Economic Growth of Nonmetropolitan and Agricultural Region Cities

A thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at George Mason University

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ABSTRACT

ECONOMIC GROWTH OF NONMETROPOLITAN AND AGRICULTURAL REGION CITIES

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Economic growth of nonmetropolitan regions is an important aspect of the U.S. economy in terms of overall productivity and national integration. Cities offer a nexus for understanding and affecting growth of these regions as critical points of attachment in the socioeconomic geography. The objective of this research is gain a better understanding of the economic growth patterns and factors for cities located in these nonmetropolitan regions.

Analysis of real per capita income trends among 926 U.S. cities, between 1969 and 2000, provides evidence that these economies are diverging. City economies are found to be diverging at a rate of about one percent per year, consistent with previous research. New growth ideals of endogenous growth provide a basis for discussing this economic landscape.

It is important to understand the factors contributing to these diverging growth paths in designing policies to pursue national economic development goals. Factorial analysis of nonmetropolitan U.S. city growth offers new insight into the economies of the nation's smaller cities. Industrial concentration, competitive freight transportation service, and human capital levels are all found to be significant influences in the economic growth of mesopolitans. Mesopolitans are those cities between the 75th and 50th percentiles in a distribution of U.S. cities based on population.

Human capital is found to be the single largest influential factor in mesopolitan growth between 1980 and 2000. The division of labor and local industry competition benefits associated with industrial specialization are positively related to economic growth among mesopolitan cities. Finally, cities in agricultural regions do not significantly differ from other nonmetropolitan cities in their economic growth factors.

These results offer important insight for revisiting policies designed to grow nonmetropolitan and rural economies. Given the perpetual and self-reinforcing nature of endogenous growth forces, it may be necessary to offer more assertive economic development and economic growth policies to realize national economic egalitarian goals. In addition, the economies of nonmetropolitan areas do exhibit economic growth characteristics that differentiate them from those of large urban. These differences should be considered in formulating national policies and regional initiatives.

CHAPTER I

INTRODUCTION

The investigation conducted for this dissertation includes convergence analysis and multivariate regression modeling focused on understanding the economic growth patterns of nonmetropolitan city-centers during the knowledge age. While the depopulation of rural areas is a well-documented migration trend, the migration has flowed to both major metropolitan areas and to cities in nonmetropolitan areas. The economic growth of cities in these nonmetropolitan regions is largely neglected in economic development literature. Gaining insight into recent economic growth patterns of these smaller U.S. cities, such as the role of natural and man-made factors in the growth patterns, is important for crafting future national economic development policy. The knowledge is a valuable in evaluating the roles of government institutions and policy designed to facilitate economic growth for cities located in nonmetropolitan, and especially agricultural, regions.

Research Setting

The United States encompasses a vast geography with a complex socioeconomic landscape bridging its borders. This economic diversity has provided both opportunities and challenges as the nation made the transitions from agrarian- to industrial- to knowledge- and service-based activities. Across these transitions, the relative value of a region's endowments and investments in physical, human, and social resources has varied. An important determinant in this valuation is the spatial system underlying these activities. The spatial aspects of economies have been the subject of research concerned with history, economics, and geography. It is an economic aspect, specifically what Vance (1960) terms "points of attachment," that is the focus of this research.

Theories of geographic organization and economic development form the foundation for this investigation. Geographic organization suggests a progression for economic development that is based in first-order and second-order geographic advantages and interconnections among market nodes. The nodes are individual economies characterized by varying levels of productive capacity and output. The value of good or service produced in an economy is generally determined by the market in a capitalist society.

Von Thünen's early work describes production location and trade flows in a closed agricultural economy. In this rudimentary assessment, he describes how proximity to market and relative production values can be enlisted to understand the spatial organization of an economy. The spatial price concept introduces a broad range

of factors one should consider when discussing regional growth and development. Following the ideals set forth by von Thünen, at any point in time resources are valued as a function of their position in the larger economy. Therefore, viewing the market economy in the context of spatial organization encourages better management of scarce human and capital resources that influence the relative value of a good or service.

The position has both static and dynamic components (Vance, 1970; Muller, 1977; Cronin, 1991; Berliant and Konishi, 2000). The static array includes natural resource endowment and proximity to first-order geographic advantages. First-order advantages refer to naturally occurring factors geographic such as a navigable waterway. Dynamic factors are those such as second-order geographic advantages and human capital. Second-order geographic conditions are man-made enhancements to the existing geography, such as Class I railroad or interstate highway adjacency.

A region is generally defined by some geographic or administrative boundary for assessing economic return on endowments and investments. Common physical and political boundaries include mountain ranges, oceans, nations, states, counties, cities, and voting jurisdictions. The regional unit of study selected for this investigation is a form of the city boundary that is detailed in Chapter IV. The city is identified as appropriate based on the sub-national economic activity focus, available data, and policy implications.

Jacobs (1969) suggests that cites are leaders in economic development. Her account of industry advancements and technology transfer illustrate the importance that

human capital resource concentration has in specialization and cross-fertilization activities. While an individual city political demarcation may not clearly distinguish "an economic region," it does offer nexus for studying economic activity. Concentration of populations allows for productivity gains Adam Smith attributed to division of labor. This specialization then contributes to productivity by encouraging competition and innovation. In addition, agglomeration benefits are attributed to the spillovers from concentration of human capital and the economies of scale and convenience. As individuals and firms become more concentrated, knowledge spillovers within and among industries become more prevalent. Furthermore, firms' location decisions have a self-reinforcing component as competitors and related companies have a proclivity to locate in the same area (Marshall, 1960; Krugman, 1991).

In addition to the city political boundary, the nonmetropolitan area classification must be defined for the proceeding analysis. The terms nonmetropolitan and rural are often used interchangeably, but are distinct in U.S. Census definition. According to the U.S. Census, rural areas are generally defined as those areas and places outside urban areas. Urban areas consist of a core census block groups or blocks that have population densities of at least 1,000 people per square mile, and surrounding census blocks that have an overall density of at least 500 people per square mile (U.S. Census Bureau, 2003b). Office of Management and Budget (OMB) does not offer a distinct definition of rural, but by default it is the area located outside of the core-based statistical areas (CBSAs). An individual CBSA includes a socially, economically, and geographically

connected urban area or cluster comprised of at least 10,000 residents (U.S. Office of Management and Budget, 2000).

Neither the U.S. Census nor OMB offer a succinct definition for nonmetropolitan. OMB delineates metropolitan areas as a CBSA with population of 50,000 or more, from smaller micropolitan areas that have one or more urban clusters under 50,000. The nonmetropolitan and rural definitions applied here are based on the OMB definitions of CBSAs and the distribution of these CBSA populations. Nonmetropolitan CBSAs are those urban areas or clusters with populations under 428,854, which are under the 75th percentile in the distribution of CBSAs by 2000 population levels. The rural term applies to the area located outside CBSAs. These metropolitan, nonmetropolitan, and rural definitions are used throughout the remainder of this paper.

The regions across the United States both benefit from and contribute to a global complex of market linkages. Cities offer a nexus for nonmetropolitan, agricultural regions to integrate their resources into the larger economy and to derive a form of agglomeration benefits. Understanding the U.S. city network in a theoretical context and nodal growth in pragmatic terms may serve efforts to support and grow regional nonmetropolitan economies through their city-based links to distant metropolitan and global markets. The metropolitan and nonmetropolitan city population distinction allows for more detailed analysis of economic growth in often neglected nonmetropolitan cities.

Goal and Scope

The goal of this work is to gain insight into the growth of nonmetropolitan cities, with special attention given to those located in historically agricultural regions. In the tradition of Jacobs, it is suggested that these city-centers are a necessary but not sufficient factor in the success of nonmetropolitan economies. Thus, understanding the economies these nonmetropolitan cities may not ensure growth, but will provide valuable insight for policy and investment discussions and their effects on regional prosperity. In addition, an investigation into the agricultural sub-population of these cities may generate new information that can be used to stem and reverse depopulation trends of traditionally agricultural regions that are often sparsely populated and rural in nature.

Two aspects of economic growth will be addressed. The first facet is the trend in growth paths among all U.S. cities. The allocation of capital is driven largely by a competitive market in the United States. The production function, which represents the transformation of capital, labor, and technology into output, provides the market with signals for efficient allocation of resources where market signals are assumed to originate from a perfectly competitive market environment. In our capitalist democracy, a large middle class has continued to seek equity and opportunity (Birdsall, 1990). "The equity goals seem contradictory to the incentives associated with success in a competitive market" (Okun, 1975). These equity goals and the opportunities they yield, however, are a critical fiber in our socioeconomic fabric. Myrdal (1957) suggests that public policy may be needed to induce investment in laggard regions in his discussion of cumulative

causation. In designing and implementing policies, it is important to understand if it is more realistic to model the market through neoclassical theories of diminishing returns and convergence, or new growth theories of endogeneity and divergence.

The mercantile theory, which is prefaced as underlying the U.S. city geography, suggests we should expect parallel growth that more closely follows that of the new growth philosophy. The experiences and resources of individual cities, along with relationships between and among cities lend themselves to a growth pattern that is based in rather stable marketing channels rather than an unstable disequilibrium that tends toward reallocation in search of a uniform economic plane. Along these marketing channels are dispersed concentrations of activity that tend to attract more activity through forces of agglomeration forces, such as internal, interindustry, localization, and urbanization economies.

Research will next be directed toward identifying factors indicative of economic growth in nonmetropolitan cities. Both the analysis of economic growth factors and income mobility consider a recent time period in our economy that is known as the knowledge age. The current era is termed the knowledge age because it is characterized by the increasing importance of knowledge as a resource in a technologically-advanced global market (Romer, 1986). The increasing complexity and dynamic global market may offer even more challenges for those regions deemed lagging economies, as it also may become more difficult for these regions to catch-up or leap-frog other regions.

This research will be distinguished from previous work in several ways. First, it uses the relatively new CBSA urban geography, which includes a larger city geography than previously defined. It is also concerned with city growth in agricultural regions. This aspect is particularly important given the social and economic issues associated with the continued depopulation of our nation's vast agricultural and rural areas. Another distinction is in defining transportation service as a potential factor in economic growth. In addition, the income mobility analysis is atypical as it considers sub-national convergence.

The growth of nonmetropolitan areas has received limited attention in previous research compared to that of metropolitan cities. As migration of individuals from rural to urban regions continues, gaining insight into the development of nonmetropolitan cities, especially in agricultural regions, and their potential sustainability and growth in the knowledge age and beyond is critical. When revisiting the equity and efficiency priorities in our society, institutions may find new ways to contribute to the economies of these regions by supporting these cities as nexus in regional growth.

To achieve research goals, the initial task is to profile the U.S. city population and the nonmetropolitan city segment, including the agricultural region sub-population. The nonmetropolitan cities are defined as U.S. Census CBSA below the 75^{th} percentile in a distribution by population levels. The agricultural sub-strata is defined geographically by a seven-state area including Montana, North Dakota, South Dakota, Nebraska, Kansas, Iowa, and Minnesota. These states are characterized by having over twice as much of

their gross state product attributed to the agricultural industry than the national average. Additional information regarding the agricultural sub-strata are included in the next section of this chapter.

This information provides the context for developing and interpreting models of economic growth indicators for nonmetropolitan cities. It is important to distinguish these finding from those presented in urban and more aggregate forms. In addition, the quality of transportation services will be assessed as an aspect of nonmetropolitan city economic activity. Transportation service, both freight and business travel, varies when compared among nonmetropolitan cities and compared to metropolitan cities, which typically house multimodal freight transport and business air transport hubs.

The findings will provide nonmetropolitan and agricultural areas guidance for making investment and policy decisions to positively affect their cities' economies. These cities offer nonmetropolitan regions the opportunity to derive some form of agglomeration benefits and serve as a critical point of attachment for the region in the larger global economy. Thus, promoting the region and its market connections in a more holistic fashion may benefit efforts to foster economic growth.

Significance

Over one-third of the Nation's population lives in nonmetropolitan and rural areas (U.S. Census). Considering a population that was located primarily in rural areas in the agrarian age of the early 1900s, the socioeconomic landscape has been transformed over

the last century. Although the rural/urban population ratio has stabilized somewhat over recent decades, the migration effects continue to be felt in rural areas. In addition, the U.S. urban population is now distributed across a national network of U.S. cities.

Regarding those cities located in traditionally agricultural areas, it is especially interesting to better understand their relative success in growing their economies during the knowledge age because agriculture is seen as a rather mature sector in our economy. For the future of these cities, it is important to understand factors that have influenced their ability to assimilate into labor and product markets during the knowledge age. Agricultural sector employment, a livelihood for many rural residents during the infancy of the U.S. economy, has diminished substantially with farming contributing by employing only 2 to 3 percent of the U.S. workforce in recent years. Although the farm sector produced more than twice as much output in 1994 (in inflation-adjusted terms) as it did in 1948, it did so with only 29 percent of the labor. Counties that remained in the farming-dependent category in the 1990's shared in national economic growth, but to a lesser degree than other rural counties (Economic Research Service, 2000).

States in the north central region of the United States were still relatively dependent on agriculture in their economies in 1977. Eight Midwest states attributed at least 6 percent of their gross state product (GSP) to agriculture (U.S. Census, 2002). This was more than twice the share of the national average of 2.7 percent. With mechanical and biological advancements in technology, the farm sector has undergone a transition to larger, more geographically dispersed farm operations. The U.S. farm where the labor of

a single man today produces quantities to feed more than 100 people is in stark contrast to less developed farm industries such as Africa where it requires the labor of five men to feed four (Heilbroner and Milberg, 2001).

As farming has become technologically adept, human labor has been displaced by machines and biological products, and local market closed-economy type marketing has been replaced by an open-economy global market complex. As labor input costs have increased, relative to technological substitutes, human capital has shifted primarily from a large quantity, homogeneous input as physical labor to a lesser quantity input that is heterogeneous factor in its management and innovation respects. With fewer agents employed on farms, the surrounding rural population and rural economy has been forced to adapt.

This flow of labor from rural to urban areas is evidenced by the distribution of population within the nation and within two Census Divisions, the Midwest and West North Central, illustrated in Figure 1. The geographic boundaries of these Census Divisions are illustrated in Appendix A. The Midwest includes a majority of the states with a high proportion of agriculture in their economies. The West North Central, a sub-division of the Midwest, provides additional insight as it is comprised of states with economies in which agriculture is an influential economic sector, in that it accounts for at least six percent of GSP.

The migration of people from rural to urban settings is a clear trend through the mid-1970s. This trend, while still positive, seems to have reached a plateau in recent

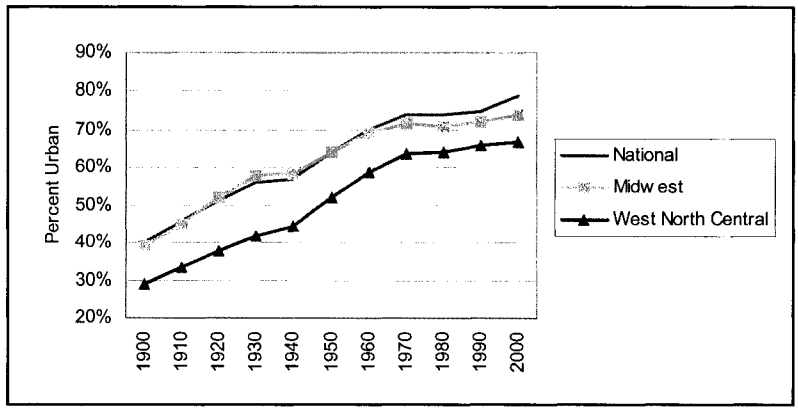

Figure 1. Urban Share of U.S. Population

years. The larger Midwest Division followed national trends closely until about 1970. Since then, the Midwest has diverged to establish a plateau urban share that is lower than that for the nation. Although the urban share remains lower than the national average, Rathge and Highman (1998) show that concentrated intra regional population and successful larger urban centers increasingly characterize this region between 1950 and 1996. This flow of population from rural to urban areas has both social and economic aspects as the rural population has dissipated and new industries have emerged in the economies of these states. Understanding the factors contributing to the relative economic success of these population centers provides insight for future rural economic development policy.

Rural Economic Development

National economic integration and economic opportunity goals have been pursued through transportation, agricultural, and economic development policies. U.S. transportation systems were used as an integration mechanism to generate economic and social ties among urban and rural areas. Early innovation waves in the transportation industry are junctures in the development of the United States economy. In addition, settlement patterns are attributed greatly to the proximity of ports, canals, and railways. Roads and air transport initiated later transportation waves that are associated with industrialization and globalization.

Canals offered the first alternative to the slow, tedious movement of commodities between regions by horse and wagon. Government participation in the waterway system began when the United States Railroad Administration initiated barge operations on various segments of the system in 1818. This action was taken to increase capacity of the nation's transport system (Howe et al., 1969). At 19 cents per ton mile, the price of canal transport was estimated to be 40 to 70 percent lower than wagon transport during the early decades of the 19th Century (Taylor, 1951).

By the end of the 19th century, the railroad offered freight rates of 2 cents per ton mile and passenger rates of less than 1 cent per mile (Cain, 1997). The Baltimore and Ohio Railroad began its operation in 1830 as the first U.S. railroad. Two decades later the U.S. government participated in a 30-year railroad construction phase. Major

projects included the Illinois Central Railroad, that provided year-round north-south transportation, and four railroads that formed national east-west corridors.

The maiden endeavor for the federal government into the nation's road system was a Road Information Center. It was established in the Department of Agriculture in 1893. The Bureau of Public Roads, its predecessor, was instrumental in crafting the first substantive federal road legislation, the Federal-Aid Road Act of 1916. This legislation established a federal-aid highway program with a 50 percent-50 percent, federal-state matching share.

This transition across modes to a more flexible, wider-reaching gathering network and more competitive freight rates transformed agriculture. New, fertile production areas were accessible as rail lines were extended to integrate the frontier regions of the west with the growing population centers in the east. The average output of a farm, that had once been based on a sustenance farming system where a producer grew only what they could consume or sell locally, increased as markets developed to serve the needs of an industrializing nation. Expanded markets allowed for specialization, encouraging productivity improvements associated with new technologies and economies of scale.

In addition to the physical infrastructure, the institutional parameters are an important influence in understanding rural economies and their agricultural roots. National philosophies and policies form the cornerstone of the institutions. "The fundamental goal of farm policy is to maintain a prosperous, productive farm sector with a family-farm type of organization" (Cochrane and Ryan, 1976). Its dilemma is often in

the policies and methods employed to achieve what seem to be potentially contradictory goals. Social goals associated with maintaining the Rockwellian picture of the family-farm production in U.S. agriculture may require very different resource allocations than the economic goals directed at promoting an efficient and competitive U.S. farm industry (Hoag, 1999).

Modern farm policy was introduced to deal with excess supply that followed World War I. Interventionist farm programs began with the Agricultural Adjustment Act of 1933. The goal of this legislation was to restore farm purchasing power to a fair exchange value using the concept of parity prices to restore farm purchasing power to pre-war levels. Parity prices provided a fair return on labor and capital costs, or roughly equal to what prices should be during favorable market times. In years of overproduction, when crop prices fell below the parity level, the government agreed to buy the excess. President Franklin D. Roosevelt included this parity price guarantee to farmers as a means of stabilizing wages because the farm sector was seen as a pivotal industry in the nation's economy.

The next notable piece of agricultural legislation was the Agricultural Adjustment Act of 1938. Unlike previous farm legislation, the consumer constituency is recognized in the last of three policy goals, that include soil conservation, farm income parity, and consumer food supply protection. It is this act that offers the framework for predecessor farm policy. Various combinations of supply control, including land idling, soil conservation, and government induced planned production, were introduced in a series of

farm programs that continues in current farm policy. Food aid, foreign loan guarantees, and sales price subsidies have been included as methods of demand inducement. Farm programs continue to influence the production patterns, market flows, and research/development expenditures that dynamically affect the efficiency and effectiveness of transportation and its role in rural agricultural economies (Tweeten, 1979; Orden et al., 1999; Economic Research Service, 2000b).

While agriculture has evolved within its institutional and market framework, the transportation industry too made its progression. Legislation relevant to the transportation industry is segmented into investment and regulation. Investment decisions are evidenced by federal support of canal building and federal resources devoted to building a transcontinental rail system.[1] The Interstate Highway Act in 1956 authorized 25 billion dollars for a 42,500 mile system of arterial roads across the United States (Rose, 1979). More recent funding priorities are evidenced by the series of surface transportation funding bills, including the most recent titled "The Transportation Equity Act for the 21st Century" (TEA-21). Major discussions with regard to the funding centers on maintenance versus new construction, federal monies distribution, and local/regional project participation parameters.

The brief discussion of regulatory transportation legislation presented in this section concentrates on the rail industry. The relationship between rail and agrarian

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[1]The government invested roughly 133 million dollars in canals between 1812 and 1837 (Goodrich et al, 1961) and footed roughly one-half of the 1 billion dollar investment in railroads between 1930 and 1960 (Fishlow, 1972).

interests is a long-running one that continues to generate much policy debate. It is important to understand the progression of rail institutions, as this mode continues to service many businesses in rural and nonmetropolitan areas, in particular the natural resource-based industries such as agriculture and mining. Common carriage ideals that underpin regulatory institutions surrounding the U.S. rail industry were actually originated in medieval British common law. Common carriage requires private companies to assume some risk when granted government franchises or monopolies (Keeler, 1983). It allows the government to grant the carrier certain rights and privileges, such as profiting from a monopoly transportation route. In return the carrier assumes certain obligations, such as providing a minimum level of service for all customers along the route.

As interstate traffic expanded and the rail industry grew, state corporate charters that enabled railroads to provide common carriage service became rather ineffective. In addition, the rail industry itself became involved in rather chaotic pricing practices. Rail rate wars often drove rates below what were believed to be profitable levels. Railroads attempted to curtail these wars by forming cartels to collude on rates and services. The inconsistencies in pricing resulted in many states establishing regulatory agencies during the 1870s. Continued complaints about rail industry business actions and the piecemeal workings of the numerous state agencies provided the catalyst for Congressional action. The Interstate Commerce Act of 1887 established a federal agency, the Interstate Commerce Commission (ICC), with the authority to oversee and enforce the principles of

common carriage and oversee industry behavior such as competitive practices. The ICC was retained as an industry oversight institution through most of the 20th century.

During the latter half of the 20th century, however, an overbuilt and inefficient rail system began deteriorating. The Railroad Revitalization and Regulatory Reform Act (4Rs Act) provided government funding for a reorganization of six bankrupt railroads in the northeast to form Consolidated Rail Corporation (Conrail) in 1975. It was followed by the Staggers Act of 1980 that gave railroads pricing authority and allowed them the right to employ discriminatory pricing practices in the market. The ICC was retained throughout the deregulatory wave, though its role was substantially diminished. Congress did later create the Surface Transportation Board (STB) to replace the ICC. The STB maintains much of the former ICC docket, including rail merger and rail rate oversight. Railroads continue to play an important role in national economic integration. This background information is useful to review the long-standing relationship between railroads and rural, agricultural regions, and learn from our experiences. It is referenced in the model of economic growth factors.

Rural development activity is often concerned with creating jobs in communities that historically served the farm population (Economic Research Service, 2000a). Rural economic development programs have come full circle as the fledgling program was formulated on place-based ideals. The first rural economic development program – administered through the Homestead Division of President Franklin Roosevelt's National Industrial Recovery Act – was concerned also with averting urban poverty. It was

initiated under the auspices of the New Deal in 1933. With this program, families were relocated from the urban inner city to rural communities where they were offered employment and home ownership opportunities (Burns and Dunn, 2001). The program failed miserably, but did open the door for future rural development initiatives.

The Farm Consolidation and Rural Development Act of 1972 was the last substantial attempt to interject stimuli to reverse the rural to urban population flow (Cowan, 2004; Drabenstott, 2003). The law was envisioned to revitalize rural America, by making these areas socially and economically attractive alternatives to large cities. The Department of Agriculture was identified, in the legislation, to take the federal government leadership role in developing and implementing the nation's rural development programs and in dispersing program funds. A great deal of latitude was given for the use of the economic development funds, from paying for basic necessities such as water and waste facilities to establishing specialized funds to attract new businesses. The current policies continue to be rooted in the 1972 legislation. Prior to this legislation, programs were typically sector-based initiatives targeted at specific commodities or grower groups. Place-based economic development initiatives have again seen favor but as a component in programs designed to target regions (Reid and Flora, 2002).

National institutions and policies are critical factors in the regional economic development and growth. The agricultural, economic development, and transportation policies mentioned above continue their slow morph in our policy system as knowledge

is gained. These policy decisions form an important part of the foundation for the longer-term economic network. Our past experience offer insight for future policy initiatives in both their intended and unintended consequences.

Research Hypotheses

Several hypotheses concerned the spatial organization of the U.S. city network and factors influential in economic growth of these cities are offered in the existing regional economics literature. The principle directive in this paper is to create a better understanding of the characteristics of nonmetropolitan cities' economic growth, especially those located in traditionally agricultural regions. This directive forms the nucleus for the hypothesis presented in this section. These hypothesis are based on largely accepted economic principles that have been developed and tested through empirical analysis of national and large-city economies.

Four hypotheses surrounding economic growth the mesopolitan group of U.S. cities, and a hypothesis that distinguishes characteristics for mesopolitans located in agricultural regions form, the inquiry core of this dissertation. Mesopolitans include U.S. cities between the 75^{th} and 50^{th} percentile in a distribution of U.S. cities by 2000 population levels. Greater detail regarding the definition is provided in Chapter IV. The hypotheses are directed attaining a clearer understanding of economic growth paths, industrial diversity, human capital development, and transportation services as factors in

the economic growth of nonmetropolitan cities, and the subgroup of nonmetropolitan cities located in traditional agricultural regions. The hypotheses are:

Hypothesis I_0: The growth rates of U.S. cities exhibit converging trends consistent with the decreasing returns to capital posed in neoclassic theory.

Hypothesis II_0: Nonmetropolitan cities with specialized economies have more success in growing their economies, as they benefit from division of labor and economies of industry agglomeration.

Hypothesis III_0: Nonmetropolitan areas experience "brain drain," where human capital is negatively related to the economic growth rates as education enables people to leave nonmetropolitan areas for opportunities in metropolitan areas.

Hypothesis IV_0: Transportation is a necessary but not sufficient factor in nonmetropolitan economic growth.

Sub-Hypothesis $IV_{0F:}$ Freight transport service - Transportation competition is not a factor in nonmetropolitan economic growth.

Sub-Hypothesis $IV_{0B:}$ Business transport service - Air transport, as a factor in business relationships, does not affect nonmetropolitan economic growth.

Hypothesis $V_{0:}$ The traditionally natural resource-based economies of agrarian region nonmetropolitan areas are not unique, compared to other nonmetropolitan areas, with regard to the roles of industrial

1specialization, human capital levels, and transportation service, as factors in economic growth during the knowledge age.

Research Organization

The research is comprised of the five chapters that follow this introduction. Chapter II is a presentation of the theoretical framework underlying this work, as well as previous research that has offered empirical application of the theories and hypotheses produced. The model is developed, and the study scope and data are detailed in Chapter III. Chapter IV includes definitions of the U.S. city groups and a profile of their characteristics to establish a context for interpreting the research results. The empirical analysis of U.S. city income convergence and mesopolitan economic growth is presented in Chapter V. The final chapter summarizes major findings from the research.

CHAPTER II

LITERATURE REVIEW

The review of literature establishes the theoretical context for the empirical analysis of nonmetropolitan city growth. Initially, the spatial organization of the economy is discussed as networks of attached city-markets. Ideals of external market forces in mercantile theory and local market influences in central place theory form theories that underlie spatial organization of economic activity. Theories of convergence and agglomeration create the backdrop for the investigation into the economic growth of the nonmetropolitan city as regional economic nexus.

Theoretical Framework

Opportunities for economic development and growth in nonmetropolitan and agricultural regions may be more efficiently identified and pursued by first understanding the geographic structure of the economy and then considering factors that are influential in city growth. The underlying national city network is described as a rather static foundation that is predicated on early city location based in natural and long-lived man-made resources, and external market forces. The ensuing growth of cities within this market complex is dynamic, responding to both internal and external market factors.

Geographic Structure of City System

Primary lines of thought in the geographic organization of city systems are those based in export-base, cumulative causation, and central place. Innis (1930), Hirschman (1958 and 1978), and Vance (1970) offer extensions of the export-base theory in their studies of North American trade and city geography. The economic geography of the United States was modeled by Vance as a product of exogenous forces in his mercantile theory (1970). He presents a dynamic model for the development of the North American city system where the city is formed not by forces from within the population itself but from forces emanated by countries across the Atlantic. He suggests that "trade did not grow out of American economic development rather it induced that development." In employing the mercantile theory for modeling economies in the United States and Canada, the fundamental force molding the spatial structure of an urban system is shown to be the establishment of dependent outposts in new territories by distant commercial interests (Marshall, 1989).

Mercantile theory differs from the rigid hierarchy of urban/periphery relationships in Christaller's central place theory, allowing for heterogeneity of geography and resources across space. Mercantile patterns, which include wholesaling and support activities such as banking, insurance, and transportation, are seen to establish the nodes for connecting economies. The routes for relocating goods and people become entrenched over time. History, market intelligence, and mass are primary determinants of the city system in the mercantile model. While mercantile theory loses much of its' value in application in more modern knowledge-based economy, it provides a context for

understanding the underlying structure of the city network that remains fairly stagnant with regard to the formation of new cities considering the most recent decades.

Christaller's central place theory offers a more limited view for discussing local retailing and intraregional activities in autarky (Christaller, 1962). Central place theory assumes homogeneity of resources and economic activity across a geographic plane (Getis and Getis, 1970). Over time central places develop to form a hierarchical system of cities in which the center node has the most extensive set of services that are accessed by the entire population within that center nodes' surrounding system of cities. These center nodes and their dependent smaller cities are dispersed uniformly across the geographic plane.

The mercantile and central place theories provide insight into the U.S. city system as cities are viewed as entities participating in both open and closed economies. Mercantile theory offers a framework for understanding the entrenched nature of trading patterns and the evolution of market connectivity in an open economy of intercity/interregional relationships. In this sense, U.S. city system is an open economy. A liberal interpretation of the central place theory establishes a number of local closed economies, as defined by cities and their hinterlands, that are interconnected as nodes in the larger open market economy. Although this interpretation does not satisfy the strict hierarchical organization offered in central place theory, it does permit for accessibility and agglomeration benefits to be accrued and shared by a city-hinterlands region.

Economic Geography and Agglomeration

Theories of economic geography provide insight into the complex of locations

that form our rather mature city system. One aspect of this city system structure is the trend in their relative economies over time. Specifically, do the economies of cities or groups of cities converge over time? Neoclassical models offer a traditional Cobb-Douglas model of growth in which output is based on labor productivity given capital and technology inputs (Solow, 1956). A key characteristics of this model, that functions in a perfectly competitive environment, is the diminishing returns associated with capital inputs. It assumes that the marginal productivity capital declines with each additional unit. This premise establishes the means for convergence as returns to additional capital become relatively less attractive over time in capital-dense areas and resources are redistributed to capital-deficit areas where potential returns are higher. Over time, theory suggests that productivity will converge.

Although the neoclassic growth models offered a theoretical foundation for capitalism to flourish in market-based long-run sustainability, it failed to address the issues of persistent growth rate differences. New Growth models allow for increasing returns in the economic growth (Romer, 1986 and 1990; Lucas, 1988). In a reformation of traditional paradigms, these models include a broad definition of capital, including social forms of capital such as human, organizational, and knowledge, that generate increasing returns that endure over time. Increasing returns generated by the creation of social capital produces differences in the growth of economies. It may be exacerbated as self-reinforcing market signals support agglomeration rather than dispersion of resources. The persistence characteristic is footed in Myrdal's work on cumulative causation, which while it offers little explanation for factors underlying growth, does provide evidence that

"history does matter" in growth paths. Over time, the economies of capital-rich and capital-poor regions diverge to become more pronounced under these assumptions. Information pertaining to growth rates convergence is important in understanding the value of investment decisions and policy prescriptions designed to affect these patterns.

Beyond structural trends that establish underlying patterns of city growth, more dynamic phenomenon may influence economic growth. One such influence is agglomeration. Agglomeration economies take many forms, including efficiencies that are associated with internal, localization, and urbanization factors (Blair, 1995; Maki and Lichty, 2000; Fujita and Thisse, 2000). Internal agglomeration economics are realized by a firm as they are able to diffuse fixed costs. The gains from localization economies result when the concentration of activity lowers costs for all the firms in an industry at that location. Urbanization benefits that result from the overall level of activity in an urban area are shared across firms and industries at a location through the overall concentration economic activity. It is the benefits of urbanization, that may be realized in labor force specialization, public goods apportioning, and innovation capacity, that is the focus here. Urbanization economies are not limited to the individual firm or industry cluster, but are considered external because they benefit firms based on geography regardless of activity.

Cities function in a rather open economic environment in the United States as a result of low-level cultural and institutional inhibitors, relative to those such as the language differences present in the European Union. In this economy, resources migrate among competing locations based on net return considering production and transaction

costs. As migration activities concentrate in one location, a source of economic growth may be realized through the benefits of agglomeration.

In his agglomeration ideas, Pred (1966) posits that urbanization offers inherent benefits such as economies of scale and convenience. These economies allow for specialization and lead to competition, innovation, enhanced productivity, and greater returns to resources. The economies of scale offer incentive for businesses and workers to congregate. As a skilled and stable labor pool emerges, it creates an attractive draw for businesses. This presence of existing business makes it more likely that a second business, competitive or supportive, will locate in close proximity (Vance, 1970). This creates a self-reinforcing influence in the economy of the region as businesses and workers continue to cluster until some point where diseconomies of scale are experienced.

Jacobs (1969) postulates that the agglomerative forces of cities form the seed and propagate growth in the economy in new goods and services. In contrast to the specialization ideals promoted by the Marshall-Arrow-Romer theory (MAR) concerning intraindustry knowledge transfers and Porter (1990) in his local competition model, Jacobs suggests that diversification and its associated intersectoral spillovers are critical. She recounts when crop rotation commenced what is termed an "agricultural revolution" in Europe during the 18th century. The fodder, nitrogen producing, crops in the rotation were adapted from the French town gardens where they had been grown for over a century. A more recent example may be the agricultural application of global positioning satellite technology, which was developed by the defense sector, as a tool in precision

farming (PF). The PF technology is used in managing aspects of crop production such as variable rate seeding and nutrient application based on factors such as soil characteristics, planting date, and weather.

The ideas associated with spatial aspects of mercantile and central place theories and the economic considerations of agglomeration establish the theoretical underpinnings for a discussion of nonmetropolitan city economies. In this context, the location of these cities is understood as nodes of connection in rather entrenched routes that are associated with external mercantile forces. The growth of these cities is influenced both by their positions in these routes and through endogenous factors more attributable to ideals of central place and economic phenomenon such as urban agglomeration and industry composition.

Empirical Applications of Theory

The literature on economic growth experienced a revitalization with new growth theories, and the countering traditional explanations. The literature surveyed for this project concentrated on research that tested five hypotheses. The first for convergence at a sub-national level. A second regarding the relationship between economic growth and sources of agglomeration, specifically industrial diversification and human capital availability. The third is concerned with education infrastructure as a pillar in economic development. The next hypotheses of interest considers the link between transportation service and economic activity. A final hypothesis distinguishes economies in traditionally agricultural regions from other areas of the United States.

The convergence postulate is supported if the initial per capita income levels are inversely related to subsequent rates of growth of per capita income. Application of convergence theories at the sub-national level has been rather sparse, with the bulk of the research concerned with the variation among national growth rates. Conditional convergence, which has been offered as a modified neoclassical explanation of growth rate trends, suggests that initial conditions of nations (chronic differences in production functions) provide differential, steady state growth rates in the long run. Because resources are assumed to move rather freely within the U.S. economy, the caveat offered by conditional convergence is not appropriate. Thus, tests for convergence of growth rates should exhibit the expected trends toward unity if the neoclassical assumptions of diminishing returns are valid. As presented in the following section, results regarding sub-national convergence are mixed.

Barro and Sala-i-Martin (1992) consider income convergence for open economies of the 48 contiguous U.S. states and closed economies including 98 countries. Of interest is their assessment of the open economy convergence (β). Data on personal income since 1840 and gross state product since 1963 were collected for each of the states. Results provide evidence of convergence in that economies tend to grow faster in per capita terms when they are further below the steady-state position. Over long time periods, poor states grow faster in per capita income terms than rich states even when variables other than initial per capita income and product are not held constant. With regional and sectoral composition controls, the speed of convergence appears to be about the same, 2 percent per year, regardless of time period or measure of growth.

Two approaches to convergence are discussed by Sala-i-Martin (1996) in his study of interregional per capita incomes for the United States, Japan, Canada, and selected European nations. The β convergence is the primal form of convergence and offers insight into the mobility of income, within the same distribution, over time. A second form of convergence, termed σ convergence, considers the distribution of income over time. He uses personal income data from 1880 to 1990 for the contiguous 48 states in the United States, prefectural income data from 1955 to 1990 for 47 prefectures in Japan, personal income data from 1961 to 1991 for 10 provinces in Canada and gross domestic product data from 1955 to 1990 for 90 regions covering Netherlands, Belgium, Germany, United Kingdom, France, Italy, and Spain. Nonlinear regression is used to analyze regional convergence in per capita incomes by regressing the average growth rate of a set of regions between times t_0 and t_0+T on the initial level of income. The estimated speeds of convergence are similar, converging at a rate of approximately 2 percent per year. Sala-i-Martin also finds that interregional distribution of income of all countries has shrunk over time. The findings support neoclassical growth presumptions (with partial capital mobility) and the hypothesis of technological diffusion.

Boyle and McCarthy (1997) offer a simple measure of β-convergence based on ordinal rankings. It offered as a transparent evaluation of income convergence that is not subject to "Gallon's fallacy" criticism of convergence tests (Friedman, 1992; Quah, 1995). In their illustration, the rank concordance index for the OECD countries gross domestic product between 1950 and 1988 finds divergence post-1972. The lack of mobility is contrary to findings Sala-i-Martin (1994) produced using similar OECD data.

Bernat (2001) uses data on state per capita income between 1950 and 1999 to assess the convergence tendencies at a sub-national level. He finds that convergence in state per capita income was evidenced in the first three decades of data, but that the income have been relatively stable in their growth paths since 1979. Potential explanations of the lack of convergence in latter years are offered, including a temporary transition period, relative price adjustment, or achievement of steady-state growth rates. His suggestion that the 1979 per capita incomes are steady-state implies a rather unrealistic view of individual states as closed economies.

Sigma income convergence among U.S. metropolitans is investigated by Drennan et al. (2004). Their analysis of per capita income and average wage per job finds divergence among the metropolitan economies between 1969 and 2001. The findings are consistent with earlier research that identified a shift among U.S. state and metropolitan economies in the 1970's from convergence to divergence. It is suggested that the increasing differences among economies may be attributed to the more prominent role of human capital as a resource, static transportation technology, and perhaps an acceleration in skill-biased technological change.

Although investigation into the economic growth factors of the rural populations is uncommon, the literature regarding economic growth in urban centers provides valuable resources in terms of metafindings, methodology, and research practices. Several studies have investigated the spatial and economic aspects of larger cities. In one of the first such studies, initially published in 1899, Weber (1965) sought to understand the geographic and economic concentrations of population, considering national and

international context. Through statistical enumeration, he finds the earliest economic force working for the concentration of the agricultural population is trade. The factor of chief importance in the location of cities is a juncture in the transportation system. Regarding concentration of population for formation of large urban centers, it is suggested that commerce provides incentive in benefits as a diverse population offers the opportunity for specialization and economies of scale.

Henderson (1997) considers the role of medium-size cities in economies. He finds the spatial geography and relative city-size relationships are stable over time. Further, he suggests that medium-size cities are highly specialized as service centers or manufacturing centers in terms of production for export outside the city. Specialization occurs because of economies of scale internal to the industry in a city, and that local firms benefit from additional activity within the industry but not from other industries' activities. Large metro areas are more specialized in modern services (finance, advertising, etc.) and consumer oriented manufacturing and they are highly diversified. Henderson suggests that as part of the product life cycle, the metro areas act as incubators and as the ideas mature and items are standardized processes are pushed to medium-size cities.

Mills (1967) discusses agglomeration in terms of production functions and factor substitution. Agglomeration economies are created in the forms of increasing returns to scale (ie. vertical and horizontal) and scale economies (ie. need certain mass/demand to justify specialized businesses), with locational effects on efficiency parameters or increasing returns justifying a city. He notes that transport costs are a critical factor in

explaining the economics of city geography, but that resource heterogeneity and assorted production function forms are also influential. Assuming land is one input among many in a production function, the location of U.S. cities near cheap water transport seems reasonable. Mills also discusses diseconomies as an upper limit on city size.

Dobkins and Ioannides (2001) test several theories associated with economic geography, considering spatial interactions among U.S. cities between 1900 and 1990, under Herbert Simon's theory of random urban growth. They identify factors that affected the initial geographic path of city settlements and the eventual size of these cities. Metro area population, date of settlement, and spatial measures of distance from the nearest higher-tier city are offered as parameters that indicate initial advantage and adjacency development. They find that new cities tend to locate near other cities and that as city age increases it is more likely a city will have a neighbor. These findings support theories of agglomeration as cities tend to locate in close proximity to one another. Authors do not, however, find evidence to support central place ideals as distance to a higher-tier city is not always a significant determinant of size and growth. Initial advantage is evidenced but effects seem to wane over time.

Glaeser et al. (1995) assess the relationship between urban (political and social) characteristics and urban growth. Analysis of a cross-section of U.S. cities, between 1960 and 1990, focuses on human capital as a determinant of city growth. Regression analysis is used to assess an array of demographic and locational characteristics as factors of urban growth (in terms of population and income) for 203 large U.S. cities. Results suggest that average education matters and total education does not, considering the

median years of schooling and deviation in education stock from the all-city average. Total education stock for a city is measured as the deviation of median years of schooling from the average across all cities times the log population deviation from the average population for all cities. Income and population growth are found to move together, being positively related to initial schooling and negatively related to initial unemployment and initial share of employment in manufacturing. Little plausible evidence could be offered regarding social and political influences.

Cities with higher education levels are hypothesized to have higher rates of productivity attributable to human capital externalities – that are viewed as a public good. Rauch (1993) studies wages and land rents across Statistical Metropolitan Statistical Areas in the United States to assess benefits attributable to human capital through formal education. He finds a 2.8 percent increase in productivity can be attributed to an additional year of average education. These findings are similar to Lucas (1988). In his estimation of the returns to public investment in education, Rauch finds positive externatilities are present as there is a divergence in private and social returns with the latter exceeding the former by a factor of 1.7.

The rural population "brain drain" is a topic of research presented by Huang, et al. (1992). In their study of factors affecting population growth between 1950 and 1990 in 306 rural U.S. counties, they find that the income-enhancing effects of increased education are out-weighed by out-migration tendencies associated with the opportunity to earn higher incomes in urban areas. Huang et al. direct their research toward the future sustainability of rural population and the roles of nonfarm income, but do not discuss the

factors affecting these incomes nor standard of living in rural areas.

Palivos and Wang (1996) consider opposing forces in the constructs of city formation and growth. A dynamic general equilibrium model with spatial interactions is designed to consider competing forces associated with the benefits of human capital agglomeration and costs of transportation. They postulate that cities provide effective organization for economic activities in which uncompensated knowledge spillover is the main centripetal force in agglomeration. Centrifugal force (transportation) forms the bounds for limiting gains from this resource. They consider the existence of a socially optimal city size in open economies and discuss how public policies may enable a decentralized city to attain the socially optimal allocation.

Glaeser, et al. (1992) discuss agglomeration economics from human capital in terms of knowledge spillovers in cities. Regression analysis of a cross section of large-industry size and composition for 170 U.S. cities, from 1956 to 1987, is conducted. Theories of city growth differ along two dimensions, first in whether knowledge spillovers come from within the industry of from other industries, and second in their predictions of how local competition affects the impact of these knowledge spillovers. Standardized measures of specialization and competition are regressed against the growth rates of the industries for the population of larger urban centers. Specialization is measured as concentration of that industry in a city relative to that of the nation. Competition is measured as the number of firms per worker in an industry compared to the number of firms per worker in the industry for the nation. They find that local competition and urban variety, but not regional specialization, encourage employment

growth in industries. Findings suggest that intraindustry knowledge spillovers are less important for growth than spillovers across industries in mature cities.

Simon and Nardinelli (2002) posit that cities that start out with proportionately more knowledgeable people grow faster in the long run because knowledge spillovers are geographically limited to the city, and because much knowledge is most productive in the city within which it is acquired. They examine the determinants of city growth over 1900-1990 in both cross sectional and time-series dimensions. Regression analysis is employed in the discussion of city growth and evolution of human capital. They find that city-aggregates and metropolitan areas with higher average levels of human capital grew faster over the 20th century. In addition, human capital becomes more important in non-manufacturing versus manufacturing cities over time.

Drennen and Tobier (1995) test for divergence in the per capita incomes of the 51 largest U.S. cities during the 1980s. They suggest the increased demand for services, which are often concentrated in larger urban areas, contributed to a shift from converging to diverging regional incomes in terms of median household income growth between 1979 and 1989. Cities specialized in producer services in the initial year are found to have faster growth than those specialized in manufacturing.

Tamura (1996) studies the affects of human capital levels and human capital diversity on economic growth rates through a model of task specialization with coordination costs. It contains static and dynamic agglomeration economies. The presence of agglomeration economies is found but human capital differences overshadow these effects in regional integration. He finds that greater levels of human capital

heterogeneity can reduce the formation of large markets and lower per capita income and growth rates among regions. Results also indicate that regions with relatively high levels of human capital tend to be early integrators into the larger economy.

Central place implications, specifically spread and backwash effects in the rural-urban labor market, are a consideration in investments and policies that may influence these relationships in a study by Schmitt and Henry (2000). With their case study analysis of the French labor market, they seek to gain an understanding of the relationship between rural growth and rural areas considering employment and population. Rather than the more typical aggregate assessment of relationships across national urban-rural populations, the authors present case study analysis. Patterns of spatial change associated with alternative growth rates and various sizes attributed to the urban core for six distinct French labor regions are considered. They find that medium-size urban places have the strongest positive impacts on rural commune change among urban centers. Thus, the theoretical confines of central place theory that require homogeneity across the production field seem rather unrealistic in application and should be recognized in discussions of core-periphery relations across a geographic plane.

The role of transportation in regional economic development is generally seen as a rather passive factor (Button, 2000). In regional development literature, research in transportation has been concentrated on capital investment and physical assets, while the service component of transportation has received little attention. Previous findings provide little evidence of substantive economic benefits resulting from marginal transportation infrastructure investment.

An exception to this synthesis are the Aschauer (1989) findings regarding his hypothesis: "does higher public capital accumulation crowd out private investment?" Higher public capital accumulation raises the national investment rate above the level chosen by rational agents and induces an ex ante crowding out of private investment. However, an increase in the public capital stock also raises the return to private capital, which crowds in private capital accumulation. Empirical evidence on the net effect of these opposing forces is presented. Considering national non-defense public capital goods spending and private output between 1949 and 1985, Aschauer finds that public investment increases output of private firms by a large magnitude compared to a similar investment by an individual firm.

Following the Aschuaer report, several researchers delved into their own assessments of the economic effects of infrastructure investments with mixed results. The subsequent research largely agrees that public infrastructure spending produces, at best, a marginal return in private sector output (Gramlich, 1994; U.S. Congressional Budget Office, 1998; Fisher, 1997; Canning, 1999; Canning and Bennathan, 2000). Fox and Porca (2001) offer a meta analysis of previous research regarding the economic effects of transportation infrastructure investment. They define infrastructure as the services drawn from the set of public works that traditionally have been supported by the public sector. Five attributes of infrastructure are identified: accessibility, capacity, quality, diversity, and condition. They find that the contribution of infrastructure investments, at the margin, have little effect on economic performance. Infrastructure may actually be seen as a competing means for enhancing rural economic environments.

One exception is a cross-sectional study of state productivity and public capital where Munnell (1990) also finds that public spending enhances private sector productivity. The net effects, however, are found to be smaller than the Aschuaer estimates.

In another disaggregate study of metropolitans and states, Crihfield and Panggabean (1995) use a growth model to estimate the economic effect of public infrastructure capital spending between 1960 and 1977. They find a modest effect on factor (population and investment) markets and a slightly positive effect on per-capita income at the state level. Local public investment at the metropolitan level is found to have a small positive impact on the workforce, in terms of population level, but no effect on the standard of living as measures by per-capita income. The coefficients for the transportation infrastructure parameters in both the state and local investment models are generally not insignificant.

Chandra and Thompson (2000) use regression analysis to test several hypotheses regarding the link between infrastructure investment and economic activity in rural areas. In their model, highways are the proxy for investment. Results indicate an initial construction benefit to the adjacent counties, but the longer-term regional affects seem to be a spatial redistribution of economic activity to adjacent counties from non-adjacent counties.

The traffic service component has received little attention in regional economic development. Early location theory suggests that transportation costs are a major deterrent in industrial location (Weber, 1899). It assumes the typical Classical economic

premise of perfect knowledge and posits a linear relation between distance and freight rates. Later works added some reality by relaxing assumptions such as rate linearity and market heterogeneity.

Wilson et al. (1982) investigate the role of transportation factors, beyond infrastructure, in the regional economy. The objective is to assess the role of public expenditures to improve transportation costs, service, and infrastructure as a policy instrument to enhance economic development. A quantitative ordering of the significance of all plant-location factors, considering economic and non-economic factors, is presented as a means for integrating location theory into regional economic development projects. The average ranking of all factors, transportation (considering rail, road, and port) ranks fifth among nine factors considered. Among the three modes, road received the highest ranking and was fourth among all factors. Factors ranked more important by the survey respondents included proximity to raw materials, residence of owner, and proximity to market. Proximity to a skilled labor force was fifth among the factors. The results of this regional case study, based on a sample of 95 Atlantic region firms, suggest pursuing regional economic development through transport infrastructure investment may not be an optimal strategy.

Kilkenny (1998) critiques literature in positing her theory that rural communities may benefit from certain forms of lower transportation costs. The fixed cost component transhipment of transport systems is an important factor in the dispersion of rural population centers. Classic location theory assumes perfect competition and

homogeneity across markets. In this environment, factor endowments and fixed costs are primary determinants in the location of market activities. Weight-losing industries – input transport costs are low relative to output transport costs – locate near inputs, while other industries tend to locate near the consuming market. Due to fixed costs, a transhipment location that concentrates shipments becomes an agglomeration point for the transport input. To the degree that rural regions are able to lower transport costs to market regions, with the market region not receiving the same benefits, transport can contribute as a non-market good positive externality. Models show that government subsidies ultimately go to the owners of relatively fixed factors of production (land), while positive externalities (external to firm, but internal to industry) offer a means to improve quality of rural life by raising rural wages. Kilkenny offers that agglomeration benefits attributed to transport provide one potential form of an externality.

Regional economic development may be assessed across many geographic boundaries, such as nations, states, and cities. The literature reviewed in this section is concerned with the growth of cities. Human capital, dynamic externalities, and transportation are discussed as potential benefits associated with urban centers. As many regions in the United States continue to function as rural economies, it is important to understand the transferability of the benefits discussed in urban literature to less dense population areas, specifically nonmetropolitan cities and their surrounding rural regions.

CHAPTER III

METHODOLOGY AND DATA

This analysis of U.S. city economic growth includes statistical enumeration and econometric analysis. U.S. city population groups are defined. The city groups are then described in terms of their geography, population, demographics, and economic. For the mesopolitan group of nonmetropolitan cities, that is the focal city group, a model of economic growth is presented. The information presented in this section provides the framework for the empirical analysis and its interpretation.

Definitions and Scope

Mesopolitans are generally defined as population centers in nonmetropolitan areas. The migration of U.S. population from rural to urban settings and interregionally is evident in U.S. Census Bureau data. While national migration patterns and the economies of large urban areas are frequently the topic of national and international research, the economies the of small and mid-sized population centers, especially those not in close proximity to the large urban centers, have received sporadic attention in economic growth literature.

The city is selected as the unit of study for this investigation of nonmetropolitan

economic growth. The city-level analysis provides for the fluid flow of goods, services, and people across state and county borders in the United States. At the same time it allows for the consideration of underlying economic interdependencies among counties in analysis of labor market commutation data (Office of Management and Budget, 2003; U.S. Bureau of Labor Statistics, 2003).

The city definition is based on CBSA definitions, CBSA populations, and the associated county geographic borders. The city system description includes the delineation of four city groups, based on population, along with information regarding the geography, economics, and demographics of the groups. Considering the goals of this research, characteristics including education, industry diversity, and transportation service are highlighted in the statistical analysis of the U.S. city network. This city system profile provides the context for developing and interpreting econometric results.

A focal point of this research is economic growth of mesopolitans in an agricultural region covering the U.S. northern plains. The northern plains states, including Montana, North Dakota, South Dakota, Nebraska, Kansas, Iowa, and Minnesota (Figure 2), have traditionally had agriculture as a staple in the economic bases of these states. These seven states are defined as the "Ag Region," and the mesopolitans are extracted as a subgroup in the analysis and compared to other mesopolitans in the United States to determine if it has unique economic growth characteristics associated with its agrarian culture. The degree of heterogeneity of per capita income and

population growth rates between the Ag Region and other mesopolitans is an important aspect of the empirical analysis.

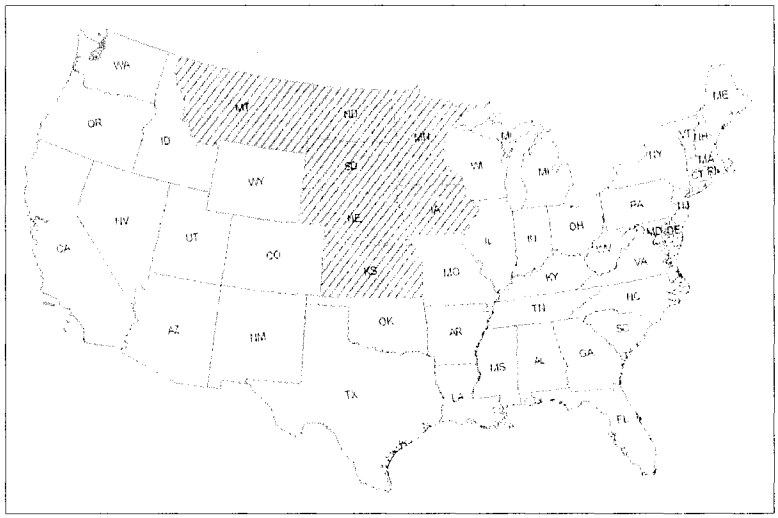


Figure 2. States with Prominent Agriculture Sector in the Traditional Economy

This assessment of economic growth investigates both converge trends and indicative factors in the economies of U.S. mesopolitans. The time period analyzed is 1969 to 2000, based on nationwide economic data available at the county level. The convergence analysis considers the entire 31-year period. The analysis of economic growth indicators is limited to the most recent two decades, 1980 to 2000.

Econometric techniques, in the form of regression modeling, are utilized for the quantitative analysis (Kennedy, 1992; Koo, 1990; Pyndick and Rubinfeld, 1991; Freund and Littell, 2000; Greene, 2002). Two forms of regression analysis are used to assess income mobility and to identify factors indicative of economic growth for U.S.

mesopolitans. The first regression, for the cross-section of U.S. mesopolitans, is in nonlinear form. The nonlinear form of the β-convergence model selected for this research has been applied in several studies considering international, interregional, and intraregional income tendencies. The model is used to address the first of the five hypotheses presented in Chapter I. In this model the per capita income growth between 1969 and 2000 will be regressed on the initial per capita income.

Non-conditional convergence is considered to determine if the neoclassic-based logic is supported in the growth of U.S. cities and mesopolitans over recent decades. The 31-year time period provides unique insight in the economy of the United States given its county level of sub-national geographic stratum in an increasingly dynamic and sophisticated marketplace. Advances in communications, technology, and international trade all contribute to the complex which offers opportunities, as well as challenges, for those lagging in terms of economic growth. Convergence within the national city system is examined. The β coefficient measures the trend in the convergence among incomes.

A negative β coefficient provides evidence that mesopolitans characterized by lower initial per capita income are those mesopolitans with the higher rates of per capita growth over time under the neoclassic assumption of decreasing returns to capital suggests. A higher β value indicates a higher tendency for convergence. If model results produce an insignificant or positive β value, the null hypothesis regarding mesopolitans growth patterns is rejected. Rejection of the null hypothesis provides evidence supporting the new growth premise of parallelism or divergence in economic growth,

where growth is positively related to initial income.

Multivariate regression analysis is used to investigate the relationship of demographic and economic factors to economic growth rates of mesopolitans. An ordinary least squares (OLS) model is constructed to assess the relationship of economic growth, in terms of per capita income and population between 1980 and 2000, to static and dynamic characteristics attributed to the mesopolitans. The static variables are primary- and secondary-order geographic factors, such as proximity to navigable waterway, interstate highway, airport, and a major urban center. Dynamic variables are associated with technology and human capital factors that include education, industrial mix, transportation service, and agglomeration externalities. The convergence and factor analysis of mesopolitan economies contribute new knowledge to the compendium of national economic growth literature.

Model Specification

Convergence is important to policymakers as it signals that lagging economies are doing relatively well, compared to those economies that have historically been leaders, and that the nation's economic landscape is becoming more balanced. National philosophies and funding principles are based in economic equality and equal opportunity for all citizens. Policy is currently formulated with an underlying assumption for natural tendencies toward equalization, or convergence, among regions. A lack of this assumed tendency toward equalization may require a different and more

aggressive approach to jump start lagging economies. Hypothesis I is defined as a means to more clearly understand the underlying tendencies of the growth in U.S. city economies, be it convergence or divergence, over recent decades.

The time series of cities real per capita income may be subject to Galton's fallacy where fictitious relationship in data is presented as a robust finding. Specifically, the real income variable time series may be non-stationary, having no tendency to revert to a mean (Dickey, et al, 1991; Castro, 2004). In preparation for the convergence model specified below, the city time series data set is tested for non-stationarity using the augmented Dickey-Fuller (ADF) regression. The ADF form is

$$\Delta Y_{i,t} = \beta_t + \theta \ln Y_{i,t-1} + \varepsilon_{i,t}$$

where $\Delta Y_{i,t} = Y_{i,t} - Y_{i,t-1}$. The real per capita income variable, $Y_{i,t}$, is tested for non-stationarity using the ADF with the time series control. If non-stationarity is determined, another t-test is conducted using first differences, or real per capita income change, $\Delta Y_{i,t}$, rather than in the real per capita income variable itself. The null hypothesis is that the difference or $I(1)$ is non-stationary. If some of the individual time series are integrated of order one, they may be cointegrated.

The cointegration means that although an individual time series is non-stationary, linear combinations of the time series tend to move together as stationary. In this process, the per capita income for city i is regressed on a set of other city income values. The cointegration test for significance in the relationship of individual time series residuals is modeled as

$$\Delta y_t = \alpha_t + (\rho - 1)_{yothercities,\, t-1} + \varepsilon_t$$

where the critical value in the relationship between change in the real per capita income residual, Δy_t, and the value of the residual in t-1. A control for time trend may also be included in the model, with effects measured as α. The t-values are checked against Dickey-Fuller critical values are used to determine if the null hypothesis is rejected.

Economic convergence of U.S. city is analyzed across the entire system of cities. The nonlinear least squares model of convergence presented by Barro and Sala-i-Martin is used in this analysis (1992). In the model, a log form of the measure of economic growth is regressed on the economic measure in the initial time period. The β-convergence equation takes the following form

$$\log Y_{iT} - \log Y_{i0} = \alpha + \beta \log Y_{i0} + \varepsilon_i$$

where Y_{iT} is the log of per capita income in mesopolitan i in year t, for T from 1969 to 2000. A convergence in the standard deviation for the economic measure, per capita income, produces a negative β. The negative result signals that locations with relatively low incomes in the initial time period tend to grow faster than other regions, supporting the neoclassical assumptions of decreasing returns to capital. The model presented above indicates non-conditional convergence.

A mathematical model of mesopolitan economic growth is defined to address the remaining hypotheses. The hypotheses, as presented in Chapter I, are concerned with the

influence of dynamic externalities, human capital levels, and transportation service on the economic growth rates of mesopolitans over the past two decades. The model form selected for this analysis of mesopolitan economic growth is an OLS multivariate regression model. Its general form is

$$Y_i = \beta_0 + \beta_1 I80_i + \beta_2 P80_i + \beta_s s_i + \beta_d d_i + \beta_{sa} s_i Ag + \beta_{sd} d_i Ag + e_i$$

where Y is economic growth; I is per capita income in 1980; P is population in 1980; s and d are vectors of static and dynamic characteristics of mesopolitan i, respectively. The Ag is a dummy variable for location of the city in the Ag Region. This methodology has widespread application in economic research, and has been applied to investigate growth indicators in previous sub national economic growth literature (Glaeser, et al. 1992; Beeson et al.; Simon and Nardinelli 2002; Kusmin, et al., 1996; Kusmin, 1994; Higgs, 1969).

A national population of U.S. mesopolitans is included in the cross-sectional data examined in the multivariate analysis. The agricultural-region mesopolitans hypothesis is encapsulated in an Ag Region identifier that is used in (Ag) interaction terms that are defined to capture differential effects for this region (Jaccard, 2001; Preacher, 2004). The interaction terms allow for differences in relationships between dependent economic growth measure and the growth parameters for Ag Region mesopolitans relative to that relationship for other mesopolitans. For example, an interaction term will be created to account for differences in the Ag Region mesocites region with respect to rail freight

transportation service, compared to the rest of the mesopolitan population. The relative importance of rail freight in the Ag Region mesopolitans may prove to be insignificant. An insignificant finding would mean that the relationship is not significantly different from the relationship between rail freight and economic growth in other mesopolitans. Alternatively, it may be significant, as expected, in showing that rail freight has relatively greater importance in the Ag Region mesopolitans.

Growth in population and real per capita income are defined as economic success measures for mesopolitan economies. Population is a crude measure of the economic success of a region. It is not completely reflective of the economic health of a region as the standard of living cannot be clearly assessed in population numbers. Population is, however, an indicator of the success of a region in attracting and maintaining individuals in a labor market especially in a national competitive market economy such as the United States. Per capita income is a proxy for the standard of living attributed to a location. The per capita income does not provide an indication for overall population or migration trends, but does provide insight regarding the welfare of residents. It is important to study these dependent variables individually as well as consider correlation between these dependent variables in assessing economic growth. A high degree of positive correlation between the variables suggests that it may be possible to limit ex post analysis to a single measure.

Geographic factors may be incorporated through an array of variables. A potential first-order geographic condition considered is location on water. The mercantile theory

established the location advantages associated with waterway access as territory was settled in the Plains of the United States. This model will consider the importance of this water access on growth in recent decades. Second-order geographic conditions are those enhancements made to the natural geography. Transportation infrastructure variables, such as interstate highway adjacency and intermodal facility proximity, are identified for each mesopolitan. Although it is generally accepted that a unitary relationship does not exist between infrastructure investment and economic growth, there is a positive correlation between adequate infrastructure and economic growth. The transportation infrastructure is largely in place in 1980, the initial year in the factorial analysis. The relationship between economic growth and geographic factors is expected to be stronger for mesopolitans in the agricultural region. The bulky nature of nature resource-based commodities, such as grain, require physical infrastructure capacity unlike the electronic infrastructure requirements for information based products.

The role of dynamic externalities (technological spillovers), human capital, and transportation service in the development of mesopolitan economies is investigated via regression analysis. Dynamic externalities are considered in a variable that measures the degree of concentration of earnings in economic sectors. A Herfindahl-Hirschman (*H*) index of industrial sector earnings computed for each mesopolitan (Kennedy, 1981). The index is calculated as a sum of the squared values of the ten one-digit standard industrial category (SIC) sector earnings for each mesopolitan. The index mathematical form is

$$H = \sum_{i=1}^{d} X_i^2$$

where, *d* is industry earning share for the industrial sectors *i* in mesopolitan *X*. County level U.S. Department of Commerce (2002) data on earnings by industrial sector is weighted by county population to calculate the indexes at the mesopolitan level for mesopolitans borders that encompass more than one county.

Consistent with Jacobs' theories of agglomeration benefits shared across industries, a greater degree of diversification is expected to be positively associated with economic growth rates. The agricultural region mesopolitans are expected to exhibit a weaker relationship than other mesopolitans considering potential gains from agglomeration, as resources in this region have been more heavily devoted to the agricultural production industry, a slow growth economic sector considering trends in personal income composition (U.S. Bureau of Labor Statistics, 2003). Understanding the nature of benefits associated with concentration of industry is important in encouraging policies that most efficiently foster economic development, be that through specialization based in the benefits of local competition and an intraindustry knowledge base or diversification and the benefits attributed to cross-industry knowledge spillovers.

The evidence suggests that cross-fertilization of ideas across industries speeds up growth (Jacobs, 1969; Glaeser, 1992). Previous investigation into the ideals of specialization versus diversification for cities has considered mature, larger urban centers. The effects of specialization and diversification may differ for nonmetropolitan urban areas and its Ag Region sub-population when compared to their urban counterparts. Simon and Nardinelli (2002) recognize demographics and spatial factors in

their discussion of human capital and city growth, but do not consider dynamic externalities. Infrastructure variables included in the initial model are eliminated in final results as they were found to be insignificant. Considering the plethora of city growth literature that establishes an important role for first- and second-order geographical advantages, this seems suspect.

In addition to infrastructure considerations, service in the transportation market may be influential in the economic growth of a mesopolitan. Since rail, highway, and waterway account for over 95 percent of U.S. freight movements, service indicators for these modes are included in the model. As competition increases in the freight market, businesses should have access to better service in terms of lower rates and more reliability. Measures of modal competition are average revenue per ton mile for rail freight, distance to water terminal, and proximity to interstate highway (Vachal et al., 2004). These variables are considered reflective of the relative service available among cities.

A spatial control variable, indicating the relative importance of geographic access to a major consumer market, is also included. One proxy is distance to the nearest major consumer market from the mesopolitan. A major consumer market, previously identified as a megapolitan, has a population of over a million. Dobkins and Ioannides (2001) rely on methodology presented by Pickard (1959) and Noyelle and Stanback (1984) to devise their city tiers in a city-center type hierarchy for proximity analysis. The concept of higher-tier adjacency in the city system as a factor in economic growth is an interesting

one. It is consistent with central place philosophies on economic organization, but may delude the effects of adjacency in terms of access to primary consumer markets (megapolitans). The agricultural region mesopolitans economies, as with other U.S. mesopolitans, are expected to benefit from closer geographic proximity to megapolitans. A more detailed definition of megapolitans is included in Chapter III.

Business travel may also play a significant role in economic growth. In the today's service economy, business agent mobility may be important in attracting and growing businesses. The cost of intercity travel is offered as proxy for the business traveler transport service. Although telecommunications, including videoconferencing, facsimile, and electronic mail, offer substitution for travel, it seems unlikely that these methods of interactions will supersede automobile and air travel (Stephenson and Bender, 1996). In fact, it has been suggested that telecommunications and travel are positively correlated, as increasingly effective and efficient communication may stimulate travel demand by increasing business activity (Khan, 1987; Mokhtarian, 1990; Gaspar and Glaeser, 1998).

The two intercity business traveler modes considered in this analysis are automobile and airplane. A delineation of the distance at which these modes are interchangeable is a one-way distance of 250 to 300 miles, based on previous research (Stephenson and Bender, 1996; Bureau of Transportation Statistics, 1997; Sharkey, 2003). A mobility measure is calculated as distance from mesopolitan to airport hub. The location of U.S. hub airports is illustrated in Figure 3. The hub designation is based

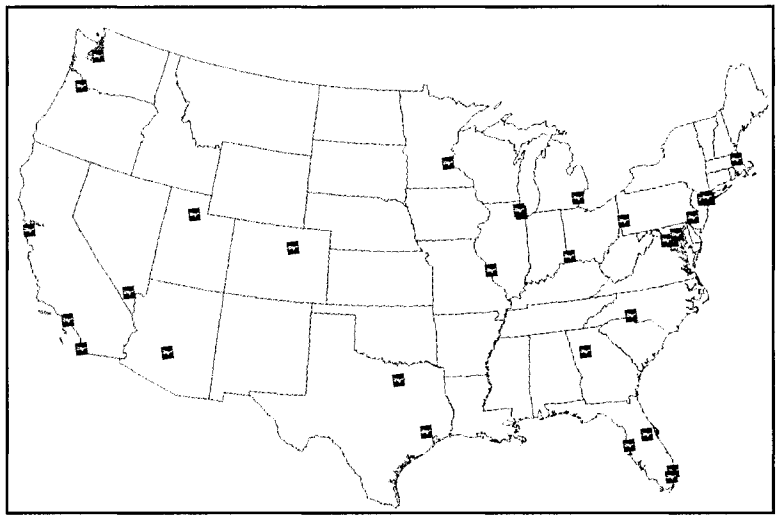


Figure 3. Hub Airport Locations

on the U.S. Department of Transportation classification system defined under 29 U.S.C. §41713(a)(3). It identifies large hub airports as facilities that are publicly-owned and handle at least one percent of annual passenger boardings (U.S. Department of Transportation, 2003). Higher levels of business transportation service, in terms of closer proximity to airport hub, are predicted to be positively related to the economic growth for mesopolitans.

The role of human capital is also investigated. Human capital is an important basic resource in economic growth. Two forms of human capital considered are basic knowledge and advanced knowledge. Basic knowledge is defined as the education and social skills attained in completing high school. Advanced knowledge refers to the education, experience, and social skills that would be associated with completing a four-year college degree. It is expected that stronger capacity in basic education and advanced knowledge produce higher rates of economic growth, holding other factors constant.

The financial crises in the early 2000's, with deficit spending in many state budgets, along with national education initiatives set forth in the No Child Left Behind Act of 2001 have created a great deal of uncertainty regarding future roles of local, state, and federal entities in financing and managing educational infrastructure. It is important for decision makers at every level to understand the value of education in economic growth for more informed resource allocations. While education is generally found to have a positive correlation with economic growth, this research provides nonmetropolitan urban centers with more reliable assessment of the benefits gained from investment in basic and advanced education infrastructure.

One exception to the positive correlation between education and economic growth is the brain drain posited for rural areas depopulation. The theory suggests that education is a negative factor for rural, often agricultural industry-based, economies as it enables individuals to move from rural to urban areas. This research addresses the validity of the Brain Drain theory by selecting the Ag Region mesopolitans as a sub-population of all mesopolitans. The interaction term for the agricultural mesopolitans is expected to be insignificant, suggesting that these cities share the same benefits from investment in education as other mesopolitans. These findings would not support statements that suggest education encourages individuals to move out of these regions to make their contribution to the economy rather than supporting economic growth in the local economy (Artz, 2003; McGranahan, 2002).

Finally, designation of "special case" observations is common in regional

economic literature. For instance, if a mesopolitan houses the state capitol or a university its economy may exhibit unique characteristics. Mesopolitans that are state capitols may have distinct economies from those of other locations because the businesses and non-government organizations related to the state institutions are often located in close proximity. University activity may also differentiate mesopolitans as cities housing higher educations establishment may have more specialized economies or higher education levels (Anselin, et al., 1997 and 2000; Miyata, 2000; Ó hUallacháin, 1992). The government and education economies may be somewhat insulated from national and regional economic trends that affect employment and profitability in the private sector, to the degree that these economies are driven by the public domain industries. These designations are made and included as control variables in the model.

The previous paragraphs generally describe the independent and dependent variables incorporated in the multivariate model of U.S. mesopolitan growth. Initial time period income and population values are included as controls to avoid endogeneity issues associated with the right-hand side variables. Furthermore, the water, highway, and rail infrastructure are not considered to have endogeneity issues as these systems were largely in place prior to 1960. The dependent and continuous independent variables are transformed into natural log form for the analysis tas it is found to be a better fit for regression function. The logarithmic form reduces potential heteroscedascity problems, including inefficiency in equal observation weights that affect the solution and biased standard errors that affect confidence intervals. A mathematical representation of the

economic growth model developed for this research is

$$\ln ECGRWTH = \beta_0 + \beta_1 \ln PCI80 + \beta_2 \ln POP80 + \beta_4 MEGDIS + \beta_5 AIRDIS + \beta_6 H2ODIS + \beta_7 RAILRATE + \beta_8 INTERST + \beta_9 \ln CONTDIS + \beta_{10} \ln INDHERF80 + \beta_{11} \ln INDMANF80 + \beta_{12} \ln INDSERV80 + \beta_{13} HSGRAD + \beta_{14} \ln PCTED16YR + \beta_{15} ACADEMIC + \beta_{16} \ln STCAP + \beta_{17} AVGTEMP + \beta_{18} NE + \beta_{19} MW + \beta_{20} SO + u$$

ECGRWTH	=	Economic growth between 1980 and 2000, in terms of the change in real per capita income and population
PCI80	=	Real per capita income in the initial time period, 1980
POP80	=	Population in the initial time period, 1980
MEGDIS	=	Distance to nearest megapolitan, in terms of highway miles
AIRDIS	=	Distance to nearest hub airport, in terms of highway miles
H2ODIS	=	Distance to nearest water terminal (inland or sea), in terms of highway miles
RAILRATE	=	Average rail revenue per ton mile for freight traffic originated by the mesopolitan BEA between 1999-2001
INTERST	=	Identifier for location within 5-mile highway drive of interstate highway (INTERST=1)
CONTDIS	=	Distance to nearest rail/truck intermodal container facility handling container on flat cars (COFC) or trailer on flat car (TOFC) shipments
INDHERF	=	Herfindahl-Hirshman index of industry diversification, in terms of sectoral industry incomes in 1980
INDMANF80	=	Share of per capita income derived from manufacturing industry in 1980
INDSERV80	=	Share of per capita income derived from service industry in 1980

HSGRAD	=	Identifier indicating greater than mean value for share of population with basic education of 12 years or more in 1982 (HSGRAD=1)
PCTED16YR	=	Percent of mesopolitan population with advanced education of 16 years or more in 1982
ACADEMIC	=	Identifier variable for post-secondary academic institution (ACADEMIC=1)
CAPITOL	=	Identifier for state capitol (CAPITOL=1)
TEMP	=	Average temperature, based on mean temperatures in January and July from 1941 to 1970
NE	=	Identifier for Northeast Census Division (NE=1)
MW	=	Identifier for Midwest Census Division (MW=1)
WE	=	Identifier for West Census Division (WE=1)
u	=	error term

where economic growth is measured by the dependent variables per capita income growth and population growth (ECGRWTH) between 1980 and 2000. Control variables are included for the level of per capita income in the initial time period, 1980 (PCI80) and population in 1980 (POP80).

The 1980 population data is also used to identify agglomeration benefits associated with increasing population mass in the mesopolitan CBSA group. The scale economies and cross-fertilization opportunities are expected to enhance the economies of larger cities relative to their smaller population counterparts. A positive relationship is expected between agglomeration, as measured by population, and the economic growth.

Six spatial and transportation related variables are defined in the model of economic growth. A spatial control is included in the distance to nearest megapolitan variable (MEGDIS). The distance to megapolitan is expected to be inversely related to economic growth. The inverse relationship supports the mercantile theory premise that

the market is rather entrenched in traditional channels due to natural and man-made advantages so access to primary nodes in the system, in terms of proximity to urban population centers, is positively related to economic growth.

The frontier economy was based largely on waterborne movement of commerce. Therefore, settlements gained a comparative advantage in locating near navigable water for trade and economic growth. The advantage of water access, however, is expected to have waned over more recent decades with the onset of the knowledge age and today's plethora of transport options. The distance to closest water terminal (H2ODIS), either inland or sea, is included to assess ongoing benefits from this static characteristic of the mesopolitan location. Water terminal proximity is expected to have a weak inverse relationship with economic growth, as distance to water increases economic growth is expected to slow. While the absolute value of water access may be diluted compared to frontier days, locations may still benefit from the capacity and intermodal competition provided by this access.

Transportation service quality is expected to influence economic growth. Four measures of service quality are considered in the rail freight rates (RPTM), location within 5 miles of interstate (INTERST), distance to TOFC/COFC (trailer on flat car/container on flat car) intermodal facility, and proximity to hub airport for business transport service (AIRDIS). The average rail rate for the more recent time interval, 1999 to 2001, is included in the model due to the lag in industry response to national rail policy that largely deregulated rail rate setting in 1980. The pricing freedoms are the results of a

series of legislation concluding with the Rail Rehabilitation and Revitalization Act (4Rs) that was discussed in the introduction. Rail rates, in terms of average revenue per mile for freight shipped between 1999 and 2001, are expected to be inversely related to economic growth.

Proximity to interstate is an indicator for transport service quality as interstate access may offer benefits not available with access to state or local roadways. The U.S. interstate highway system was completed during the industrial age. The U.S. interstate system, which comprises less than one percent of this system, is a primary conduit in the U.S. road network. The importance of this interstate system to commerce is apparent in the U.S. Department of Transportation roadway statistics, which show the annual vehicle miles traveled per lane-mile on the interstate is 4 million per year compared to 1.5 million for other arterial roads. While the benefits of this static attribute may be related to industrial mix and alternative road characteristics, close proximity to an interstate is expected to be positively related to economic growth in the access it provides to a nationwide transportation network. Close interstate proximity is defined as location within 5 miles of an interstate.

Access to a TOFC/COFC intermodal facility is included as a third freight transportation service indicator. Container shipping has grown substantially since its introduction in the 1950s. Containerized transport offers flexible and reliable repositioning for production in a global market. The knowledge age has both increased the demand for and lent to the capabilities of this industry in the market communication

and operations technology. Closer proximity to a container facility is expected to enhance economic growth in the associated capacity and service competition benefits.

The final transportation service augments the freight service quality variables by adding a business travel service quality measure. While automobile, bus, and train do offer options for business travel, air travel is selected as prevalent in the business location decisions and ongoing operations in a global market. Airport hub proximity is used as a proxy for business travel. The business air travel variable is expected to be inversely related to economic growth. As distance to airport hub declines, mesopolitan economic growth is expected to increase.

Three variables related to industrial composition are included to measure the effects of local industry diversification in terms of specialization gains and knowledge spillovers, along with the effects of broader national and international industrial sector market forces on local industry. An industry Herfindahl-Hirschman index (INDHERF) of industrial sector earnings measures the degree of specialization of a mesopolitan. The index is expected to be negatively related to economic growth due to industry agglomeration benefits of knowledge spillovers. The Herfindahl-Hirschman index ranged from 0.76 for the most specialized economy to 0.13 for the most diversified economy among the mesopolitans.

In addition, individual local industry share measures for the two largest industrial sectors, manufacturing (INDMANF80) and services (INDSERV80), measure the effects of broader national industry trends on local economic growth in terms of revenue. The

manufacturing and services account for 22 and 12 percent of personal income in 1980, respectively. These shares compare to two and one percent for farming and mining, respectively, that are the next largest industry shares in the compendium of ten industrial sectors defined by the U.S. Department of Commerce. A positive correlation between economic growth and industry shares in services in 1980 is expected due to the national growth in this industry sector, in terms of its share of the economy, in the past two decades. Industry shares in manufacturing are expected to be negatively related to economic growth as the share of these sectors in the national economy has declined since 1980.

Measures of human capital are included in two variables. The first variable is an identifier term that differentiates mesopolitans that have relatively more of their population with 12 years or more of education (HSGRAD), compared to the mean for the mesopolitan population. This measure is an indicator for the value of basic education typically associated with acquiring a high school degree. A second human capital variable measures the relationship between advanced education and economic growth using the share of mesopolitan population with 16 years or more of education in 1982 as the proxy for advanced education (PCTED16YR). Both basic and advanced education parameters are expected to be positively related to the growth regressors.

The final variables in the model are associated with location attributes. The first is a measure of average temperature (TEMP) for the mesopolitan as a more defined proxy for climate amenities (Gyourko and Tracy, 1991; McGrahanan and Beale, 1999; Huang

et al., 2002). Regional dummy variables, defined by U.S. Census Divisions as Northwest (NE), Midwest (MW), and West (WE) are included to as a broader control for attributes such as recreation, overall climate, and air quality that impact interregional migration trends. East is the fourth and final Census Division. It is excluded from the model as the reference category for the geographic regional identifiers.

The economic growth model outlined in this section set the framework for the empirical analysis. Insight into the economic growth of mesopolitans is valuable to a growing city sector population in the U.S. economic landscape. This research will enable decision makers seeking to promote economic growth in nonmetropolitan areas to make more informed decisions in resource allocations and policy development.

Data

The economic convergence presented includes 926 U.S. cities, as defined by the CBSAs (U.S. Census Bureau, 2003a). The economic growth analysis is limited to the mesopolitan population, a subset of the U.S. city population including 368 cities with populations between 38,758 and 428,853. National county-level economic and demographic data is aggregated at the county level for a geographic representation of the CBSA units that define the U.S. city system.

Two data sets for U.S. cities were constructed for the analysis. Both sets are based on county-level data that are aggregated to CBSA level, with counties weighted by population, to reflect the CBSA definitions that are published by OMB (U.S. Census

Bureau, 2003a). The first data set includes annual per capita income and population for each CBSA in the United States from 1969 to 2000, the entire time period for which this economic data exists. This information was developed based on county-level data published by the U.S. Department of Commerce in its Regional Economic Information System (2002). This data set will be employed in the analysis of income convergence.

In a second data set, the U.S. Department of Commerce income and population data is truncated to include data from 1980 to 2000 for counties included in the mesopolitan geography. This base mesopolitan data set is supplemented with data from the U.S. Census Bureau, including *County and City Data Book* for 1988 and 2000 and *USA Counties: 1998*, to create the demographic and economic profile for each of the mesopolitans. The U.S. Census publishes county-level information required for the measuring level of education as part of its decennial census. The decennial census also includes variables such as born in-state and foreign-born residents that are potential variables in the model of economic growth.

The U.S. Department of Transportation's *Public Use Waybill*, *Commodity Flow Survey*, and *National Transportation Database* publications, were accessed to compile information required for the rail rate, background information, and other transportation regression variables. The National Science Foundation *Computer-Aided Science Policy Analysis and Research* (CASPAR) online data system was used to estimate higher education total research and development expenditures and enrollment by county. The final data source was the Area Resource File (ARF), which is maintained by the Office of

Research and Planning, Bureau of Health Professionals, within the Health Resources and Services Administration, as referenced by McGranahan and Beale (2002). The ARF includes climatic data used for computing the average temperature parameter.

As indicated in the previous paragraphs, the analysis of mesopolitan growth patterns is based on county-level data. Individual mesopolitan geographies are defined by county borders that may include one or more counties as defined in the OMB CBSA definitions. The county-level data are aggregated and weighted by population to reflect this CBSA composition. The data described in this section are the primary sources utilized.

CHAPTER IV

POPULATION PROFILE

U.S. cities, defined using OMB CBSAs which are geographically delineated by county border areas, are profiled in this chapter. The entire population of over 900 cities is included in the non-conditional analysis of economic convergence between 1969 and 2000. Cities are stratified by 2000 population for the factorial analysis of mesopolitan economic growth. General characteristics of the U.S. city population are presented in this section. In addition, the social and economic characteristics of the entire mesopolitan city group and the Ag Region mesopolitan sub-population are offered in more detail. The population profile details fundamental information about city group definitions, geography, and characteristics. The profile is valuable in understanding the U.S. city network composition and in interpreting research findings regarding economic growth of its members.

City Group Definitions

Cities are generally defined as political subdivisions of urban population. The CBSA definitions are utilized to set county-level geographic boundaries that are necessary for associating social and economic data in small- and medium-size urban

areas. A total of 926 CBSAs are defined for the research. About two-thirds of the CBSAs are contained within a single county border with the balance of the CBSA borders defined by combining the county borders of 2 to 28 counties. For the CBSAs including more than one county, the highest population county is used as the primary county. The per-capita income and demographic characteristics for the multi-county CBSA are a weighted average, with county population as the weighting factor. Categorical characteristics are determined by the primary county characteristics. The state and census region locations of the CBSA are assigned based on the primary county location.

Individual CBSA populations range from under 13,000 to over 18 million in 2000. For the profile and analysis, the CBSAs are divided into four city groups. The groups are defined by the distribution of the 2000 CBSA populations. Differences in the mean 2000 CBSA population among city groups is statistically significant ($F=176.96$, $p=.00$).

Each of the city groups is given a name to simplify data presentation and discussion. The groups names are megapolitan, metropolitan, mesopolitan, and

Table 1. Population Ranges for City Groups

	City Group			
	Megapolitan	Metropolitan	Mesopolitan	Micropolitan
Population	over 1,097,315	482,854 to 1,097,315	68,639 to 482,853	under 68,639
Frequency	46	46	368	465

micropolitan. The population ranges that define each of the groups are presented in Table 1. The geographic distribution of these city groups is illustrated in Figure 4.

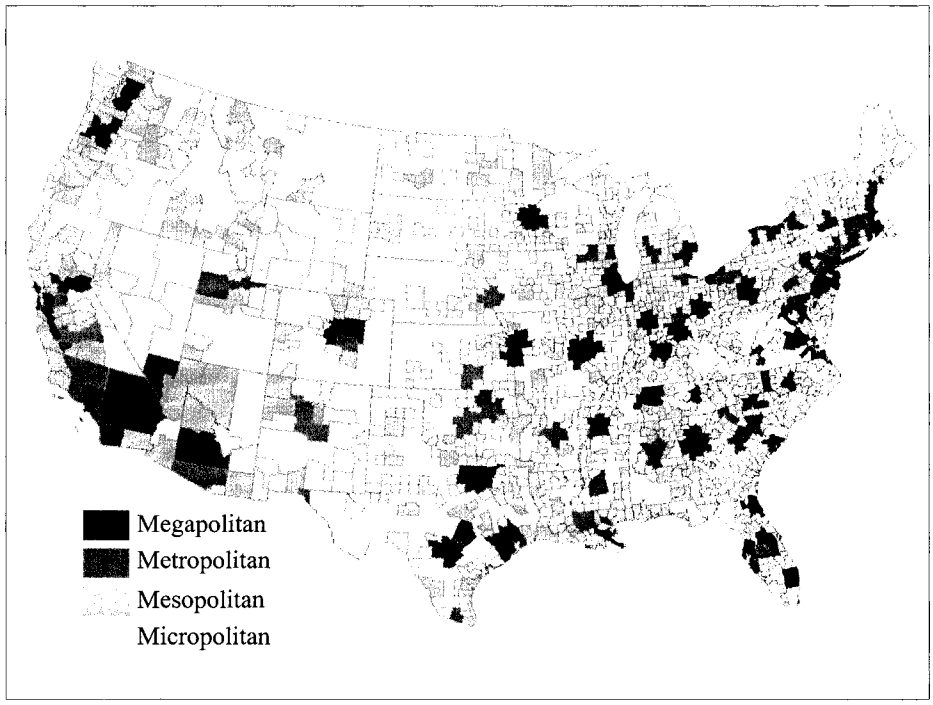


Figure 4. Location of Cities, by Group

Megapolitan population centers are defined as economic hubs in the socioeconomic geography of the U.S. city system. The megapolitan city population is defined as CBSAs in the 90th percentile for 2000 CBSA population. A list of the 46 megapolitans in the group is provided in Tables 2 and 3.

The 99th percentile for 2000 CBSA population includes ten cities. Table 2 identifies these ten largest megapolitans and specifies their population levels for 2000. The populations range from 18.3 to 4.3 million residents. These ten largest population

centers account for approximately 30 percent of total U.S. urban population in 2000. The two largest CBSAs, covering the New York and Los Angeles urban areas, maintain their

Table 2. Ten Largest Megapolitan CBSAs in 2000

CBSA Rank	CBSA Title	CBSA Population
1	New York Northern New Jersey Long Island, NY NJ PA	18,347,756
2	Los Angeles Long Beach Santa Ana, CA	12,403,090
3	Virginia Beach Norfolk Newport News, VA NC	10,672,778
4	Chicago Naperville Joliet, IL IN WI	9,116,570
5	Philadelphia Camden Wilmington, PA NJ DE MD	5,692,378
6	Dallas Fort Worth Arlington, TX	5,193,867
7	Houston Baytown Sugar Land, TX	4,739,762
8	Detroit Warren Livonia, MI	4,456,645
9	Boston Cambridge Quincy, MA NH	4,396,392
10	Atlanta Sandy Springs Marietta, GA	4,281,551

Sources: U.S. Department of Commerce, 2002; U.S. Census Bureau, 2003a

first and second positions, respectively, in CBSA population rankings for 1980, 1990, and 2000 (Appendix B). The remaining eight are fairly static with regard to composition, but population rank-order varies for 2000 compared to 1980 and 1990 (Appendix B). A single CBSA, Atlanta Sandy Springs Marietta, Georgia, does move from the lower-strata megapolitan group into the ten largest megapolitan group over the time period to replace the San Francisco Oakland Fremont, California CBSA in 2000.

The remaining 36 megapolitan CBSAs are presented in Table 3. The 1980 and 1990 population rank-orders for these smaller megapolitans are detailed in Appendix B.

The megapolitans have populations from 1.1 to 4.1 million. Comparing the CBSAs included in the smaller megapolitan group in 1980, 1990, and 2000, membership does show some change between 1980 and 2000 with six cities shifting in and out (Appendix B).

The higher populated megapolitans group exhibit more stability in terms of their positions within the rank-order. Although there are shifts in rankings among the top 20 in the group, the composition is unchanged compared to 1990 with the one exception. Understanding the relative positions of the larger cities is important in integrating proximity to major population center as a parameter in the economic growth of the smaller mesopolitan population centers. The comparison across the three time periods also provides an indication of stability in the nodal city system, as is expected in the entrenched mercantile city geography.

The 368 mesopolitans are identified as CBSAs with populations between the 50th and 75th percentiles for the distribution of CBSA populations in 2000. The CBSA included in this group have populations between 68,365 and 428,853. Cities in this range include medium and small urban centers. The remaining CBSAs are defined as metropolitans or micropolitans, based on their 2000 populations levels. Metropolitan CBSA population is in the 75th to 90th percentile in 2000. The 46 metropolitan CBSAs have populations of over 428,000 and under 1.1 million. The largest group, in terms of CBSA numbers, is the final group – micropolitans. The 465 micropolitans have populations ranging from 10,000 to 68,365. The micropolitans include all CBSAs in the

Table 3. Megapolitan CBSAs 2000, Rank by Population

CBSA Title	CBSA Rank	CBSA Title	CBSA Rank
San Francisco Oakland Fremont, CA	11	Sacramento Arden Arcade Roseville, CA	29
Washington Arlington Alexandria, DC VA MD WV	12	San Jose Sunnyvale Santa Clara, CA	30
Riverside San Bernardino Ontario, CA	13	San Antonio, TX	31
Phoenix Mesa Scottsdale, AZ	14	Orlando, FL	32
Seattle Tacoma Bellevue, WA	15	Columbus, OH	33
Minneapolis St. Paul Bloomington, MN WI	16	Providence New Bedford Fall River, RI MA	34
San Diego Carlsbad San Marcos, CA	17	Indianapolis, IN	35
Miami Fort Lauderdale Miami Beach, FL	18	Milwaukee Waukesha West Allis, WI	36
St. Louis, MO IL	19	Las Vegas Paradise, NV	37
Baltimore Towson, MD	20	Charlotte Gastonia Concord, NC SC	38
Richmond, VA	21	Nashville Davidson Murfreesboro, TN	39
Pittsburgh, PA	22	New Orleans Metairie Kenner, LA	40
Tampa St. Petersburg Clearwater, FL	23	Austin Round Rock, TX	41
Denver Aurora, CO	24	Memphis, TN MS AR	42
Cleveland Elyria Mentor, OH	25	Buffalo Niagara Falls, NY	43
Cincinnati Middletown, OH KY IN	26	Louisville, KY IN	44
Portland Vancouver Beaverton, OR WA	27	Hartford West Hartford East Hartford, CT	45
Kansas City, MO KS	28	Jacksonville, FL	46

Sources: U.S. Department of Commerce, 2002; U.S. Census Bureau, 2003a

lower half of the CBSA population distribution in 2000.

City System Geography

U.S. city population totals over 268 million in 2000 based on the CBSA defined cities (U.S. Census Bureau, 2002). Over half of this population resides in cities comprising the largest cities, megapolitans. Mesopolitans, the focal city group, are home to approximately one-fourth of the U.S. urban population. The city population is largest, by number of residents, in the South Census region (Figure 5). The South has 97 million urban residents that accounts for over 36 percent of U.S. urban population. Urban populations in the West, Midwest, and East Census Divisions all range between 53 and 59 million people.

The U.S. economy geography, in terms of population, shifted from northeast to southwest (Otterstrom, 2001; Plane and Rogerson, 1994). The interregional migration trends are evident in the net population change across regions between 1980 and 2000 in Figure 5. These relocation decisions are attributed individual utility decisions that may be influenced by economic, social, and geographic factors. Regional attractiveness is defined by a wide array of factors such as employment opportunities, housing costs, climate, civic activities, and recreational proximity (Cromartie, 1998; Rudzitis, 1999; Kusmin, 1994). In the 1990s, researchers posited that the more footloose nature of information age businesses allowed for a rural area repopulation and nonmetropolitan growth attributed to social and environmental amenities (Sutton, 2004; Johnson and

Beale, 1998). Beyers and Nelson (2000) find that nontraditional factors, such as niche manufacturing, inter community connectivity, and induced real estate development, should be considered in contemporary nonmetropolitan population trends in their case study of four U.S. counties.

The South and West Census Divisions have population increases of 14.6 and 14.0 percent between 1998 and 2000, respectively (Figure 5). The East and Midwest populations decline 15.6 and 14.5 percent, respectively, during this time period. The

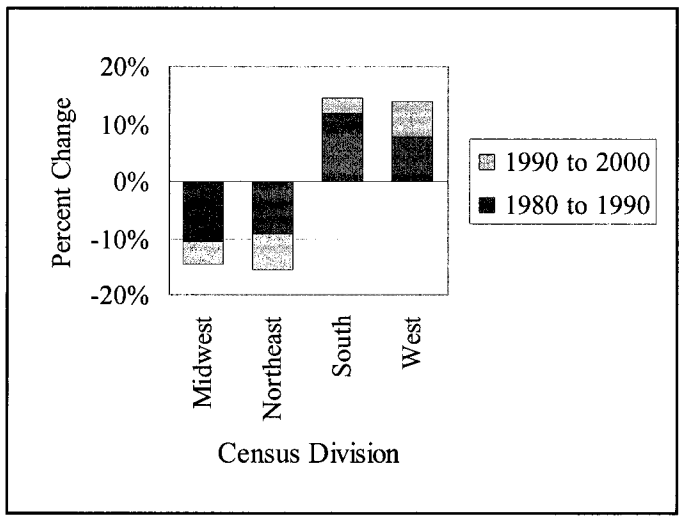


Figure 5. Regional Population Change, 1980 to 1990 and 1990 to 2000

population decline in the Midwest and the increase in the South occur largely during the first ten years. Population changes in the Northeast and West are more evenly spread across the two decades.

The greatest concentration of urban population is located in the Northeast, as the

urban population density is 316 per square mile for the total area of the region (Table 4). The West is most sparsely populated at 34 persons per mile for 11 states included its geography of that region. Urban population densities in the South and Midwest are 111

Table 4. Location and Population of U.S. Cites, by U.S. Census Region and City Group

Region	City Group				Total City Population	Urban Population Density*
	Megapolitan	Metropolitan	Mesopolitan	Micropolitan		
	----------Number of CBSAs----------				*(in 1,000)*	*(per sq. mi.)*
Northeast	7	12	50	25	52,690	316
South	18	18	147	205	97,128	111
Midwest	10	8	102	163	58,245	76
West	11	8	69	72	59,466	34
All Regions	*----------Number of Residents---------- (in 1,000)*					
City Group Population	153,337	32,281	63,406	18,504	268,529	

*Urban population density is calculated as city residents divided by total land area of the Census region.
Sources: U.S. Department of Commerce, 2002; U.S. Census Bureau, 2000

and 76 persons per square mile, respectively, considering the total area covered by each region. While urban population is dispersed across the Census Divisions, the prevalence of urban population varies. As density indicates, the West has more urban residents than the East but the population is more geographically dispersed. It is important to recognize these distinctions as they may have implications for policymakers and local economic development initiatives developed under the premise that "one size fits all."

The cities group members are dispersed across the United States to define the economic and market geography (Figure 6). Considering U.S. Census Divisions illustrated in Appendix A, the South houses the largest proportion of cities considering number. The largest number of mesopolitans, 147, are located in this region. They account for 40 percent of U.S. mesopolitans, and about 38 percent of the cities in the region. The Midwest is second in mesopolitan population, with 102. They account for 36 percent of the cities in the region and about 28 percent of the all U.S mesopolitans.

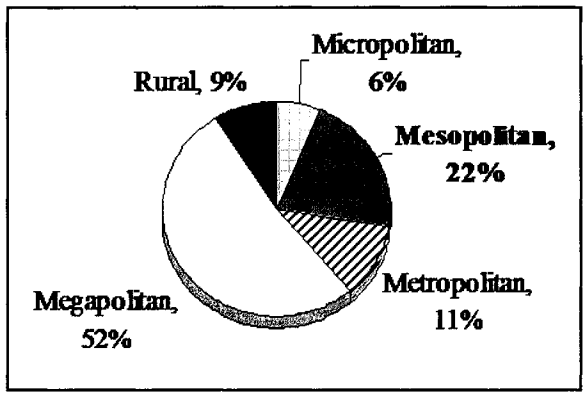


Figure 6. Distribution of U.S. Population the Among Rural Area and City Groups, 2000

The West and Northeast contain 69 and 50 mesopolitans, respectively. Although smaller in number than in the other regions, this city group accounts for more, 43 and 59 percent respectively, of the CBSAs located in these regions.

Considering the seven agricultural-state region (Ag Region), the distribution is skewed toward the mesopolitans in terms of population among the groups. The 26 mesopolitans have a total population of about 4.2 million, accounting for about 40

percent of the population in the Ag Region. The Ag Region includes a single megapolitan CBSA, Minneapolis-St. Paul Bloomington, Minnesota-Wisconsin, with a population of approximately 3 million, and two metropolitans Omaha-Council Bluffs, Nebraska-Iowa and Wichita, Kansas with populations totaling 1.3 million. Twenty-six micropolitans located in the Ag Region have a total population of about 2.5 million. The prevalence of the mesopolitan-type CBSA in the region, in terms of population, suggests this research provides valuable insight for the regional economy and its city-system.

U.S. City Group Characteristics

The population of the United States is predominately urban. The urban-defined CBSA counties that form the cities studied here account for 45 percent of U.S. land area and 90 percent of U.S. population in 2000. The share of U.S. residents living in rural counties declined 10 percent, from 10 to 9 percent between 1980 and 2000. Therefore, the economic growth of city groups, in terms of population, is affected by a continued migration from rural to urban areas but is largely determined by migration among cities.

The average real per capita incomes for individual city groups are positively related to population differences among the groups (Figure 7). The relationship has tended to become more pronounced in 2000 compared to 1980. The average real per capita income for mesopolitans in 1980 was 18,545 dollars compared to 25,276 dollars for megapolitans. Although average real per capita increases for each of the city groups between 1980 and 2000, megapolitan cities gain proportionately more than the other

cities in the groups. Consider gains in terms of an index where average real per capita income growth between 1980 and 2000 for all U.S. cities is equal to one. The gain for megapolitans between 1980 and 2000 is 1.19, compared to 0.59, 0.65 and 0.84, respectively for the micropolitan, mesopolitan, and metropolitan cities.

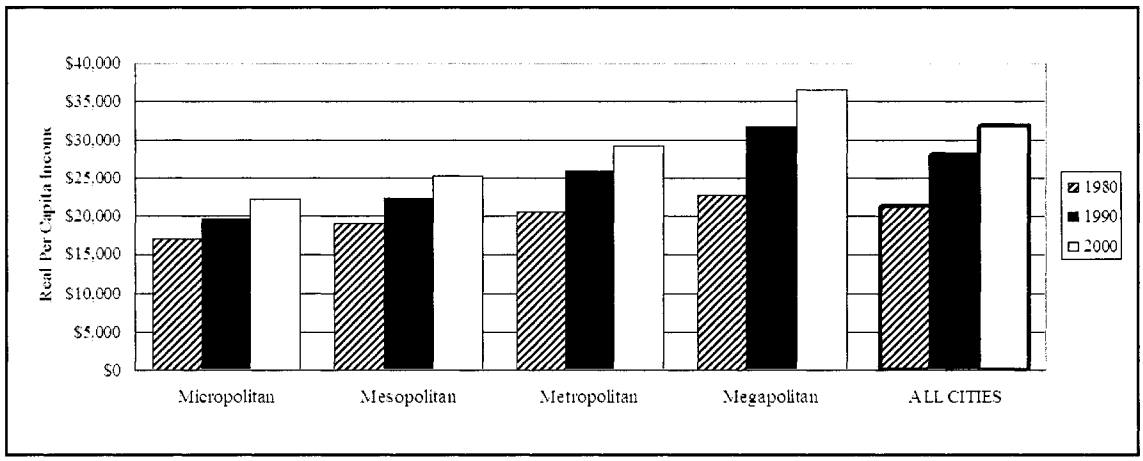


Figure 7. Real Per Capital Income Trends for City Groups, 1980 to 2000

Comparing average real per capita income for all cities to the average income for each city group, in 1980, 1990, and 2000, provides insight into relative economic well-being over time in terms of the overall situation of U.S. city economies. The megapolitan city group maintains income greater than the national average in each of the three time periods. In addition, the megapolitan cities gain relative to their initial position as the 1990 and 2000 indexes are 1.14 compared to 1.09 in 1980 (Table 5).

Table 5. Economic Growth for City Groups, Index of Average Annual Real Per Capita Income in 1980, 1990, and 2000 Based on Average for All Cities in Each Year

City Group	1980	1990	2000
	Annual Index, Average Real Per Capital Income for All Cities in Year=1		
Micropolitan	0.80	0.69	0.69
Mesopolitan	0.89	0.79	0.79
Metropolitan	0.96	0.92	0.91
Megapolitan	1.09	1.14	1.14
All Cities (=index)	1.00	1.00	1.00

Considering the city groups experiencing a decline in relative real per capita income between 1980 and 2000, the micropolitan group experienced the greatest relative decline in real per capita income of 14 percent, compared to the national average real per capita income for all cities. For both the micropolitan and mesopolitan cities, the relative income losses occurred between 1980 and 1990. The micropolitan and mesopolitan average incomes are stable relative to the national average at 0.69 and 0.79, respectively, in 1990 and 2000. Although the metropolitan city group maintains a real per capital income closer to the national average than the micropolitan and mesopolitan city groups, income for this city group declines relative to the national average across the three time periods (Table 5). The income index is 0.96 for metropolitan cities compared to 0.92 in 1990 and 0.91 in 2000.

The economic growth of cities in each of the city groups in terms of population, shows similar trends as the largest city group gains relative to other groups. Within the

Table 6. Economic Growth for City Groups, Index of Population Change Between 1980 and 2000

City Group	1980 to 1990	1990 to 2000	1980 to 2000
	Index, Percent Growth in All City Population=1		
Micropolitan	0.16	0.71	0.39
Mesopolitan	0.61	1.03	0.79
Metropolitan	0.87	0.93	0.89
Megapolitan	1.33	1.04	1.21
All Cities	1.00	1.00	1.00

city groups, the megapolitans increased population by 36 percent between 1980 and 2000. The metropolitan and mesopolitan groups also experience substantial population gain with 26 and 23 percent increases in residents, respectively. Based on an index of national population growth, megapolitans are the only cities to maintain above average population growth when the 1980 to 2000 time period is divided into two decades (Table 6). The only other above average population growth, compared to the national population growth for all cities, is observed for the mesopolitan group in the more recent decade. This income and population information helps in understanding the geography and characteristics of the city groups defined for this research.

Mesopolitan Attributes

The mesopolitan group accounts for approximately 38 percent of urban land area, considering county-level CSBA-based city group definitions. Considering the distribution of mesopolitan areas across U.S. Census Divisions, the West accounts for the

largest share with 39 percent. The smallest share of 8 percent, as expected, is in the highly urbanized geography of the Northeast. The South and Midwest account for 31 and 22 percent of the mesopolitan land area.

Regarding the distribution of mesopolitan population, the South has the largest share with 41 percent. While mesopolitan population increased across all Census Divisions between 1980 and 2000, the largest increase is for mesopolitans in this region. A 5.7 million person increase in mesopolitan population represents a 28 percent increase in mesopolitan population. The West also had substantial gain in its mesopolitan population with a 4.1 million person increase in its mesopolitan population. The increase is 47 percent above the 1980 mesopolitan population count. The Midwest had the smallest percent gain in mesopolitan population with a 9 percent increase in 2000 compared to 1980. The Northeast had the smallest actual gain, as mesopolitan population

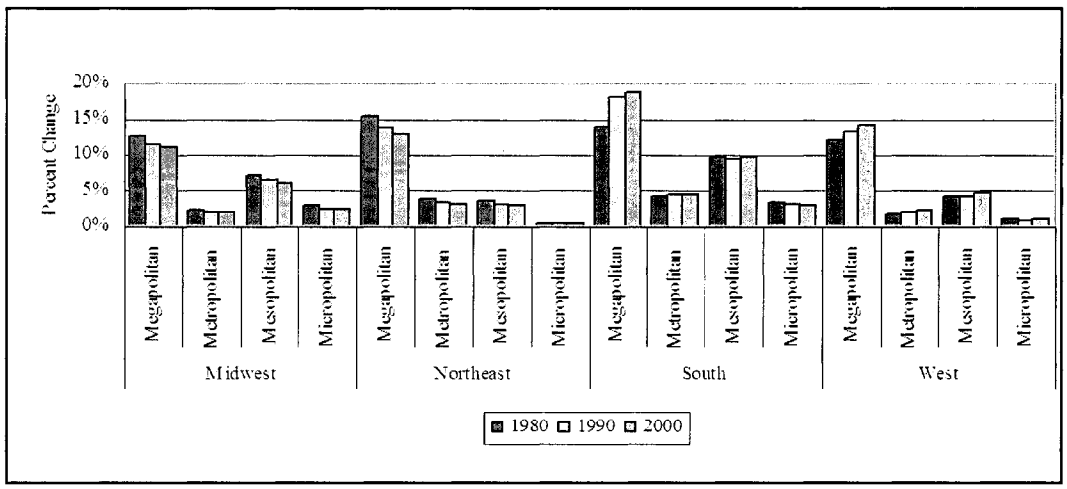


Figure 8. U.S. Population Distribution Across Census Divisions and City Groups in 1980, 1990, and 2000

increased by only 0.8 million. These population changes may be the result of intraregional among city groups or interregional migration among or within city groups (Figure 8).

The mesopolitan population means for the inherent and dynamic attributes are provided in Table 7. In addition, the correlation with the per capita income and population economic growth measures are detailed in the Pearson Product-Moment correlation coefficient and significance measures. The change in real per capita income and change in population between 1980 and 2000 are defined as economic growth measures. The mean per capital income for mesopolitans in 1980 is 18,545 dollars. The standard deviation of 2,734 dollars, that is equal to 15 percent of the 1980 mean income. The standard deviation is equal to 15 percent of the 1980 mean income, and may be stated as a 0.15 coefficient of variation. Average 1980 population for the mesopolitan group is 139,691 with a standard deviation of 83,498 or 60 percent of the mean population.

In the mercantile city structure, access to urban hub consumer markets and infrastructure nodes provides a competitive advantage in economic growth for smaller cities. Geographic proximity is one measure of urban hub access. The distance from mesopolitan to megapolitan ranges from 16 to 653 miles. The mesopolitan population distribution is skewed toward the shorter distances, with an average of 67 miles.

Table 7. Means and Relationships for Independent Variables used to Model Mesopolitan Economic Growth

			Correlation with Economic Growth Measure[1]			
	Mean	S.D.	PCI	*P*	POP	*P*
PCI80	18,544.74	2,734.26	0.040	0.44	0.153	0.00
POP80	139,691.65	83,498.02	0.099	0.06	0.313	0.00
MEGDIS	67.34	50.42	-0.187	0.00	0.046	0.39
AIRDIS	163.20	97.07	-0.175	0.00	-0.037	0.49
H2ODIS	103.01	142.25	-0.190	0.00	0.161	0.00
RAILRATE	5.86	2.48	0.038	0.48	-0.098	0.07
INTERST (= 1)	0.33	0.47	-0.074	0.24	-0.170	0.00
CONTDIS	67.34	50.42	-0.148	0.01	0.193	0.00
INDHERF	0.02	0.08	0.141	0.01	-0.130	0.01
INDMANF80	0.29	0.15	0.102	0.05	-0.343	0.00
INDSERV80	0.17	0.05	0.257	0.00	0.295	0.00
HSGRAD (= 1)	0.52	0.50	0.170	0.00	0.167	0.00
PCTED16YR	0.14	5.40	0.521	0.00	0.280	0.00
ACADEMIC (= 1)	0.91	0.28	0.127	0.01	0.013	0.80
CAPITOL (= 1)	0.05	0.22	0.128	0.01	0.097	0.06
TEMP	54.92	8.15	-0.085	0.11	0.351	0.00
AGST (= 1)	0.07	0.26	0.044	0.40	-0.093	0.07
MW (= 1)	0.28	0.45	0.032	0.54	-0.292	0.00
SO (= 1)	0.40	0.49	0.097	0.06	0.126	0.01
NE (= 1)	0.14	0.34	0.138	0.01	-0.151	0.00

[1]Economic growth (*ECGRWTH*) between 1980 and 2000, in terms of the change in real per capita income (*PCI*) and population (*POP*).

Access is also impacted by transportation infrastructure and service. Although distance and costs generally have a positive correlation with regard to the provision of freight transportation, competitive factors impact this relationship in the capitalistic U.S. markets. Transportation access is a function of both static and dynamic transportation

factors. Location on a waterway or coast line is a natural or static factor. Distance to closest water freight terminal, which was a particularly important characteristic for city location growth during the frontier era, averages 103 miles with a range from 0 to over 700 miles. Correlation between these static transportation variables and the growth measures are weak to insignificant. Regarding dynamic transportation factors proximity to hub airport and to container facility do have significant relationships with at least one of the economic growth measures. The average distance to hub airport is 163 miles. Container facilities are generally closer, as the trip from mesopolitan to container facility averages 67 miles.

Agglomeration gains associated with cross-fertilization and specialization benefits attributed to division of labor are evidenced in industrial sector concentration. The 1980 Herfindahl index suggests specialization in the economies of mesopolitans, relative to other cities, as the value of 0.22 is high compared to the national average for all cities of 0.16. The mesopolitans characteristics do suggest increasing diversity over the ensuing two decades, as the average 2000 Herfindahl index for the mesopolitan population of 0.23 is equal to that for all U.S. cities. The correlation between the population economic growth and industrial concentration measure is weak and significant at the one percent level. The Herfindahl index does not have a statistically significant relationship to income economic growth measure when these bivariate correlations are considered.

Regarding the role of national industry trends in the mesopolitan economy, both

the service sector and manufacturing sector have significant correlations. On average, 17 percent of mesopolitan residents' personal income is attained through service industry activities in 1980 which is on par with the national average for 1980. Mesopolitans have expanded the service industry, as a share of personal income, to 0.27 in 2000. This share surpasses the national mean of 0.25 for the same year. With the exception of the correlations between the Herfindahl index and manufacturing as share of mesopolitan residents' personal income, local industry concentration and national industry trends are significantly correlated to the economic growth measures.

Regarding human capital, 1980 levels for mesopolitans are greater than the national average. On average, 65 percent of U.S. mesopolitan residents have at least a basic education of 12 years for 1980. Fifty-two percent of mesopolitans have higher than average shares of their population with at least 12 years of education compared to 46 percent for all cities. About 14 percent of mesopolitan population has 16 years or more of advanced education, this is slightly more than the national average of 13 percent. Using bachelor degree attainment as a continuation of the 16 years of education measure in the U.S. Census Bureau county statistics, mesopolitans continue to be slightly above the national average in their level of advanced education residents in 2000. On average, approximately 20 percent of mesopolitan population has a bachelors degree in 2000 compared to 19 percent for the U.S. city population. The correlations between education and economic growth variables is significant, but moderate, considering the income measure and weak considering the population measure.

This descriptive information provides basic facts about mesopolitan economies. Average income and population, along with ranges, show the range of economies in the mesopolitan group. Information regarding transportation characteristics, industry trends, and human capital resources provide additional fodder in understanding the mesopolitan population and its economic growth during recent decades.

Ag Region Mesopolitan Features

A discussion of features for the 26 mesopolitans located in the Ag Region provide context for modeling and interpreting the economic growth in this sub-population of the mesopolitan population. The individual Ag Region mesopolitans are identified in Appendix D. Six of the Ag Region states are located in the Midwest census region, with only Montana located in the West region. Per capita income for these Ag Region mesopolitans averages 20,493 dollars in 1980. This income level is significantly

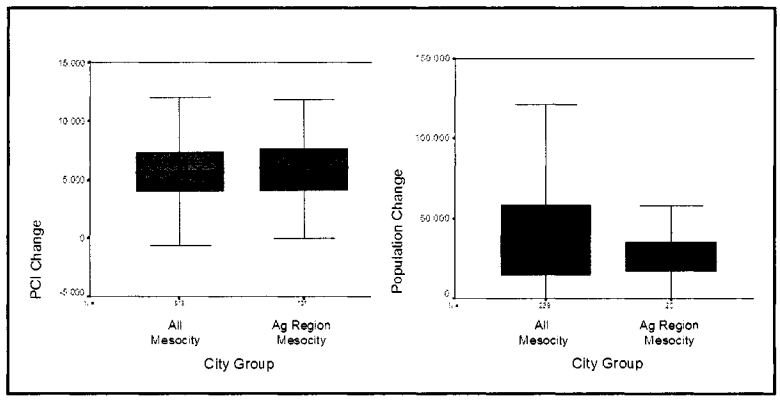


Figure 9. Per Capita Income and Population Growth, Distributions for All Mesopolitan and Ag Region Mesopolitan Groups

above the 18,545 dollar average for other mesopolitans (t=-2.464, p=.01). The per capita income growth of 5,946 dollars between 1980 and 2000 does vary significantly from the mesopolitan city group average growth of 5,893 dollars as illustrated in Figure 9 (t=-2.086, p=.04).

The average population among the Ag Region mesopolitans in 1980 was 144,477, compared to that of 139,217 for the balance of the mesopolitan population. Growth for mesopolitans averages 18,575 individuals, or 13 percent, for Ag Region mesopolitans between 1980 and 2000. This level of growth is 45 percent below the mesopolitan population average growth rate. The economic growth rate distributions in terms of population change, presented in Figure 8, do not vary significantly different (t=1.797, p=.07).

The industrial composition of economies in Ag Region mesopolitans has become slightly more concentrated in 2000, compared to 1980. The small increase in industry specialization across the 20 years moved the Herfindahl average from 0.21 to 0.22. The economies of these cities remain more diversified than for the mesopolitan population as a whole, that have an average Herfindahl index of 0.23 in 2000. The industrial composition of the Ag Region mesopolitans does not vary significantly from that of the mesopolitan group, based on the 1980 Herfindahl index for each group (t=1.797, p=.07).

Although these 26 cities are selected as the Ag Region mesopolitans due to their location in states that have had traditionally agrarian economies, on average the cities

themselves attribute lower shares of their economies to the agricultural industry than do the population of all mesopolitans. Approximately 3 percent of per capita personal income for all mesopolitans is attributed to the agricultural industry in 1980, compared to only 2 percent for the Ag Region mesopolitans. Therefore, although the regional economy is characterized as agricultural, the urban centers are not as dependent on this industry in their income composition. The agricultural industry share remained stable for Ag Region mesopolitans in 2000 compared to 1980, but declined among the other mesopolitan population to fall to that same level of 2 percent.

With regard to the regional agricultural industry, however, the role of farm programs should be considered as Ag Region mesopolitan economies may benefit from agricultural hinterlands consumer purchases and labor force commuters, as farm families often have another source of income from an off-farm job (U.S. Department of Agriculture, 2004). Government payments support farm income during times of low commodity prices under an array of production control, price support, and conservation programs. A substantial share of the benefits of farm payments are capitalized into the farm land values (Barnard et al., 2001). Therefore, adjustments to the farm program may impact these Ag Region mesopolitans in terms of consumer spending, labor market composition, and regional property values.

Regarding the two largest industry sectors, among the ten delineated in the U.S. Department of Commerce derivation of personal income estimates, the Ag Region has a composition that differs from that of the larger mesopolitan population in terms of its

manufacturing share but is similar in its service industry share. The Ag Region mesopolitans attribute 21 percent of personal income earnings to the manufacturing industry in 1980, compared to 30 percent for the balance of the mesopolitan population. The prevalence of this industry in personal income is substantially different (t=2.801, p=.00), and may have important implications as manufacturing has represented a decreasing share of the personal income composition over recent decades.

The service industry shares average 20 and 17 percent for the Ag Region mesopolitans and non-Ag Region mesopolitans, respectively, in 1980. The variance in these shares is statistically significant (t=-2.261, p=.02). As expected, there is an increasing presence for the service sector as it accounts for 30 and 27 percent of the Ag Region and non-Ag Region personal income earnings by industry in 2000, respectively. The levels of service industry earnings are equal or above the national average of 17 and 25 in 1980 and 2000, respectively. The ability of these traditionally agrarian economy cities to increase activity in a growing industrial sector is an interesting aspect of the group's economic growth.

Human capital is a final Ag Region mesopolitan characteristic detailed in this sub-population profile. Considering the 12-years and 16-years of schooling as basic and advanced education, respectively, the Ag Region mesopolitans have above average levels of human capital in 1980. Seventy-five percent of the Ag Region mesopolitan residents have completed at least 12 years of education, this compares to 63 and 64 percent of population for all U.S. cities and the other mesopolitans, respectively. The Ag Region

basic education level is significantly different from that of other mesopolitans (t=-6.242, p=.00). Advanced education levels also vary significantly in statistical terms, as 19 percent of the Ag Region population has 16 or more years of education compared to 14 for other mesopolitans (t=-5.302, p=.00). The average share of population with advanced education is 13 percent across all U.S. cities. The higher levels of human capital are an important resource for economic growth in today's knowledge economy.

The U.S. city population profile establishes the city group categories, and provides a description of social and economic characteristics that are considered in the models of economic growth. The non-conditional convergence analysis in the following section considers the characteristics of the 926 CBSAs that have been transformed into a city geography. Information presented in the economic profile suggests that larger cities have experienced greater growth than smaller cities during the most recent three decades. To gain an understanding in economies of the smaller cities, the characteristics of the mesopolitan group are detailed. The values and factor correlations for geographic, economic, and social characteristics of the 368 mesopolitan cities, and the Ag-Region sub-population of 26 cities, provide valuable information for defining and interpreting the model of economic growth that is presented in the next section. Statistics presented in the next chapter profile many factors that may influence growth of these smaller cities, and show that the economic growth of the Ag Region sub-population is unique in terms of per capita income change, compared to other mesopolitans.

CHAPTER V

EMPIRICAL ANALYSIS

As the cities of New York and Chicago provide hubs for capital accumulation, industry exchange, transportation, and market transactions in their regions, mesopolitans may provide a focal point for accumulation and growth in their regional economies. Mesopolitans offer a mass of population, infrastructure, or other resource capable of generating agglomeration benefits. The success of cities in nonmetropolitan areas has received little attention. Economic growth literature is dominated by discussions of national economies and large urban centers. The existing literature regarding urban city location and agglomeration provides excellent background for considering ideals that cities offer these lighter density population areas a source for deriving some form of urban agglomeration economies. At the same time, it is possible to identify distinguishing characteristics of these nonmetropolitan economies.

It is important to distinguish between theoretical and pragmatic applications. The theoretical base for this discussion has been adopted from its application in a primarily urban environment and aggregate context. It is critical to assess the validity of applying the hypotheses set forth in these theories to economic growth for smaller cities and in nonmetropolitan and agricultural economies. The ideals established in these hypotheses,

as presented in the introduction, are a foundation for local and national policy and investment decisions that are aimed at economic growth. The applicability of hypotheses for nonmetropolitan areas are tested. Findings are valuable to practitioners in smaller U.S. cities, especially those with agricultural based economies, as well as a base for future research concerned with the economies of cities in these regions.

The analysis presented in the following section first tests the convergence hypothesis that underlies much of the current economic development policy. Evidence of convergence suggests that current policies and infrastructure are sufficient in directing economies toward longer-term social goals of economic equality among all U.S. cities. The analysis then narrows, in terms of the population, to focus on the mesopolitan segment of the U.S. city network. The mesopolitan research tests several hypotheses related to agglomeration, transportation, and human capital in a model of the economic growth that has occurred in these cities during the past two decades. Failure to reject any of the hypotheses supports the assumption that theories tested in the urban growth literature are an appropriate foundation for policies and decisions relevant to economic development in smaller cities during the current knowledge age.

Convergence Evidence

A cursory look at the distribution of U.S. city population income growth between 1969 and 2000 suggests that income leaders have had greater economic gains. A positive slope in the log form of the distribution of growth in real per capita income between 1969

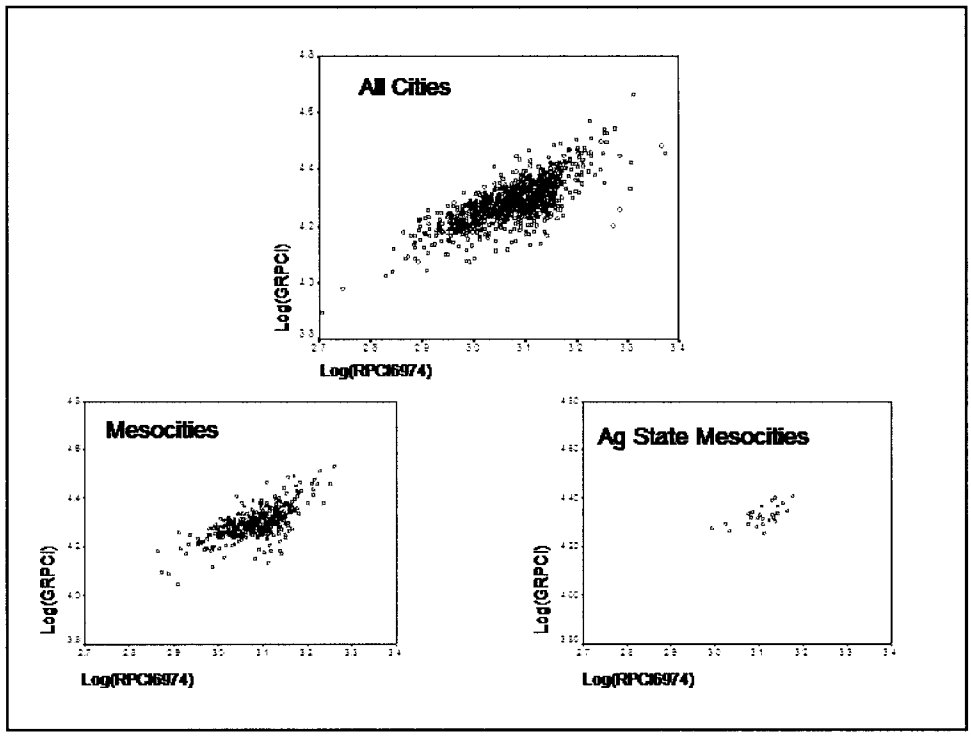


Figure 10. Distribution of *ln*Real Per Capita Income Growth

and 2000 over average initial per capita incomes between 1969 and 1974, shows that cities with higher incomes in the initial time period tended to have relatively larger income gains over the following decades (Figure 10). The mesopolitan and Ag State mesopolitan population income growth distributions are illustrated along with that for all U.S. cities. Although the mesopolitan mean does vary significantly from the all city population mean for both the initial and growth measures ($F=50.28$, $\propto =.00$; $F=108.01$, $\propto =.00$), the more condensed distribution pattern of the mesopolitan population does exhibit similar trends. The higher income mesopolitans tend to have great gains in income. While mean real per capita income in the initial time period and the distribution of the real per capita income growth do vary significantly between the mesopolitan and Ag

State mesopolitan substrata of the population (F=0.04, $\propto$ =.04; F=4.8949, $\propto$ =.03), the positive relationship between initial income level and corresponding income growth is evident in this subgroup as well.

The Barro convergence model is employed in a quantitative test of the city economic growth path trends. In preparation for this model, the data are first examined for stationarity. Due to the large number of cities, a random sample of 5 percent is selected and tested. The ADF fails to reject the null hypothesis, and individual city real per capita income is found to be non-stationary. As a next step in testing for stationarity, the first difference values are calculated for each city. T-values for coefficient from these tests meet the ADF critical value criteria, so null hypothesis is rejected in each of the 64 tests. The first difference of the per capita income series is found to be stationary of order one for the city time (Table 8). Although each of the cities in the sample is found to be stationary, a more robust model may be supported by testing for cointegration among the city series.

Cointegration among the city income time series tests for stationarity of the time series variables through a linear combinations of individual series. In the case that an individual city series fails to reject the null hypothesis, cointegration may provide stationarity. Due to the large number of cities, random subsets of the 64-city sample are defined for conintegration tests based on Census Division location. Integration of order one, I(1), among the individual city time series allows rejection of the null hypothesis that the series is non-stationary in each of the tests. The results of the four Census

Table 8. Augmented Dickey-Fuller Unit Root Test Statistics for U.S. City Real Per Capita Income

U.S. City	ADF*	U.S. City	ADF*
Akron, OH	-5.50	La Crosse, WI MN	-5.60
Alexandria, MN	-4.73	Lewisburg, PA	-5.61
Amarillo, TX	-5.80	Magnolia, AR	-5.51
Bangor, ME	-5.64	Manhattan, KS	-5.56
Bay City, TX	-5.73	Marshall, MO	-5.64
Beaumont Port Arthur, TX	-5.56	Meadville, PA	-5.55
Bend, OR	-5.67	Mount Sterling, KY	-5.60
Bloomington, IN	-5.51	Nogales, AZ	-5.68
Bloomsburg Berwick, PA	-5.59	Norfolk, NE	-5.47
Boston Cambridge Quincy, MA NH	-5.58	Orlando, FL	-5.58
Brevard, NC	-5.57	Oskaloosa, IA	-5.60
Brownsville, TN	-5.70	Pella, IA	-5.59
Campbellsville, KY	-5.49	Peoria, IL	-5.60
Cape Girardeau Jackson, MO IL	-5.64	Pittsfield, MA	-5.57
Clarksdale, MS	-5.68	Rochester, MN	-5.52
Del Rio, TX	-5.61	St. Louis, MO IL	-5.57
DuBois, PA	-5.61	Salem, OR	-5.57
Dyersburg, TN	-5.62	San Angelo, TX	-5.65
East Stroudsburg, PA	-5.62	Shelton, WA	-5.48
Fairmont, MN	-5.72	Silver City, NM	-5.58
Forrest City, AR	-5.70	Spartanburg, SC	-5.58
Fort Dodge, IA	-5.55	Starkville, MS	-5.63
Gaffney, SC	-5.60	Stockton, CA	-5.58
Gillette, WY	-5.64	Storm Lake, IA	-5.60
Gulfport Biloxi, MS	-5.51	Toledo, OH	-5.56
Hagerstown Martnsburg, MD WV	-5.71	Urbana, OH	-5.58
Harrisburg, IL	-5.60	Vallejo Fairfield, CA	-5.53
Hattiesburg, MS	-5.59	Vernon, TX	-5.62
Heber, UT	-5.58	Vincennes, IN	-5.51
Jackson, MI	-5.52	Wahpeton, ND MN	-5.69
Kingsville, TX	-5.59	Waterloo Cedar Falls, IA	-5.57
Knoxville, TN	-5.59	Wisconsin Rapids Marshfield, WI	-5.57

**The critical value for the Augmented Dickey-Fuller (ADF) test is -3.75 at the 1 percent level.*

Table 9. Cointegration Test Statistics for U.S. City Real Per Capita Income, by Census Region and National

Geography	City Group	ADF*
Census Region		
Northeast	Bangor, ME; Boston Cambridge Quincy, MA NH; East Stroudsburg, PA; Meadville, PA	-4.14
South	Amarillo, TX; Campbellsville, KY; Gaffney, SC; Kingsville, TX; San Angelo, TX	-5.61
Midwest	Akron, OH; Fairmont, MN; Pella, IA; St. Louis, MO IL; Wisconsin Rapids Marshfield, WI	-4.81
West	Bend, OR; Gillette, WY; Nogales, AZ; Shelton, WA; Vallejo Fairfield, CA	-4.46
National	Akron, OH; Amarillo, TX; Bangor, ME; Bend, OR; Meadville, PA; Pella, IA; San Angelo, TX; Vallejo Fairfield, CA	-4.17

**The critical value for the ADF test is -3.75 at the 1 percent level.*

Divisions and the national sample cointegration tests are presented in Table 9. Stationarity is characteristic of stable a long-run relationship among variables that is necessary for robust model results.

The entire U.S. city population real per capita income, between 1969 and 2000, is included in the model of economic convergence. The coefficient for the β is estimated to be 0.01 (R^2=0.08). The value suggests economic divergence among cities. The cities with the lower per capita incomes are increasing lagging behind cities with the higher initial per capita incomes. The mercantile theory for the city system is supported by these findings as positions in the city system remain rather entrenched. They also concur with the common theme in several recent studies that suggests a divergence within the U.S.

economy over recent decades (Drennan and Tobier, 1996; Coughlin and Mandelbaum, 1996; Tsionas, 2000). The neoclassic assumptions for decreasing returns to capital inputs is not supported and therefore, the null Hypothesis I is rejected based on the positive β value. The positive coefficient suggests diverging economies for cities over recent decades. Lack of convergence evidence in the assessment of city economic growth means that the tendency toward equalization of productivity among cities is not a current trend.

In addition to the convergence model, the distribution of income growth for all U.S. cities and the mesopolitan city group provide additional insight regarding the relative economic well-being among residents of U.S. cities. Real per capita incomes are converted to z-scores so a comparison of distributions can be made without interference from the change in mean income levels. Real per capita incomes are averaged for the periods 1969 to 1974 and 1995 to 2000 for the distribution illustration. The z-scores show that real per capita income exhibited a more normal distribution in the initial time period, and that the distribution has less symmetry with concentration around the mean and a skew of fewer higher income cities in the more recent time period (Figure 11). The kurtosis statistic shows a movement away from the normal distribution curve shape to a flatter or platykurtic shape, a characteristic in divergence among observations. The overall distribution becomes more skewed toward the lower incomes with a long tail of few relatively high per capita income cities.

Two-thirds of the observations are within two standard deviations of the mean in a normally distributed population. Therefore, a narrower range, as represented by the spans of two standard distributions within the entire range, would indicate convergence in the population. The two-standard deviation range covers 36 percent of the population

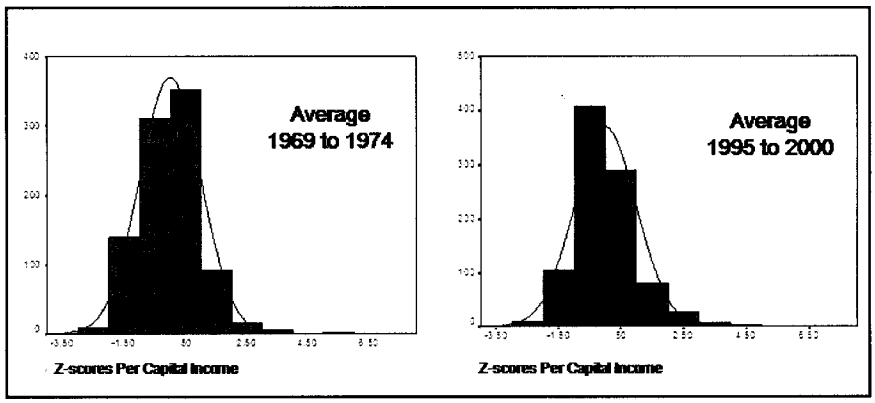


Figure 11. All U.S. Cities Real Per Capita Income Distribution, Average 1969-1974 and 1995-2000

per capita income range in 1969 to 1974 distribution, and only 37 percent of the income range in the latter time period. Real per capita income for U.S. cities defined for this research averaged 16,157 dollars, with a standard deviation of 2,896 dollars – 36 percent of the per capita income range is covered two standard deviations. The real per capita income averaged 22,889 between 1995 and 2000, with a standard deviation of 4,236 dollars – a 37 percent of the income range is included covered by two standard deviations.

Considering incomes within the mesopolitan group for the same time periods, 1969 to 1974 and 1995 to 2000, distributions also move away from the normal

distribution in terms of kurtosis and skewness (Figure 12). The mesopolitan real per capita distribution exhibits a more normal pattern with lower skewness and kurtosis, compared to the total city population, but the distribution does become more skewed toward the lower incomes. In addition, divergence in mesopolitan population incomes is suggested as the curve becomes flatter for the more recent time period. The initial distribution includes a mean real per capita income of 16,478 dollars, and a standard deviation of 2,403 dollars. The distribution range is contained within a two-standard deviation range of the mean. In the 1995 to 2000 time period, the mean real per capita income of 23,558 dollars and standard deviation of 3,575 covers 30 percent of the income range in two standard deviations.

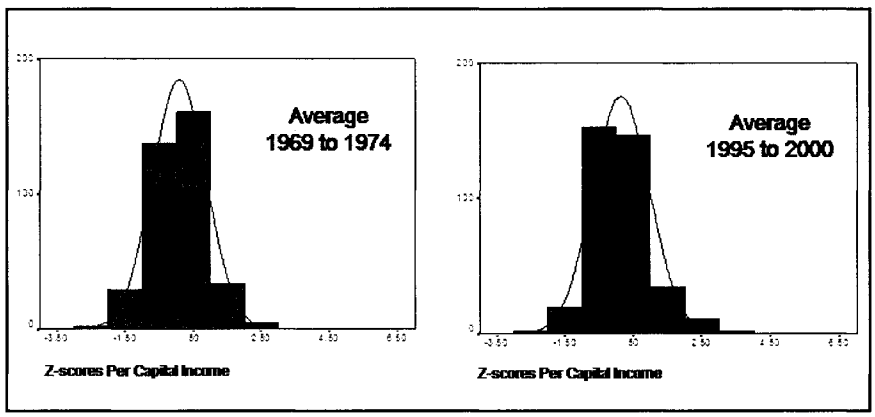


Figure 12. Mesopolitan Real Per Capita Income Distribution, Average 1969-1974 and 1995-2000

The homogeneity among Ag State mesopolitan standards of living is a consideration in the treatment of this group a subset and in the potential to differentiate

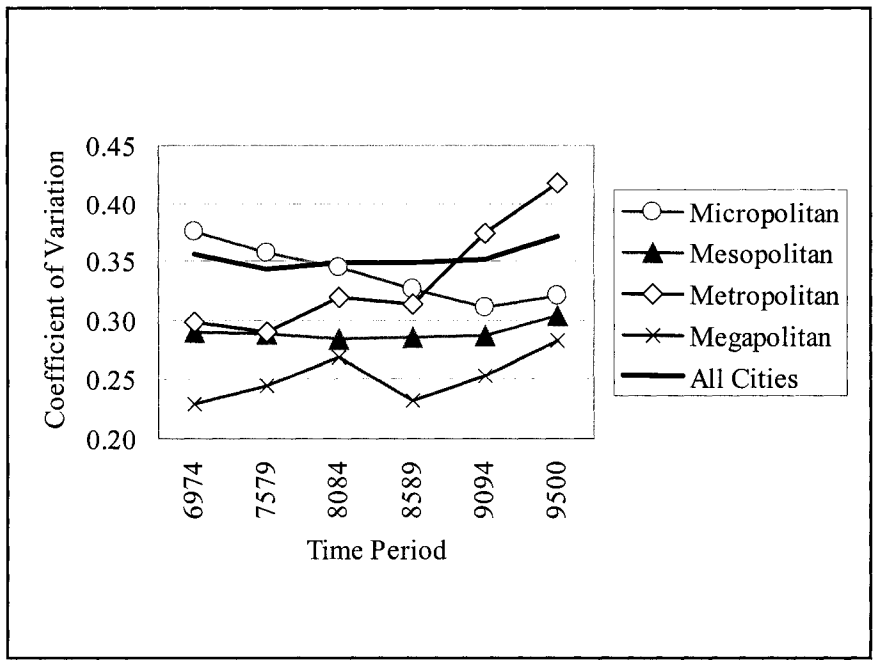


Figure 13. Coefficients of Variation in Per Capita Income for All U.S. Cities and City Groups, Averages for 1969 to 2000 Time Periods

within this group of the U.S. city population. Approximately 94 and 100 percent of the distribution range are contained within two standard deviations of the mean in the average real per capita income distributions for 1969 to 1974 and 1995 to 2000 suggesting a greater degree of homogeneity than within the total population and larger mesopolitan substrata. The distribution of incomes for these mesopolitans is more stable considering average real per capita incomes in 1969 to 1974 and 1995 to 2000. While the

distribution does shift slightly from a positive to negative skew and positive to negative kurtosis, the overall fit remains closer to the normal distribution than that of the total population and mesopolitan substrata.

A final illustration on the variability of per capita income for the U.S. city group and within the city groups is presented in Figure 13. The average coefficients of variation for 5- or 6-year intervals are calculated to gauge the relative distribution around the mean. Convergence is indicated in lower coefficients where variations are more closely distributed around the mean average real per capita income for the time period. The illustration of the four city group coefficients of variation, along with that for all cities, suggests that there was some convergence in city incomes during the early 1970s, but that these trends have reversed.

Real per capita incomes for cities in the mesopolitan group are fairly stable as the coefficient of variation ranges only between 0.28 and 0.30 across the six time periods. A strong convergence trend is shown within the micropolitan group, but as with the other three city groups there is divergence in the most recent average incomes from 1995 to 2000. The megapolitan group of cities is characterized by the smallest coefficients of variation for intervals between 1969 and 2000. City incomes in this group converge during the 1985 to 1989 time period, but overall have diverged as the coefficient of variation increased from 0.23 in the 1969 to 1974 time period to 0.28 in the final time period. This most populous city group has its highest coefficient of variation in the most recent time interval, 1995 to 2000. While the coefficients of variation do not provide

information regarding the trend in mean income, they do offer insight into the homogeneity of income levels among all U.S. cities and within city groups. Increased heterogeneity of income levels is associated with divergence, and is an indicator that city incomes are tending away from social income equality goals.

The positive β coefficient for cities average per capita incomes between 1969 and 2000, along with statistical descriptors on distributions show divergence trends within the U.S. city and mesopolitan sub-population over recent decades. These divergence trends support the mercantile city system and new growth theories, suggesting that the entrenched underlying marketing systems and infrastructure along with agglomeration economies tend to benefit established cities in economic growth. The implications of these findings are important as policymakers and those concerned with economic development may need to be more aggressive to redirect the underlying trends that have been assumed, in many cases, to have underlying tendencies toward convergence and an equalization among cities' standards of living.

Economic Growth Factor Analysis

The income analysis presented in the preceding section offers evidence that the standard of living differences, in terms of income, between the higher and lower income cities is widening. While the overall trend in average income may be increasing, lagging cities' economies are becoming increasingly disadvantaged over time. Given the social equality and national economic integration philosophies underlying U.S. institutions, it is

important to better understand factors that affect the growth of city economies. The following empirical results detail findings regarding factors affecting the economic growth in the mesopolitan population segment of U.S. cities.

The mesopolitan population exhibits a range of economic growth between 1980 and 2000. The average gain across all cities is 33 percent, with real per capita income change ranged from a 32 percent loss to 84 percent gain, for cities experiencing the lowest and highest economics gains over the most recent two decades. Given the political and social interests in promoting economic, and the evidence of income divergence that support other recent research, it seems prudent that individuals interested in the welfare of individuals living in nonmetropolitan areas consider the findings presented in this analysis of economic growth. Insight gained with this investigation will allow policymakers and other agents to revisit current efforts directed at invigorating the lagging nonmetropolitan city economies that seem to be increasingly losing economic ground to leading nonmetropolitan city economies.

Economic growth is indicated by an increase in the real output of goods and services produced by an economy. Productivity is measured as the output per unit of input. This capacity is influenced by countless factors related to fixed resources, investment, mobile resources, and infrastructure. As output per capita increases, it is viewed as an increase in the standard of living. The standard of living, on which individuals make utility-based decisions, not only includes clearly identifiable factors such as housing, insurance, and food costs, but also factors such as good parks,

greenways, and theaters, along with detractors such as traffic congestion, poor air quality, and few childcare alternatives.

For this research into U.S. mesopolitan economic growth, both per capita income and population are selected as the proxies in measuring economic growth. The correlation between these proxies is significant, but weak as measured by the Pearson Product-Moment correlation coefficient $r(366)=0.19$, $p<.0001$, so the results of both economic growth models are presented. The first model, with growth measured by per capita income, offers insight into the economy of a city in terms of the relative buying power of residents in 2000 compared to 1980. The population measure does not reflect changes in the standard of living, but does offers additional information as to the relative attractiveness of U.S. cities that goes beyond tangible factors such as relative wages. Unlike international studies that must account for cultural and political migration barriers, population flows among U.S. cities are relatively seamless so population changes should provide information regarding the relative attractiveness of economies. Presentation of both the per capita income and population determinant model results provides a broader picture of the influences in U.S. mesopolitan economic growth in terms of the standard of living and overall well-being.

Results of the economic growth regressions are presented in Table 10. The log-linear transformation is selected as the functional form. Explanatory power in initial regressions and curve-fitting residual plots support log-linear form for the mathematical representation of the economic growth model. Plots of the economic growth measures

residuals exhibited signs of heteroscedascity that are not evident after the variance stabilizing transformation to a logarithmic form. Both models are acceptable in the factors included as independent regressors with $F(14,329)=12.79$, $p<.0001$ and $F(14,281)=11.28$, $p<.0001$ for the per capita income and population economic growth measures, respectively. The model does has similar levels of explanatory power in both the variation in per capita income and population.

Per Capita Income Growth

The static, dynamic, and control parameters defined in the mesopolitan economic growth model explain 36 percent of variation in per capita income between 1980 and 2000. This economic growth model is generally acceptable as most variables have the expected sign and many are significant at the 1 or 5 percent level. Coefficients in the per capita income regression indicate that economic growth is significantly influenced by megapolitan proximity, transportation service, industrial sector concentration, national industrial sector trends, and human capital.

Education levels also contribute to economic growth in mesopolitans. Rather than the rural "brain drain" chronicled in some publications, economic growth is higher in mesopolitans where a greater share of residents have advanced education. The null hypothesis III is rejected as the coefficient for knowledge gained through advanced education has significant positive relationship to per capita income growth. The average share of mesopolitan population with 16 years or more of education is 14 percent for ,

Table 10. Mesopolitan Economic Growth Regression Results

	Per Capita Income		Population	
Variable	Coefficient	S.E.	Coefficient	S.E.
Explanatory Variables				
POP80	-0.0043	0.0439		
PCI80			-0.6036	0.5222
MEGDIS	-0.0909	0.0402*	-0.2315	0.1180*
AIR300 (=1)	-0.0931	0.0760	-0.1758	0.2230
H2ODIS	0.0024	0.0153	0.0592	0.0481
RAILRATE	-0.1347	0.0616*	0.1751	0.1971
INDHERF	0.3869	0.0981**	-0.4063	0.2973
INDMANF80	0.1141	0.0389**	-0.2843	0.1090**
INDSERV80	0.4212	0.1011**	0.0378	0.2897
HSGRAD (=1)	0.0867	0.0620	0.1143	0.1859
PCTED16YR	0.5159	0.0841**	0.6403	0.2540**
Control Variables				
POP80			0.9322	0.1301*
PCI80	-0.3619	0.1903		
NE (=1)	0.0040	0.0738	-0.5653	0.2446*
MW (=1)	-0.1579	0.0645*	-0.8281	0.1970**
WE (=1)	-0.5019	0.0759**	0.3929	0.2093
Intercept	13.116	1.8476**	2.3189	4.4203
	R^2=.3625		R^2=.3717	
	F = 12.79, p=.0001		F = 11.28, p=.0001	
	N = 315		N = 267	
	Chi-Square=95.58, p=.8513		Chi-Square=96.33, p=.8206	

S.E. = standard error
**significant at the 1 percent level
* significant at the 5 percent level
All continuous variables in natural logarithms

1980. Quantifying the benefits associated with contributing resources to advanced education, increasing advanced education by one standard deviation raises per capita income by 267 dollars. These findings lend strength to national education initiatives such federal Pell grants, higher education student loan programs, and the state and local fiscal support for education as a fundamental component in economic growth.

The hypotheses related to agglomeration benefits association with industry concentration is not rejected based on the coefficient of the Herfindahl-Hirshman industry composition index (Herfindahl index). Mesopolitans with greater industry concentration in their economies experienced higher rates of economic growth over the two decades. The Herfindahl index is third, trailing initial per capita income and service industry, as an influence in mesopolitan economic growth. A one percent increase in the concentration measure generates a 0.04 percent increase in economic growth. One standard deviation increase in the Herfindahl index generates an additional 233 dollars in real per capita income, holding other values constant. The results suggest industry agglomeration, specialization, division of labor, and cumulative growth are more important than the cross-fertilization gains promoted as a benefit of diversification in mesopolitan economies.

The influence of national industry trends is evident in the significance of the service and manufacturing share coefficients. As expected, the share of the mesopolitan economy attributed to the service industry is positively related to economic growth, in terms of per capita income. Those mesopolitans with higher proportions service industry

in their 1980 incomes, benefitted as our economy moved into the knowledge age. On average the service industry accounted for 17 percent of mesopolitan personal income in 1980, by 2000 this average rose to 27 percent. The mesopolitans with a service industry share one standard deviation above the mean experience per capita income growth 0.04 percent greater than the average growth.

Although a much lower value, the positive sign of the manufacturing industry share is somewhat a surprise given the decline in this industry as a share of income between 1980 and 2000. The positive sign may, however, be related to advancements in technology that require higher paying skilled labor and to an off-shore movement of lower-paying jobs that utilize unskilled labor. Mesopolitans with a 1980 manufacturing industry share one percent larger than average experienced per capita income growth that was .01 percent higher over the 20-year time period. Manufacturing accounted for an average 29 percent of personal income in 1980. This share declined by 24 percent by 2000, to an average 22 percent. The declining role of the manufacturing industry in the economy is consistent with national trends. The decline, however, is relatively less than the 36 percent change seen for the national economy suggesting that mesopolitans have had some success in retaining manufacturing as a contributing industry in their economies.

Distance to closest megapolitan is included as a spatial control variable, and is an indicator of market access. The distance coefficient shows a negative relationship between large city proximity and real per capita growth. Proximity benefits for

mesopolitans associated with closer distances to the largest U.S. cities (90^{th} percentile in the U.S. city population distribution) are evident. Increasing the distance to a large city by one standard deviation has the effect of reducing per capita income by 22 dollars. These results imply that the mesopolitan population benefits from access to nearby urban centers, supporting findings that "spread" benefits outweigh potential "backwash" threats for U.S. mesopolitan economies in the core-hinterlands relationship. The spread benefits may be associated with business relationships, labor pool, or transportation costs.

The insignificance of 1980 population levels does not provide support for agglomeration economies as a source for endogenous growth. Although Hypothesis II cannot be rejected based on the model of growth factors, the insignificance of this population factor may be related to the variation among cities in this subset of the national city system. A better understanding of the agglomeration effects may be attained by considering the larger U.S. city population. As noted in the population profile, the 1980 to 2000 data does show a moderate positive correlation between city size, as defined by the megapolitan, metropolitan, mesopolitan, and micropolitan groups ($r(920)=0.50, p<.0001$). These national data do provide some evidence for urban agglomeration economies associated with population concentrations.

The final set of explanatory variables are related to a static transportation characteristic and dynamic transportation service factors. The water distance variable is an indicator for the static, or first-order geographic, characteristic of proximity to water terminal. The insignificant relationship between mesopolitan economic growth and

distance to water terminal is consistent with other recent research suggesting that location on or near a viable water terminal is becoming less important as a factor in the economic growth. As consumer and knowledge goods become the driving forces in our information age's global economy, the advantages associated with low-cost bulk commodity movement are diminished. In addition to changes in consumer goods production and consumption, the availability and efficiency of overland and air alternatives have also lessened relative transportation benefits associated with waterside location.

The two remaining transportation parameters are dynamic factors related to transportation competition and the resulting service. The freight component of null hypothesis IV, stated in sub-hypotheses F, is rejected based on the significance of the rail rate parameter. Two other freight service included in the initial model, interstate access and container terminal proximity, are not included in the final model because neither significant correlations or other statistical relationships could be established between these transportation service parameters and mesopolitan economic growth.

Intermodal and intramodal competition are important factors in the rail rates paid by shippers in the U.S. rail market. Greater ability to substitute within or across modes should result in lower rail rates and improved transportation service levels for shippers. The range of rail rates among mesopolitans, from 1.57 to 17.26, offers evidence that railroads employ market-based differential pricing schemes based on U.S. Public Use Waybill analysis (Surface Transportation Board). To the degree that transportation

service is important to the mesopolitan economy, the lower rail rates should contribute to economic growth. The negative beta coefficient shows that lower rail rates do contribute positively to economic growth for mesopolitans. For each 10 percent reduction in rail rate per ton mile, per capita income rises by 225 dollars. The rail rate coefficient provides evidence that transportation competition, as measured by rail rates, is a factor in mesopolitan economic growth.

The null sub-hypothesis IV_B is not rejected based on the coefficient of the air hub parameter. The dummy variable identifying cities located more than 300 miles from a hub airport shows that business air travel service is a factor in economic growth. Mesopolitans located in the 90^{th} percentile of the distance measure, those more than 300 miles, are not found to be at a disadvantage relative to other cities.

A control factor is included to establish baseline income differences among mesopolitans in the initial period, 1980, is not significant. Other control variables, for special case economies such as high college populations, state capitals, and Ag Region location were not found to be significant in initial models and are not included in the final model. The climate, social, and geographic factors that influence interregional migration are captured in the regional location variable that is defined by the four Census Divisions. An average temperature parameter was also included as an continuous amenity measure in the initial models. It was removed from the model due to multicollinearity problems associated with the regional control variables that provided more robust results.

Several factors are identified as significant in the relative economic success of

these cities. National service sector trends, manufacturing activity, and industrial specialization are all significant in mesopolitan growth. Advanced education is also identified a an important parameter in mesopolitan economic success. Freight transportation service is found to be a factor in economic growth, while business traveler mobility and freight infrastructure are not. The industrial specialization, transportation service, and education parameters suggest that smaller population hubs may enjoy some agglomeration benefits. These factors offer areas for focus in the future studies of these economies.

Population Growth

The population based analysis of economic growth factors offers explanation for only about of one-third of the variance in population change for mesocities (Table 10). The mesopolitan population sample is limited to only those mesopolitans experiencing population growth, or economic growth, during the most recent decades in the log form of the model. This reduces the mesopolitan population from 315 to 267 cities.

For this economic growth model, population growth between 1980 and 2000 is defined as the dependent variable. The 1980 population parameter is moved from the explanatory group to the control group of variables to account for the initial difference in population levels among cities in the mesopolitan group. The Census Division location retained to account for geographic differences in population growth that may be attributed to factors such as weather and amenities that affect the location decisions of

workers and non-workers.

The results for regressing population on the economic hub proximity, transportation, industry diversification, and education parameters do differ from the per capita income results. The difference is not unexpected given the weak correlation between the two growth measures. The population measure is found to be less sensitive to national industry and transportation service trends.

The benefits of connectivity within the city system are supported by the significant coefficient for the economic hub proximity that measures relative access of mesopolitans. The distance to economic hub has a moderate effect on mesopolitan population growth as a 10 percent increase in distance to economic hub results in a 2.3 percent decline in population growth between 1980 and 2000. A mesopolitan 243 miles from an economic hub, one standard deviation below the mean distance of 140 miles, has population growth 15 percent below the national average. These results suggest that market access, in terms of proximity, is an important factor in economic growth.

Null hypothesis IV cannot be rejected based on the population measure of economic growth, suggesting that transportation may be necessary for economic growth but that it is not an essential element in city population growth. Mesopolitan economic growth, in terms of population, does not have a statistically significant relationship in either static or dynamic transportation factors. Water terminal proximity, rail rate, and airport hub parameters are not found to influence population growth.

Industry concentration is not found to be a significant parameter in mesopolitan

population growth. Therefore, null hypothesis II cannot be rejected based on the population measure of economic growth. The population economic growth measure is not sensitive to national trends in the service sector, unlike the income measure. The single industry variable that is found to have a significant relationship to population growth is share of mesopolitan economy attributed to manufacturing. Given the national decline of manufacturing from 22 to 12 percent of personal income between 1980 and 2000, its negative effects on population growth are expected. Differing results for the manufacturing share variable may be attributed to the skilled and unskilled categories of labor. While population losses are associated with movement of unskilled jobs overseas, the positive standard of living effects associated with higher paying skilled jobs are reflected in the findings.

The two education parameters have mixed results. Advanced knowledge, measured by percent of population with at least 16 years of education, is the largest factor in economic development considering the statistically significant explanatory variables. The distance to closest economic hub and 16-years of education or more have the same sign for both the population and per capita income models. Advanced education is an asset for mesopolitan economic growth in recent decades, as measured by either the population or income change. A one percent increase in the capabilities of a mesopolitan population, in terms of their advanced knowledge, generates a 0.64 percent increase in population growth. A mesopolitan with an advanced knowledge population level that one standard deviation above the mean, has a population growth that is 15 percent higher

than average. Basic education, in terms of a higher share of the population having 12 years of education or more, is not found to be a significant factor in population change. These findings are interesting in that a core of residents with advanced knowledge has a positive relationship to economic growth while the basic skill level is not a factor considering population change. Higher education proponents may find the information valuable in building support for human capital as a pillar in local economic development.

The results presented in the previous paragraphs offer limited insight into population growth among U.S. mesopolitans over recent decades. The population measure is an indicator of mesopolitan attractiveness, but it provides little information regarding the standard of living or productivity. Although the mesopolitan population growth results do provide another perspective for understanding nonmetropolitan economic growth, results for mesopolitan income growth may be more valuable in forming policy and directing investments toward sustained economic prosperity.

Agricultural Region Economic Growth

Beyond the factors influencing growth in U.S. mesopolitans, special attention is given to growth of mesopolitans in the seven-state Ag Region. The economic growth model for Ag Region mesopolitans offer insight into a sub-population of U.S. mesopolitans. The economic growth is measured by real per capita income. A population measure is not considered because, as noted in the profile section, population growth for Ag Region mesopolitans is not significantly different from other

Table 11. Ag Region Mesopolitan Economic Growth Regression Results

	Per Capita Income	
Variable	Coefficient	S.E.
Explanatory Variables		
POP80	-0.0356	0.0460
MEGDIS	-0.1094	0.0430*
AIR300 (=1)	-0.0886	0.0814
H2ODIS	-0.0110	0.0158
RAILRATE	-0.0582	0.0660
INDHERF	0.5873	0.1049**
INDMANF80	0.1175	0.0390**
INDSERV80	0.4909	0.1051**
HSGRAD (=1)	-0.0826	0.0587
PCTED16YR	0.5241	0.0900**
AGREG*LDIS		
AGREG*RAILRATE		
AGREG*INDHERF	-0.7496	0.2806**
AGREG*PCTED16YR		
Control Variables		
PCI80	-0.6376	0
AGREG (=1)	-1.0611	0.4523*
Intercept	15.7092	1.905***
	R^2=.2813	
	F = 9.51, p=.0001	
	N = 316	
	Chi-Square=111.19, p=.1538	

S.E. = standard error
**significant at the 1 percent level
* significant at the 5 percent level
All continuous variables in natural logarithms

mesopolitans. The Ag Region economic growth is defined by modifying the mesopolitan economic growth model. In the Ag Region model, the regional dummy variables are removed and dummy variable to identify mesopolitans in the Ag Region is added (Table 11). Interaction terms are also included to identify differential effects for four explanatory variables. Model results explain 28 percent of the variation in real per capita growth. Parameters have relationships similar to those found in the model of income growth for all mesopolitans, with the exception of rail rates which is no longer significant. The single significant interaction term identifies differential effects in Ag Region mesopolitans compared to other mesopolitans, for industry concentration.

Results suggest that the economies of the Ag Region mesopolitans are distinct with regard to growth progress and some factors. The coefficient for Ag Region shows lower growth rates for the mesopolitans located in the traditionally agricultural region compared to the balance of the mesopolitan population. In addition to the distinct characteristics of higher economic growth, interaction terms inserted into the model suggest differential effects of agglomeration, industry diversification, and transportation service as explanatory variables in the Ag Region compared to the other mesopolitans. Human capital, in the form of advanced knowledge, is not found to have significantly different effects in the Ag Region mesopolitans than in other mesopolitans.

The Ag Region economic growth is 7 percent higher than that of other mesopolitans, considering per capita income growth between 1980 and 2000. The factor relationships in the per capita income growth measure are similar for the four-region and

Ag Region models, in that most of the factors are common in both models and have the same signs. Average rail rate does fall out in the Ag Region model, but this is not concerning as the relationship is not strong in the initial model

The single significant interaction term is for the effects of industry concentration on growth. While the Herfindahl index coefficient shows concentration increases per capita income, as in the four-region model, the Ag Region-Herfindahl interaction term shows this sub-group of mesopolitans benefit relatively less from concentration and in their per capita income growth. A one percent increase in industry concentration increases per capita income by 361 dollars. For mesopolitans in the Ag Region, the effects are tempered as a one percent increase in industry concentration increases per capita income by only 230 dollars.

The Ag Region model offers special insight for cities that have traditionally had a substantial agrarian component in their state economy. These mesopolitans have seen higher rates of economic growth than other mesopolitans during the past 20 years. Advanced education, as with other mesopolitans, is an important factor in this growth. These mesopolitans do distinguish themselves from other mesopolitans in that they receive relatively less benefit from specialization.

These empirical results offer new insight for nonmetropolitan economic growth. Income divergence within the U.S. city population indicates that cities with lower standards of living have become increasingly distanced from those with higher standards of living over recent decades. Empirical results investing economic growth for the

mesopolitan segment of the U.S. city complex support mercantile explanations that the U.S. city geography is a rather entrenched market network. Findings also identify several factors influential in the economic success of mesopolitans and the sub-population of Ag Region mesopolitans. These factors include industry specialization, human capital levels, and transportation service. While these factors have been studied in the context of urban economic growth, the results presented here offer unique insight for nonmetropolitan economies that may create a venue for revisiting policy that has had limited success in generating the income convergence over recent decades.

Sensitivity Tests

Numerous forms of the general model presented in the methodology section underline the analysis presented in the empirical results. Alternative forms of the dependent variable and regressors underlie the results presented in the previous sections. The real change in per capita income and population, along with standardized measures of percent change and deviation from national mean, were tested as potential dependant variables. Considering the interpretation for the results section, statistical correlation between dependants, and the explanatory strength of models, the real income and population change are selected as dependant variables for the empirical research.

Additional parameters and transformations of parameters were assessed as explanatory factors in the model of mesopolitan economic growth. The assessment of independent parameters included factors such as relevance, statistical significance,

distribution, and multicollinearity. Alternative agglomeration variables were defined and tested. In one agglomeration parameter, mesopolitans are stratified based on a distribution quartiles for 1980 population. A second agglomeration parameter was defined as a dummy variable identifying mesopolitans in the 75th percentile. Neither the ordinal or dummy agglomeration variable were found to be significant in mesopolitan economic growth.

The continuous forms of the two spatial transportation service parameters, distance to airport hub and distance to rail/truck intermodal facility were tested. Neither was found to have a significant relationship to the economic growth measures. In testing, the airport hub distance was found to have a unique relationship for mesopolitans in the 90th percentile of distance from airport hub. An indicator variable for mesopolitans located more than 300 miles from an airport hub is included in the final model to allow for this relationship. The indicator variable has a reasonable explanation in the substitutability of driving for air in business travel. The container proximity parameter has a weak correlation with the economic growth measures, but was not found to have a significant relationship in the regression analysis. It is not included as an economic growth parameter in the empirical analysis.

Temperature is included in the theoretical model of mesopolitan economic growth. Average annual temperature was introduced into the model to bring some specificity to mesopolitan amenities, compared differences associated with the general four-region delineation. The temperature variable was found to be significant as a factor

in growth, but due to concerns with the inflation of standard errors it is not included in the final analysis. In testing for multicollinearity, the variance of inflation measures revealed problems in including both the region and continuous temperature variables. In addition, the temperature variable had unexpected impacts on the relationships between other independent variables and the dependent measures of economic growth. These results would suggest the temperature variable was measuring something beyond the intended amenity differences. Alternative forms of the temperature variable were tested, but the problem could not be resolved so it was dropped from the final model.

To assess proximity to economic hub as a factor in growth of mesopolitans, two economic hub definitions were tested. One model included distance mesopolitan to the closest megapolitan, considering only the ten largest megapolitans. A second model tested the relationship between distance to the closest, among all megapolitans. A statistically significant relationship did not exist for the economic growth measures and proximity to ten largest mesopolitans, suggesting that the hierarchal central place theory for economic organization is not appropriate for the mesopolitan population. When the economic hub definition is expanded to include all megapolitans as a "network of central places," a relationship between the economic growth and market access is significant. The expanded megapolitan population are included as economic hubs in the final model. These 46 cities are points of attachment in U.S. economy.

Regarding demographic factors, the basic and advanced education variables selected to measure human capital were initially tested as two continuous variables. Due

to the high correlation between the two variables (r(368)=.69, p=.0001), a transformation was required. In order to retain the effects of both variables, differentiated the effects of basic and advanced education, the basic education variable transformed into a dummy variable identifying mesopolitans with higher than average share of the population with 12 years or more of education. Two additional demographic variables, share of residents born in-state and share of residents that are foreign-born, were also tested as potential independent variables. Neither the in-state or foreign born demographic characteristic were found to be significant determinants in economic growth.

The alternative model functional forms and variables described in this section provide a broad view of the activity involved in defining the final model. As economics is an art as well as a science, it is important to be open and creative yet diligent in these activities (Kindleberger, 1990). The final model includes the form and factors determined to be most appropriate through these activities.

CHAPTER VI

CONCLUSION

Economic development initiatives have a long history in the United States. The goal here is to provide information specific to the economic convergence of U.S. cities and to the economic growth factors for nonmetropolitan cities, termed mesopolitans. City population concentrations are critical points of attachment in the spatial economic complex. In addition, they offer inherent benefits such as agglomeration and scale economies. Although the U.S. city network includes a wide array of cities, in terms of size and function, economic growth literature has been largely confined to larger cities and regional assessments. Findings suggest that economic growth factors for the nonmetropolitan cities do differ somewhat from that of larger cities. This insight may improve management of the resources directed at growing nonmetropolitan and rural economies.

U.S. city economies are found to be diverging over more recent decades, based on city real per capita income trends between 1969 and 2000. Although the traditional neoclassic-type convergence is supported in much of the economic growth literature, these findings gives additional credence to studies positing endogenous growth and the new growth theories. These findings have important implications for lagging city

economies that, under these continued trends, may fall increasingly behind leading cities in terms of their standard of living. The results suggest that policies directed at increasing economic growth may need revision to achieve national goals for economic opportunity and equality.

Today's national economic development policies and institutions are largely rooted legislation that were established in the early 1970s. Globalization and information technology that have transformed the marketplace in the ensuing 30 years have created new challenges and opportunities. As policymakers revisit economic development policy it is important to recognize that in addition to establishing basic infrastructure, the ability to make efficient use of existing infrastructure and resources is a fundamental activity in growing economies.

The national population of mesopolitans is defined as CBSAs in the range of the 50^{th} to 75^{th} quartiles of 2000 population. It was selected for factorial analysis in this nonmetropolitan economic growth investigation. These cities account for nearly one-quarter of the U.S. urban population.

Mesopolitan economic growth, as measured by income and population, is influenced by both static and dynamic factors. Advanced education and share of the economy attributed to the service industry in 1980 are the two most influential factors among the dynamic economic growth parameters. Closer proximity to major consumer market, increased industry specialization, higher share of the economy attributed to manufacturing, and freight transportation service are also identified as positive mesocity

growth factors.

Ag Region mesopolitans growth is also strongly influenced by advanced education levels and industrial specialization. This sub-population of mesopolitans is, however, found to have lesser benefits from industrial specialization than the balance of the mesocity population, but similar in its other growth parameters. The Ag Region mesopolitans economies are not found to differ significantly from other mesopolitans. These findings put into question the agricultural emphasis in many U.S. economic development programs.

Findings presented here offer insight for nonmetropolitan communities and policymakers as they look to future rural economic growth, transportation, and agricultural policies. The current executive branch has proposed to consolidate long-standing rural economic development policies, that have been administered by several federal agencies, into a single community development program to be administered under the Department of Commerce. As economies of nonmetropolitan cities and their rural hinterlands become more diversified, the role of agriculture in economic development becomes less clear. The degree to which this reorganization enhances the ability of communities to be innovative in economic development and growth initiatives, injects accountability, encourages regional cooperation, and promotes a broader vision for decision makers, it would be a positive change.

Recent economic development policy has gone beyond place-based initiatives to encourage individual communities to develop their strengths through regional economic

consortiums. These efforts may allow communities more opportunity to improve resource utilization through cooperative efforts. Furthermore, they encourage communities to leverage federal monies to attract private industry investment through programs such as the rural Empowerment Zones and Enterprise Communities (EZ/EC). Moving forward, it may be beneficial to consider an even broader view of the rural community or region growth – as part of a large economic network of accumulation and transfers that is formed through critical points of attachment.

Future economic development programs could be directed not only at the most distressed communities, but also those communities that have the initiative to be innovative in utilizing natural and human resources and in attracting private investments. For instance close proximity to large consumer centers is identified as a contributing factor in mesopolitan economic growth, so the facilitating attempts of more distant communities to build business ties to these centers and creating interaction opportunities may be seen as a way to reduce effects of geographic distance. These investments may benefit not only these communities and their hinterlands, but also others that may learn from these experiences.

At the state or local level, other opportunities may exist in the developing settings conducive to human capital development, and especially advanced human capital development. The more successful mesopolitan economies have larger segments of workers with an advanced education. State and local governments are the primary fiscal supporters and decision makers in basic education infrastructure, as their taxing and

spending activities strongly influence this public good. This research provides additional support for continued spending on education as an economic development factor. In addition, state and local governments may consider secondary education and programs such as cooperative public/private research parks as a second tier in the education infrastructure directed at more efficient use of advanced education resources in economic growth.

As the next federal transportation spending bill and future transportation legislation is proposed, mesopolitans should consider the impacts on freight transportation. Competitive freight transportation is positively correlated with economic growth. As U.S. freight demands continue to increase, system rationing will likely further competitively impede those mesopolitans located in regions with relatively few options for moving goods to major consumer markets. Proactive consideration of new technologies, competitive alternatives, and multi-modal transportation investments and policies are critical to the future success of these mesopolitans and their surrounding rural hinterlands in making more efficient use of existing transportation infrastructure in future economic growth.

A final policy note is on agricultural policy with regard to farm policy for Ag Region mesopolitans. The agricultural industry has become a smaller component of the economies for these cities, comparing the industrial composition of per capita income composition in 1980 to 2000. Radical changes to the farm program that reduce income supports will likely negatively impact Ag Region mesopolitan economies through

hinterland consumer spending reductions and labor force relocation. It is important to recognize farm policy impacts both its micro effects for individual workers, and in its more macro implications for regional economies and their interrelated economic and social networks.

Findings begin to fill a void in knowledge regarding nonmetropolitan city economic growth that is needed to more effectively and efficiency pursue national egalitarian goals. Future investigations that categorize city growth based on population and industry activities, address the path dependency by isolating smaller city economic growth from nearby large city economies, make specific assessment of demographic characteristics such as labor force participation and degrees earned in advanced education, and develop comparative studies of smaller city economic growth convergence and factors across countries offer additional areas for exploration into nonmetropolitan city growth. Case-study analysis such as the work of Beyers and Nelson (2000) may contribute to understanding nontraditional growth factors such as niche manufacturing and commuter workforce. In addition, quantifying a presence of and understanding the scope of local and urban agglomeration economies in a cross section of cities, including those with small and large populations, would provide valuable insight regarding the transferability of these growth factors to smaller city economies.

Mesopolitans may offer a nexus for nonmetropolitan and rural regions to derive some form of agglomeration economies that are typically associated with large urban

populations. Positive relationships between industrial specialization and advanced education factors suggest that these smaller cities may produce some of the positive local and social agglomeration externalities typically associated with large cities. This increased understanding of the growth of mesopolitans may create opportunities for agents in public and private sectors to reevaluate scarce resource distributions for sustaining and growing regional economies.

REFERENCES

REFERENCES

Anselin, Luc, Attila Varga, and Zoltan Acs. (1997) Local Geographic Spillover between University Research and High Technology Innovations, *Journal of Urban Economics*, 42(3): 422-448.

_____. (2000) Geographical Sillovers and University Research: A Spatial Economic Perspective, *Growth and Change*, 31(4): 501-515.

Artz, Georgeanne. (2003) Rural Area Brain Drain: Is it a Reality?, *Choices*, 2003 Q4, 11-16.

Aschauer, David. (1989) Is Public Expenditure Productive? *Journal of Monetary Economics*, Vol. 23(2): 177-200.

Barnard, Charles, Richard Nehring, James Ryan, and Robert Collender. (2001) Higher Cropland Value from Farm Program Payments: Who Gains?, *Agricultural Outlook*, Economic Research Service, United States Department of Agriculture, Washington, D.C., November: 26-30.

Barro, R. J. and X. Sala-i-Martin. (1992) Convergence, *Journal of Political Economy*, Vol. 100(2): 223-251.

Beeson, Patricia, David DeJong, and Werner Troesken. (2001) Population Growth in U.S. Counties, 1840-1990, *Regional Science and Urban Economics*, 31: 669-699.

Bernat, G. Andrew, Jr. (2001) Convergence in State Per Capita Personal Income, (1950-99, *Survey of Current Business*, June: 36-48.

Berliant, Marcus and Hideo Konishi. (1993) The Endogenous Formation of a City: Population Agglomeration and Marketplaces in a Location-Specific Production Economy, *Regional Science and Urban Economics*, Vol. 30: 289-324.

Beyers, William and Peter Nelson. (2000) Contemporary Development Forces in the Nonmetropolitan West: New Insights from Rapidly Growing Communities, *Journal of Rural Studies*, 16: 459-474.

Birdsall, Nancy and Estelle James. (1990) *Efficiency and Equity in Social Spending, How and Why Governments Misbehave*, Policy Research and External Affairs

Complex, The World Bank, Working Paper 274.

Blair, John. (1995) Understanding Economic Structure, in *Local Economic Development: Analysis and Practice.* Sage Publications, Thousand Oaks, California: 95-115.

Boyle, Gerry and Tom McCarthy. (1997) A Simple Measure of β-Convergence, *Oxford Bulletin of Economic and Statistics*, 59(2): 257-264.

Bureau of Economic Analysis. (2002) U.S. Commerce Department, *Regional Accounts Data*, www.bea.gov/bea/regional/data.htm, accessed online August 13.

Burns, James MacGregor and Susan Dunn. (2001) *The Three Roosevelts: Patrician Leaders Who Transformed America.* Atlantic Monthly Press, New York.

Button, Kenneth. (2000) New Approaches to Spatial Economics, *Growth and Change*, Vol. 31: 480-500.

Cain, Louis. (1997) Historical Perspective on Infrastructure and U.S. Economic Development, *Regional Science and Urban Economics*, 27: 117-138.

Canning, David. (1999) *The Contribution of Infrastructure to Aggregate Output*, World Bank Policy Research Working Paper No. 2246.

Canning, David and Esra Bennathan. (2000) *The Social Rate of Return of Infrastructure Investments*, World Bank Policy Research Working Paper No. 2390.

Castro, Jose. (2004) *Indicators of Real Economic Convergence*, Comparative Regional Integration Studies, United Nations University, UNU-CRIS e-Working Papers, W-2004/2.

Chandra, Amitabh and Eric Thompson. (2000) Does Public Infrastructure Affect Economic Activity? Evidence from the Rural Interstate Highway System, *Regional Science and Urban Economics*, 30: 457-490.

Cochrane, Willard and Mary Ryan. (1976) *American Farm Policy, 1948-1973.* North Central Publishing Company, St. Paul, Minnesota.

Cromartie, John. (1998) Net Migration in the Great Plains Increasingly Linked to Natural Amenities and Suburbanization, *Rural Development Perspectives*, Economic Research Service, U.S. Department of Agriculture, Washington, D.C.,

13(1): 27-34.

Coughlin, Cletus C. And Thomas B. Mandelbaum. (1988) Why Have State per Capita Incomes Diverged Recently?, *Regional Economist*, Federal Reserve Bank of St. Louis, 88/09: 24-36.

Cowan, Tadlock. (2004) *An Overview of USDA Rural Development Programs,* Congressional Research Service, Library of Congress, Washington, D.C., Report RL31837.

Crinfield, John and Martin Panggabean. (1995) Is Public Infrastructure Productive? A Metropolitan Perspective Using New Capital Stock Estimates, *Regional Science and Urban Economics*, 25: 607-630.

Cronin, William. (1991) *Nature's Metropolis: Chicago and the Great West.* W.W. Norton, New York.

Dickey, David, Dennis Jansen, and Daniel Thornton. (1991) A Primer on Cointegration with an Application to Money and Income, *Regional Economist,* Federal Reserve Bank of St. Louis, 73(2): 58-78.

Dielman, Terry E. (1996) *Applied Regression Analysis for Business and Economics. 2nd Edition*. Wadsworth Publishing Company, Belmont, California.

Drabenstott, Mark. (2003) A New Era for Rural Policy, *Economic Review*, Federal Reserve Bank of Kansas City, Kansas City, Missouri, 2003(4): 81-98.

Drennen, Matthew and Emanuel Tobier. (1995) The Interruption of Income Convergence and Income Growth in Large Cities in the 1980s, *Urban Studies*, Vol. 33(1): 63-83.

Drennen, Matthew, José Lobo, and Deborah Strumsky. (2004) Unit Root Tests of Sigma Income Convergence Across U.S. Metropolitan Areas, *Journal of Economic Geography*, 4: 583-595.

Dobkins, Linda Harris and Yannis Ioannides. (2001) Spatial Interactions Among U.S. Cities: 1900-1990, *Regional Science and Urban Economics*, 31: 701-731.

Economic Research Service, United States Department of Agriculture. (2000a) Nonfarm Growth and Structural Change Alter Farming's Role in the Rural Economy, *Rural Conditions and Trends*, 10(2): 2-6.

Economic Research Service, United States Department of Agriculture. (2000b) U.S. Farm Policy: The First 200 Years, *Agricultural Outlook*, March: 21-25.

Economic Research Service, United States Department of Agriculture. (2002) Rural-Urban Continuum Codes, www.ers.gov/briefing/rurality/RuralUrbCon.htm, accessed online August 10, 2002.

Fox, William F. and Sanela Porca. (2001) Investing in Rural Infrastructure, *International Regional Sciences Review*, 24(1): 103-133.

Freund, Rudolf J. And Ramon C. Littell. (2002) *SAS System for Regression, 3rd Edition.* SAS Institute, Inc., Cary, North Carolina.

Friedman, Milton. (1992) Do Old Fallacies Ever Die?, *Journal of Economic Literature*, 30(4): 2129-2132.

Fujita, Masahisa and Jacques-Francois Thisse. (2000) The Formation of Economic Agglomerations: Old Problems and New Perspectives, in Jean-Marie Huriot and Jacques-Francois Thisse (Eds.), *Economics of Cities*, Cambridge University Press, New York.

Gaspar, Jess and Edward L. Glaeser. (1998) Information Technology and the Future of Cities, *Journal of Urban Economics*, Vol. 43: 136-156.

Getis, Arthur and Judith Getis. (1970) Christaller's Central Place Theory, in Fred Dohrs and Lawrence Sommers (Eds.), *Economic Geography: Selected Readings*, Thomas Y. Crowell, Inc., New York.

Glaeser, Edward, Hedi Kallal, Jose Scheinkman, and Andrei Shleifer. (1992) Growth in Cities, *The Journal of Political Economy*, 100(6): 1126-1152.

Glaeser, Edward, Jose Scheinkman, and Andrei Shleifer. (1995) Economic Growth in a Cross-Section of Cities, *Journal of Monetary Economics*, 36: 117-143.

Gramlich, Edward. (1994) Infrastructure Investment: A Review Essay, *Journal of Economic Literature*, 32(3): 1176-1196.

Greene, William. (2002) *Econometric Analysis, Fifth Edition.* Prentice Hall, Upper Saddle River, New Jersey.

Gyourko, Joesph and Joseph Tracy. (1991) The Structure of Local Public Finance and

the Quality of Life, *Journal of Political Economy*, Vol 99(4): 774-806.

Huang, Tzu-Ling, Peter F. Orazem, and Darin Wohlgemuth. (2002) Rural Population Growth, 1950-1990: The Roles of Human Capital, Industry Structure, and Government Policy, *American Journal of Agricultural Economics,* 84(3): 615-627.

Heilbroner, Robert L. and William Milberg. (2001) *The Making of Economic Society, Eleventh Edition*. Prentice Hall, Upper Saddle River, New Jersey.

Henderson, J. Vernon. (1994) Where Does Industry Locate?, *Journal of Urban Economics*, Vol. 25: 83-104.

Henderson, Vernon. (1997) Medium Size Cities, *Regional Science and Urban Economics*, Vol. 27: 583-612.

Higgs, Robert. (1969) The Growth of Cities in a Midwestern Region, *Journal of Regional Science*, Vol. 9(3): 369-375.

Hoag, Dana L. (1999) *Agricultural Crisis in America: A Reference Handbook.* ABC-CLIO, Inc., Santa Barbara, California.

Howe, Charles W. (1969) *Inland Waterway Transportation; Studies in Public and Private Management and Investment Decisions.* Washington Resources for the Future, Publisher, Distributed by Johns Hopkins Press, Baltimore.

Innis, Harold. (1956) *The Fur Trade in Canada: An Introduction to Canadian Economic History*. University of Toronto Press, Toronto, Ontario.

Jaccard, James (2001) Interaction Effects in Logistic Regression, *Series: Quantitative Applications in the Social Sciences.* Sage University Paper. Sage Publications, Thousand Oaks, CA. Series/Number 07-135.

Jacobs, Jane. (1969) *The Economy of Cities*. Random House Inc., New York.

Johnson, Kenneth and Calvin Beale. (1998) The Continuing Population Rebound in Nonmetro America, *Rural Development Perspectives*, Economic Research Service, U.S. Department of Agriculture, Washington, D.C., 13(3): 2-10..

Keeler, Theodore. (1983) *Railroads, Freight, and Public Policy*. The Brookings Institute, Washington, D.C.

Kelly, William A., Jr. (1981) A Generalized Interpretation of the Herfindahl Index, *Southern Economic Journal*, 48(1): 50-57.

Kennedy, Peter. (1992) *A Guide to Econometrics, Third Edition*. The MIT Press, Cambridge, Massachusetts.

Khan, Ata. (1987) *Sociotechnical Factors in Air Travel: Some New Insights into Telecommunications Interactions*, Transportation Research Record, No. 1147.

Kilkenny, Maureen. (1998) Transport Costs, the New Economic Geography, and Rural Development, *Growth and Change*, 29(3): 259-70.

Kindleberger, Charles (1990) *Historical Economics: Art or Science?*. University of California Press, Berkeley, California.

Koo, Won (1990) *Econometrics: Theory and Applications,* Department of Agricultural Economics, North Dakota State University.

Krugman, Paul. (1991) Increasing Returns and Economic Geography, *Journal of Political Economy*, Vol. 99: 483-499.

Kusmin, Lorin. (1994) *Factors Associated with the Growth of Local and Regional Economies: A Review of Selected Empirical Literature*, Agriculture and Rural Economy Division, Economic Research Service, U.S. Department of Agriculture, Staff Report No. AGES 9405.

Lucas, Robert. (1988) On the Mechanics of Economic Development, *Journal of Monetary Economics*, 22: 3-42.

Maki, Wilbur and Richard Lichty. (2000) *Urban Regional Economics: Concepts, Tools, Applications*. Iowa State University Press, Ames, Iowa.

Marshall, Alfred. (1961) *Principles of Economics, 9th Edition with Annotations by C.W. Guillebaud*. Macmillian for the Royal Economic Society, New York, New York.

Marshall, John. (1989) *The Structure of Urban Systems*. University of Toronto Press, Toronto, Ontario, Canada.

McGranahan, David, and Calvin Beale. (2002) Understanding Rural Population Loss, *Rural America*, Vol. 17: 13-34.

Mills, Edwin. (1967) An Aggregative Model of Resource Allocation in a Metropolitan Area, *The American Economic Review*, 57(2): (197-210.

Miyata, Yukio. (2000) An Empirical Analysis of Innovative Activity of Universities in the United States, *Technovation*, 20(8): 413-425.

Mokharian, Patricia Lyon. (1990) A Typology of Relationships Between Telecommunications and Transportation, *Transportation Research*, Vol 24(A) No. 3: 231-242.

Muller, Edward K. (1977) Regional Urbanization and the Selective Growth of Towns in North America, *Journal of Historical Geography*, Vol 3: 21-39.

Munnell, Alicia. (1990) How Does Public Infrastructure Affect Regional Economic Performance, New England Economic Review, Sep./Oct.: 69-103.

Myrdal, Gunnar. (1957) *Economic Theory and Underdeveloped Regions*. Duckworth, London.

National Science Foundation. (2002) *Computer-Aided Science Policy Analysis and Research* (CASPAR), caspar.nsf.gov/cgi-bin/WebIC.exe, accessed online August 11, 2002.

Ó hUallacháin, Breandán and Mark Satterthwaite. (1992) Sectoral Growth Patterns at the Metropolitan Level: An Evaluation of Economic Development Incentives, *Journal of Urban Economics*, 31(1): 25-58.

Office of Management and Budget. (2003) Executive Office of the President, Office of Information and Regulatory Affairs, *Statistical Programs and Standards, Final Report and Recommendations From the Metropolitan Statistical Area Standards Review Committee to the Office of Management and Budget Concerning Changes to the Standards for Defining Metropolitan Areas*, accessed online July 16, 2003, at www.whitehouse.gov/omb/inforeg/backgrd_docs.html.

Orden, David, Robert Paarlberg, and Terry Roe. (1999) *Policy Reform in American Agriculture: Analysis and Prognosis*, University of Chicago Press, Chicago, Illinois.

Otterstrom, Samuel. (2001) Trends in National and Regional Population Concentration in the United States from 1970 to 1990: From the Frontier to the Urban

Transformation, *The Social Science Journal*, 38: 393-407.

Palivos, Theodore and Ping Wang. (1996) Spatial Agglomeration and Endogenous Growth, *Regional Science and Urban Economics*, 26: 645-669.

Pindyck, Robert S. and Daniel L. Rubinfeld. (1991) *Econometric Models and Economic Forecasts*. McGraw-Hill Companies, Columbus, Ohio.

Plane, David and Peter Rogerson. (1994) *The Geographical Analysis of Population: With Applications to Planning and Business*. John Wiley and Sons Inc., New York.

Porter, Michael. (1990) *The Competitive Advantage of Nations*. Free Press, New York.

Preacher, Kristopher J. (2004) *A Primer on Interaction Effects in Multiple Linear Regression*, accessed online July 15, 2004, at www.unc.edu/~preacher/inteact/interactions.htm.

Pred, Allan. (1966) *The Spatial Dynamics of U.S. Urban-Industrial Growth, 1800-1914: Interpretive and Theoretical Essays*. MIT Press, Cambridge, MA.

Quah, Danny. (1993) *Galton's Fallacy and Tests of the Convergence Hypothesis*, LSE Economics Department, Mimeo, December.

Rudzitis, Gundars. (1999) Amenities Increasingly Draw People to the Rural West, *Rural Development Perspectives*, Economic Research Service, U.S. Department of Agriculture, Washington, D.C., 14(2): 9-13.

Rathge, Richard and Paula Highman. (1998) Population Change in the Great Plains, A History of Prolonged Decline, *Rural Development Perspectives*, Economic Research Service, U.S. Department of Agriculture, Washington, D.C., 13(1): 19-26.

Rauch, James E. (1993) Productivity Gains from Geographic Concentration of Human Capital, *Journal of Urban Economics*, Vol. 34: 380-400.

Reid, J. Norman and Cornelia Butler Flora. (2002) Advancing Knowledge and Capacity for Community Development, *Agricultural Outlook Forum 2002*, United States Department of Agriculture, Washington D.C.

Romer, Paul. (1986) Increasing Returns and Long-Run Growth, *Journal of the Political*

Economy, Vol. 94: 1002-1037.

_____. (1990) Endogenous Technical Change, *Journal of Political Economy*, 98[5 (2)]: S71-S102.

Rose, Mark. (1979) *Interstate: Express Highway Politics, 1941-1956.* The Regents Press of Kansas, Lawrence, Kansas.

Sala-i-Martin, Xavier X. (1996) Regional Cohesion: Evidence and Theories of Regional Growth and Convergence, *European Economic Review*, 40: 1325-1352.

Schmitt, Bertrand and Mark Henry. (2000) Size and Growth of Urban Centers in French Labor Market Areas: Consequences for Rural Population and Employment, *Regional Science and Urban Economics*, 30: 1-21.

Sharkey, Joe. (2003) Business Travel: On the Road; Major Change Foreseen in Air Travel, *The New York Times*, October 7: C12.

Simon, Curtis and Clark Nardinelli. (2002) Human Capital and the Rise of American Cities, *Regional Science and Urban Economics*, 32: 59-96.

Solow, Robert. (1956) A Contribution to the Theory of Economic Growth, *Quarterly Journal of Economics*, 70: 65-94.

Stephenson, Frederick and Alan Bender. (1996) Watershed: The Future of U.S. Business Air Travel, *Transportation Journal*, Vol. 36(1): 14-32.

Surface Transportation Board. (1999, 2000, 2001) *U.S. Public Use Waybill Sample*, U.S. Department of Transportation, Washington, D.C.

Sutton, Paul and Frederick Day. (2004) Types of Rapidly Growing Counties of the U.S., 1970-1990, *The Social Science Journal*, 41: 251-265.

Tamura, Robert. (1996) Regional Economies and Market Integration, *Journal of Economic Dynamics and Control*, 20: 825-845.

Taylor, George. (1951) *The Transportation Revolution, 1815-60.* Holt, Rinehart and Winston, New York.

Thünen, Johann Heinrich von. (1966) *Isolated State; An English edition of Der isolierte Staat, with Introduction by Peter Hall.* Pergamon Press, Oxford, New York.

Tsuionas, Efthymios. (2000) Regional Growth and Convergence: Evidence from the United States, *Regional Studies*, 34(3): 231-238.

Tweeten, Luther G. (1979) *Foundations of Farm Policy, 2nd Edition, Revised.* University of Nebraska Press, Lincoln, Nebraska.

U.S. Bureau of Labor Statistics. (2003) U.S. Department of Labor, Labor Market Areas, www.bls.gov/laudirectory2003.pdf , accessed online May 12, 2003.

U.S. Census Bureau. (1980, 1990, 2000) *County and City Data Book.* Economics and Statistics Administration, U.S. Department of Commerce, U.S. Government Printing Office, Washington, D.C.

U.S. Census Bureau. (2002) Economics and Statistics Administration, U.S. Department of Commerce, On-line Database, www.census.gov, accessed December 28, 2002.

U.S. Census Bureau. (2003a) Counties with Metropolitan, Micropolitan, and Combined Statistical Area Codes and Titles, *Metropolitan and Micropolitan Statistical Area Definitions*, www.census.gov/population/www/estimates/metrodef.html,accessed on-line May 12, 2003.

U.S. Census Bureau. (2003b) 2000 Census Rural and Urban Classification, On-line Document, http://www.census.gov/geo/www/ua/ua_2k.html, accessed January 28, 2003.

U.S. Census Bureau. (2003c) Urban and Rural Populations: United States, Regions, Divisions, and States: 1900 to 1990, On-line Document, accessed March 2, 2003 www.census.gov/population/censusdata/urpop0090.txt.

U.S. Congressional Budget Office. (1998) *The Economic Effects of Federal Spending on Infrastructure and Other Investments*, CBO Paper, Washington, D.C.

U.S. Department of Agriculture. (2004) *Census of Agriculture*, Accessed online at www.nass.usda.gov/census on November 22, 2004.

U.S. Department of Commerce [CD-ROM]. (2002) *Regional Economic Information System, 1969-2000*, RCN-0295, Washington, D.C.

U.S. Department of Transportation. (2003) *Domestic Airfares Consumer Report* , Federal Aviation Administration,

http://ostpxweb.dot.gov/aviation/domfares/domfares.htm#The%20Domestic%20Airline%20Fares%20Consumer%20Report, accessed Jan. 23, 2003 and Oct. 10, 2003

U.S. Office of Management and Budget. (2000) *Standards for Defining Metropolitan and Micropolitan Statistical Areas*, www.whitehouse.gov/omb/fedreg/metroareas122700.pdf, accessed August 1, 2002.

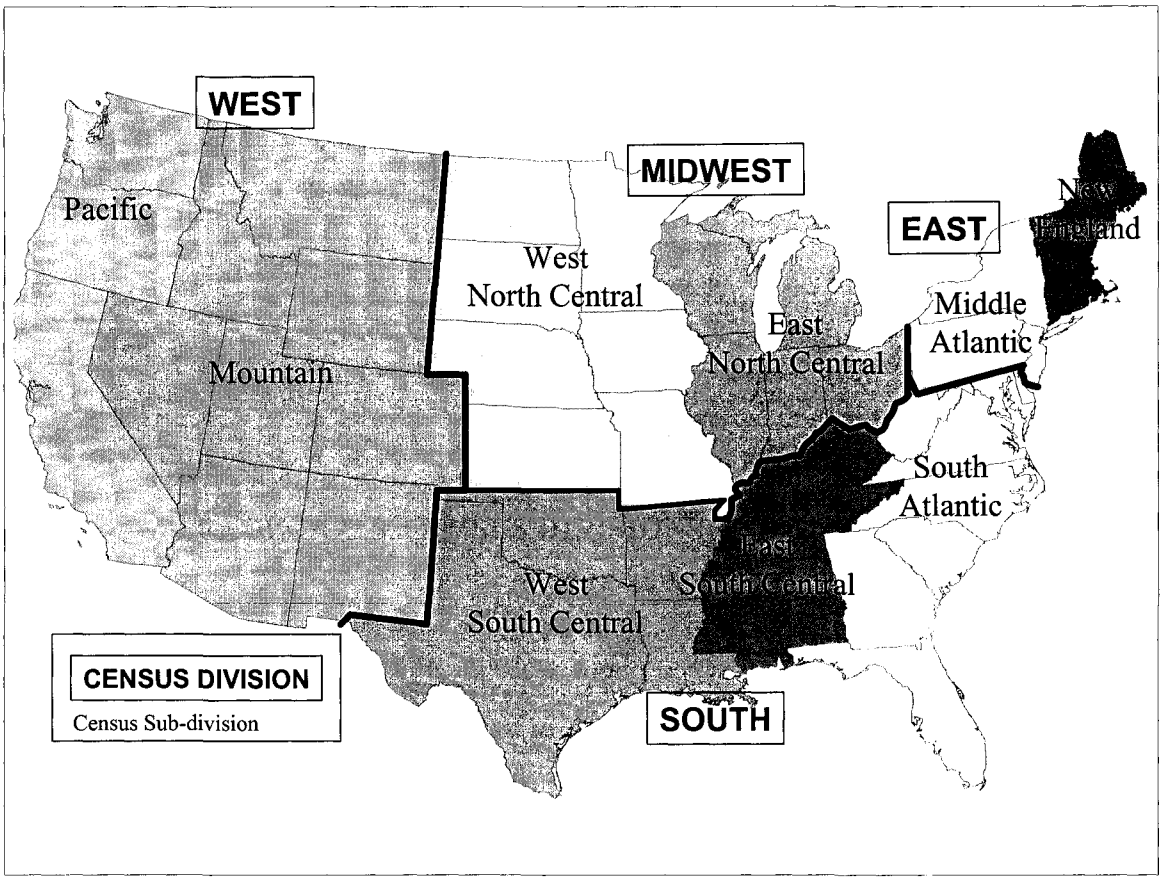
Vachal, Kimberly, John Bitzan, and Kenneth Button. (2004) *Transportation Quality Indices for Economic Analysis of Nonmetropolitan Cities*, Upper Great Plains Transportation Institute, North Dakota State University, DP-158, Fargo, North Dakota.

Vance, James. (1970) *The Merchant's World: The Geography of Wholesaling.* Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

Weber, Adna Ferrin. (1965) *The Growth of Cities in the Nineteenth Century, A Study in Statistics.* Cornell University Press, Ithaca, New York, Originally published in 1899 for Columbia University by The McMillan Company, New York as Vol. XI of Studies in History, Economics, and Public Law.

Wilson, Frank R., Albert M. Stevens, and Timothy R. Holyoke. (1982) The Impact of Transportation on Regional Development, *Transportation Research Record*, 851:13-16.

APPENDIX A.U.S. CENSUS DIVISIONS AND SUB-DIVISIONS



APPENDIX B. 95TH QUARTILE CBSAS IN 2000, RANKING BY POPULATION FOR 1980, 1990, AND 2000

95TH QUARTILE CBSAS IN 2000, RANKING BY POPULATION FOR 1980, 1990, AND 2000

	City Rank, by Population		
CBSA Title	1980	1990	2000
New York Northern New Jersey Long Island, NY NJ PA	**1**	**1**	**1**
Los Angeles Long Beach Santa Ana, CA	**2**	**2**	**2**
Virginia Beach Norfolk Newport News, VA NC	**9**	**3**	**3**
Chicago Naperville Joliet, IL IN WI	**3**	**4**	**4**
Philadelphia Camden Wilmington, PA NJ DE MD	**4**	**5**	**5**
Dallas Fort Worth Arlington, TX	**10**	**8**	**6**
Houston Baytown Sugar Land, TX	**8**	**9**	**7**
Detroit Warren Livonia, MI	**5**	**6**	**8**
Boston Cambridge Quincy, MA NH	**6**	**7**	**9**
Atlanta Sandy Springs Marietta, GA	14	11	**10**
San Francisco Oakland Fremont, CA	**7**	**10**	11
Washington Arlington Alexandria, DC VA MD WV	12	12	12
Riverside San Bernardino Ontario, CA	24	13	13
Phoenix Mesa Scottsdale, AZ	22	21	14
Seattle Tacoma Bellevue, WA	18	15	15
Minneapolis St. Paul Bloomington, MN WI	15	16	16
San Diego Carlsbad San Marcos, CA	19	17	17
Miami Fort Lauderdale Miami Beach, FL	23	22	18
St. Louis, MO IL	13	14	19
Baltimore Towson, MD	16	20	20
Richmond, VA	36	19	21
Tampa St. Petersburg Clearwater, FL	21	24	23
Pittsburgh, PA	11	18	22
Portland Vancouver Beaverton, OR WA	29	28	27

QUARTILE CBSAS IN 2000, RANKING BY POPULATION FOR 1980, 1990, AND 2000

	City Rank, by Population		
CBSA Title	1980	1990	2000
San Antonio, TX	35	34	31
Orlando, FL		37	32
Columbus, OH	32	33	33
Providence New Bedford Fall River, RI MA	27	31	34
Indianapolis, IN	34	35	35
Milwaukee Waukesha West Allis, WI	28	32	36
Las Vegas Paradise, NV			37
Charlotte Gastonia Concord, NC SC	45	43	38
Nashville Davidson Murfreesboro, TN	43	42	39
New Orleans Metairie Kenner, LA	31	36	40
Austin Round Rock, TX		49	41
Memphis, TN MS AR	40	40	42
Buffalo Niagara Falls, NY	33	38	43
Louisville, KY IN	38	41	44
Hartford West Hartford East Hartford, CT	39	39	45
Jacksonville, FL		47	46
Roanoke, VA		48	
Bridgeport Stamford Norwalk, CT		51	
Rochester, NY	41	44	
Birmingham Hoover, AL	42	46	
Oklahoma City, OK	44	45	
Dayton, OH	46	50	

APPENDIX C. RAIL RATES IN REVENUE PER TON MILE 1999 TO 2001, BY STANDARD CLASSIFICATION OF TRANSPORTATION GOODS (SCTG) COMMODITY CLASS

Commodity Class	Avg. Rate	Commodity Class	Avg. Rate
Live Animals	n.a.	Meat, Fish, Seafood	5.54
Monument & Building Stone	2.78	Basic Chemicals	5.76
Coal	2.87	Chemical Products	5.83
Cereal Grains	3.30	Pharmaceutical Products	5.94
Tobacco Products	3.37	Waste And Scrap	6.37
Metallic Ores & Concentrates	4.47	Gasoline & Aviation Turbine	6.40
Nonmetallic Minerals N.E.C.	4.48	Articles Of Base Metal	6.52
Alcoholic Beverages	4.51	Paper Or Paperboard Articles	7.02
Animal Feed & Products	4.58	Plastics & Rubber	7.44
Other Agricultural Products	4.65	Textiles, Leather	8.85
Wood Products	4.67	Printed Products	9.86
Fuel Oils	4.86	Miscellaneous Manufactured	10.75
Logs & Other Rough Wood	4.96	Precision Instruments	10.91
Base Metal Primary/Semifinish	5.00	Furniture, Mattresses	11.10
Natural Sands	5.05	Machinery	11.14
Gravel And Crushed Stone	5.08	Electronic & Other Electrical	11.27
Pulp, Newsprint, Paper	5.13	Transportation Equipment	14.73
Other Prepared Foodstuffs	5.17	Motorized & Other Vehicles	17.84
Milled Grain Products	5.26		
Nonmetallic Mineral Products	5.40		
Coal & Petroleum Products	5.43		
Fertilizers	5.49		

Source: Surface Transportation Board, 1999-2001
n.a. = not available

APPENDIX D. MESOPOLITAN LIST, BY CENSUS REGION

MESOPOLITAN LIST, BY CENSUS REGION

Northeast Region	South Region	Midwest Region	West Region
Altoona, PA	Abilene, TX	Adrian, MI	Albany Lebanon, OR
Atlantic City, NJ	Albany, GA	Allegan, MI	Bellingham, WA
Auburn, NY	Albertville, AL	Ames, IA	Bend, OR
Augusta Waterville, ME	Alexandria, LA	Anderson, IN	Billings, MT*
Bangor, ME	Amarillo, TX	Ann Arbor, MI	Boise City Nampa, ID
Barnstable Town, MA	Anderson, SC	Appleton, WI	Boulder, CO
Binghamton, NY	Anniston Oxford, AL	Ashtabula, OH	Bremerton Silverdale, WA
Bloomsburg Berwick, PA	Asheville, NC	Battle Creek, MI	Centralia, WA
Burlington S. Burlington, VT	Athens Clarke County, GA	Bay City, MI	Cheyenne, WY
Chambersburg, PA	Athens, TX	Beaver Dam, WI	Chico, CA
Concord, NH	Auburn Opelika, AL	Bismarck, ND*	Coeur d'Alene, ID
Corning, NY	Beaumont Port Arthur, TX	Bloomington Normal, IL	Corvallis, OR
DuBois, PA	Beckley, WV	Bloomington, IN	El Centro, CA
East Stroudsburg, PA	Bluefield, WV VA	Brainerd, MN*	Eugene Springfield, OR
Elmira, NY	Bowling Green, KY	Canton Massillon, OH	Eureka Arcata Fortuna, CA
Erie, PA	Brownsville Harlingen, TX	Cape Girardeau Jackson, MO IL	Farmington, NM
Gettysburg, PA	Brunswick, GA	Cedar Rapids, IA*	Flagstaff, AZ
Glens Falls, NY	Burlington, NC	Champaign Urbana, IL	Fort Collins Loveland, CO
Indiana, PA	Cape Coral Fort Myers, FL	Chillicothe, OH	Gallup, NM
Ithaca, NY	Charleston, WV	Columbia, MO	Grand Junction, CO
Jamestown Dunkirk Fredonia, NY	Chattanooga, TN GA	Columbus, IN	Grants Pass, OR
Johnstown, PA	Clarksburg, WV	Danville, IL	Great Falls, MT*
Keene, NH	Clarksville, TN KY	Davenport Moline	Greeley, CO

MESOPOLITAN LIST, BY CENSUS REGION

Northeast Region	South Region	Midwest Region	West Region
		Rock Is., IA IL*	
Kingston, NY	Cleveland, TN	Decatur, IL	Hanford Corcoran, CA
Lancaster, PA	College Station Bryan, TX	Des Moines, IA*	Idaho Falls, ID
Lebanon, NH VT	Columbia, TN	Dubuque, IA*	Kalispell, MT*
Lebanon, PA	Columbus, GA AL	Duluth, MN WI*	Kennewick Richland Pasco, WA
Lewiston Auburn, ME	Cookeville, TN	East Liverpool Salem, OH	Lake Havasu City Kingman, AZ
Manchester Nashua, NH	Corpus Christi, TX	Eau Claire, WI	Las Cruces, NM
Meadville, PA	Cullman, AL	Elkhart Goshen, IN	Logan, UT ID
New Castle, PA	Cumberland, MD WV	Evansville, IN KY	Longview, WA
Norwich New London, CT	Dalton, GA	Fargo, ND MN*	Madera, CA
Ocean City, NJ	Daphne Fairhope, AL	Findlay, OH	Medford, OR
Ogdensburg Massena, NY	Decatur, AL	Flint, MI	Merced, CA
Olean, NY	Deltona Daytona Beach Ormond Beach, FL	Fond du Lac, WI	Missoula, MT*
Pittsfield, MA	Dothan, AL	Fort Wayne, IN	Modesto, CA
Plattsburgh, NY	Dover, DE	Galesburg, IL	Moses Lake, WA
Pottsville, PA	Dunn, NC	Grand Forks, ND MN*	Mount Vernon Anacortes, WA
Reading, PA	Durham, NC	Green Bay, WI	Napa, CA
Somerset, PA	Elizabethtown, KY	Holland Grand Haven, MI	Oak Harbor, WA
State College, PA	Enterprise Ozark, AL	Iowa City, IA*	Ogden Clearfield, UT
Sunbury, PA	Fayetteville Springdale Rogers, AR MO	Jackson, MI	Olympia, WA
Torrington, CT	Fayetteville, NC	Janesville, WI	Pendleton Hermiston, OR
Trenton Ewing, NJ	Florence Muscle Shoals, AL	Jefferson City, MO	Pocatello, ID
Utica Rome, NY	Florence, SC	Joplin, MO	Prescott, AZ

MESOPOLITAN LIST, BY CENSUS REGION

Northeast Region	South Region	Midwest Region	West Region
Vineland Millville Bridgeton, NJ	Fort Smith, AR OK	Kalamazoo Portage, MI	Provo Orem, UT
Watertown Fort Drum, NY	Fort Walton Beach Crestview Destin, FL	Kankakee Bradley, IL	Pueblo, CO
Williamsport, PA	Gadsden, AL	Kokomo, IN	Redding, CA
Willimantic, CT	Gainesville, FL	La Crosse, WI MN	Reno Sparks, NV
York Hanover, PA	Gainesville, GA	Lafayette, IN	Roseburg, OR
Zanesville, OH	Goldsboro, NC	Lansing East Lansing, MI	Salem, OR
	Greenville, NC	Lawrence, KS*	Salinas, CA
	Gulfport Biloxi, MS	Lima, OH	San Luis Obispo Paso Robles, CA
	Hagerstown Martinsburg, MD WV	Lincoln, NE*	Santa Barbara Santa Maria Goleta, CA
	Hammond, LA	Manhattan, KS*	Santa Cruz Watsonville, CA
	Hattiesburg, MS	Manitowoc, WI	Santa Fe, NM
	Hickory Lenoir Morganton, NC	Mankato North Mankato, MN*	Santa Rosa Petaluma, CA
	Hilton Head Island Beaufort, SC	Mansfield, OH	Sierra Vista Douglas, AZ
	Hinesville Fort Stewart, GA	Marinette, WI MI	Spokane, WA
	Homosassa Springs, FL	Marion, IN	St. George, UT
	Hot Springs, AR	Michigan City La Porte, IN	Truckee Grass Valley, CA
	Houma Bayou Cane Thibodaux, LA	Midland, MI	Twin Falls, ID
	Huntington Ashland, WV KY OH	Monroe, MI	Ukiah, CA
	Huntsville, AL	Muncie, IN	Vallejo Fairfield, CA
	Jackson, TN	Muskegon Norton Shores, MI	Visalia Porterville, CA
	Jacksonville, NC	New Philadelphia Dover, OH	Wenatchee, WA
	Johnson City, TN	Niles Benton Harbor, MI	Yakima, WA

MESOPOLITAN LIST, BY CENSUS REGION

Northeast Region	South Region	Midwest Region	West Region
	Jonesboro, AR	Oshkosh Neenah, WI	Yuba City, CA
	Key West Marathon, FL	Ottawa Streator, IL	Yuma, AZ
	Killeen Temple Fort Hood, TX	Owosso, MI	
	Kingsport Bristol Bristol, TN VA	Peoria, IL	
	Lafayette, LA	Portsmouth, OH	
	Lake Charles, LA	Quincy, IL MO	
	Laredo, TX	Racine, WI	
	Laurel, MS	Rapid City, SD*	
	Lawton, OK	Richmond, IN	
	Lexington Fayette, KY	Rochester, MN*	
	Lexington Park, MD	Rockford, IL	
	Longview, TX	Saginaw Saginaw Township North, MI	
	Lubbock, TX	Sandusky, OH	
	Lufkin, TX	Sheboygan, WI	
	Lumberton, NC	Sioux City, IA NE SD*	
	Macon, GA	Sioux Falls, SD*	
	Meridian, MS	South Bend Mishawaka, IN MI	
	Midland, TX	Springfield, IL	
	Mobile, AL	Springfield, MO	
	Monroe, LA	Springfield, OH	
	Montgomery, AL	St. Cloud, MN*	
	Morgantown, WV	St. Joseph, MO KS	
	Morristown, TN	Terre Haute, IN	
	Mount Airy, NC	Topeka, KS*	
	Muskogee, OK	Traverse City, MI	
	Myrtle Beach Conway North Myrtle Beach, SC	Warsaw, IN	
	Naples Marco Island, FL	Waterloo Cedar Falls, IA*	
	New Bern, NC	Watertown Fort Atkinson, WI	
	New Iberia, LA	Wausau, WI	
	Ocala, FL	Weirton Steubenville, WV OH	

MESOPOLITAN LIST, BY CENSUS REGION

Northeast Region	South Region	Midwest Region	West Region
	Odessa, TX	Wheeling, WV OH	
	Opelousas Eunice, LA	Whitewater, WI	
	Orangeburg, SC	Wisconsin Rapids Marshfield, WI	
	Owensboro, KY	Wooster, OH	
	Paducah, KY IL		
	Palatka, FL		
	Palm Bay Melbourne Titusville, FL		
	Panama City Lynn Haven, FL		
	Parkersburg Marietta, WV OH		
	Pascagoula, MS		
	Pensacola Ferry Pass Brent, FL		
	Pine Bluff, AR		
	Port St. Lucie Fort Pierce, FL		
	Punta Gorda, FL		
	Richmond Berea, KY		
	Roanoke Rapids, NC		
	Rocky Mount, NC		
	Rome, GA		
	Russellville, AR		
	Salisbury, MD		
	Salisbury, NC		
	San Angelo, TX		
	Savannah, GA		
	Seaford, DE		
	Sebring, FL		
	Sevierville, TN		
	Shelby, NC		
	Sherman Denison, TX		
	Shreveport Bossier City, LA		
	Southern Pines Pinehurst, NC		
	Spartanburg, SC		

MESOPOLITAN LIST, BY CENSUS REGION

Northeast Region	South Region	Midwest Region	West Region
	Statesville		
	Mooresville, NC		
	Sumter, SC		
	Talladega Sylacauga, AL		
	Tallahassee, FL		
	Texarkana, TX		
	Texarkana, AR		
	Thomasville		
	Lexington, NC		
	Tullahoma, TN		
	Tupelo, MS		
	Tuscaloosa, AL		
	Tyler, TX		
	Valdosta, GA		
	Vero Beach, FL		
	Victoria, TX		
	Waco, TX		
	Warner Robins, GA		
	Wichita Falls, TX		
	Wilmington, NC		
	Wilson, NC		
	Winston Salem, NC		

*Agricultural Region Mesopolitan denoted with * after CBSA name.*

CURRICULUM VITAE

Kimberly Vachal received her Bachelor of Science in 1990, and Master of Science in 1992, in Agricultural Economics from North Dakota State University, Fargo, North Dakota. She is currently an advanced research fellow with the Upper Great Plains Transportation Institute, North Dakota State University. She works with local, regional, and national freight groups to identify logistical opportunities and assess policy implications. Her work focuses on promoting a healthy, competitive logistical system that will enhance the position of products originated from non-metropolitan areas, in both domestic and export markets. She began her career at the Institute in 1992. Her career path has included positions with Cargill, Inc. and the Canadian Pacific Railway. These experiences have been valuable in her research focus areas of freight logistics and non-metropolitan economic development. She has published over 30 research papers and journal articles related to agricultural and rural freight logistics. She is currently a Ph.D. candidate at the School of Public Policy, George Mason University. Her dissertation focuses on economic growth of non-metropolitan cities in the United States.