205
Maryland	(4,472)	34	17,174	5,171,634	5,130,072
Nebraska	(4,627)	35	2,003	1,666,028	1,660,772
West Virginia	(6,298)	36	238	1,806,928	1,811,688
North Dakota	(7,051)	37	854	633,666	637,808
District of Columbia	(7,227)	38	2,941	519,000	521,426
Massachusetts	(8,656)	39	14,939	6,175,169	6,144,407
Utah	(8,657)	40	4,330	2,129,836	2,100,562
Connecticut	(11,447)	41	8,259	3,282,031	3,272,563

State	Net Domestic Migration Number	Rank	International Migration	1997 Population	1998 Population
New Mexico	(12,554)	42	4,170	1,739,844	1,733,535
Michigan	(16,966)	43	13,576	9,863,775	9,820,231
Louisiana	(19,050)	44	2,267	4,372,035	4,362,758
Hawaii	(20,112)	45	4,721	1,185,497	1,190,472
New Jersey	(31,294)	46	39,749	8,143,412	8,095,542
Ohio	(32,671)	47	6,476	11,256,654	11,237,752
Pennsylvania	(37,935)	48	13,038	11,994,016	12,002,329
Illinois	(65,930)	49	47,172	12,128,370	12,069,774
California	(80,952)	50	248,490	33,145,121	32,682,794
New York	(167,818)	51	103,745	18,196,601	18,159,175

Appendix 3

Economic Development Service Delivery Regions

Georgia Economic Development Service Delivery Regions by County