

**REGIONAL VARIATION IN THE LOCATION CHOICE OF  
GOODS- AND SERVICE-PRODUCING INDUSTRIES**

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## **INTRODUCTION**

One focus of many TRED modeling initiatives is to understand how evolving economic conditions affect prospects for urban and rural places. The urban/rural (metro/non-metro) dichotomy often is used as the basis for measuring differential economic performance. While empirical studies have shown that metro areas consistently outperform non-metro areas, it is not yet known whether the rapid economic growth in late 20<sup>th</sup> century has significantly altered the economic trajectory of rural areas. However, it is commonly believed that recent advances in telecommunications and transportation systems have impacted non-metro area economic performance. But, it not yet known whether these new economic conditions make it easier or more difficult for rural and less densely populated areas to attract or promote economic growth and development. Technological change leads to innovation with the likely result being better economic performance. Schumpeter (1939) argued that technological change is an important element in economic growth and the argument is that rural areas may not be positioned to promote or effectively adopt such change.

One perspective suggests that spillovers can foster regional economic growth. These spillovers are industry-specific externalities that include, but are not limited to, product and process innovations. The link between regions or locations and the source of technical change is implied by cluster growth perspectives. Locations closer to the sources of technological advancements are likely to benefit from spillovers that result

from technical change (Cassar and Nicolini 2003). For example, research parks and businesses that specialize in relatively high technology are typically located close to universities (Anselin, et al. 1997), and empirical evidence supports the notion that technological spillovers contribute to economic growth in these regions (Anselin, et al. 1997).

The availability of advanced telecommunication infrastructure is increasingly a key factor in location choice decisions and may open markets for rural areas. Malecki (2001) found that telecommunication infrastructure was among the top five criteria used in industry location decisions, while Lawless and Gore (1999) reported it was the leading criteria in location decisions. Given recent technological advancements in telecommunication industries, and the cost advantages associated with non-metro economies, traditional goods- and service-producing industries have drawn renewed attention as a possible source for further improving rural economic conditions. It is reasonable to hypothesize that advances in communication technology and improved transportation systems have altered the location of the goods- and service-producing industries across metro and non-metro regions.

There is a renewed interest among economists to examine the impacts of the firm location choices in the context of technological advancements in telecommunication industries. In this chapter, we examine the location choices of goods- and service-producing industry firms in a metro/non-metro continuum in 1990, 1996 and 2002, using location, industry,

and establishment characteristics. This period brackets a time of rapid development and ascension of new information and telecommunications technologies, as well as the relative “peaks and valleys” in U.S. economic performance. By examining the location choice patterns of firms in three distinct time periods and across three different regions we may gain insight into the impacts of general economic conditions on regional economies and the factors that influence firm location choice decisions during times of recession and economic expansion.

From an empirical standpoint, we seek to answer several related questions: what were the key factors that influenced a firm’s location choice decision? Given the location’s characteristics, what is the likelihood of a similar firm selecting the same location? What was the discrete influence of specific characteristics from among a bundle of characteristics represented in a site? How general are these influences across different regions? If we can provide insights into these fundamental questions for a specific region we can provide insights into policies that can affect change.

This research provides insights into how regional prospects have changed during a period of rapid technological innovation. We seek to better understand how the dispersion of economic activity may be changing both the scale and scope of regional economic activity. The geographic scale of economic clusters and what it means to be a “cluster” may itself be evolving. Indeed, by better understanding the evolving location choices of economic activities, we can begin to ask questions about the nature and extent of

economic linkages and activities across space. One might hypothesize that the very notion of economic activities being tightly cluster geographically may be weakening as economic activities disperse across space to more distant locations offering discrete firm advantages. Our concern is what this may mean for the welfare and prospects of rural places and regions.

The remaining sections of this chapter are structured as follows: in the next section we review the literature on modeling industry location choices. We then specify the empirical model and present a regional classification system. In the section following, the data and variables used in this study are discussed. In the final two sections, the empirical estimation and results, and conclusions and policy implications are presented.

## **MODELING INDUSTRY LOCATION CHOICES**

Modeling industrial location choices is a complex undertaking. Debate about the appropriate theoretical and empirical modeling procedures is far from settled. Selecting the best location for a firm's business operation depends on many implicit and explicit factors, particularly in the context of a global marketplace. The objective of a firm is driven by its competitive strategy (the customer's needs the firm intends to satisfy) and returns to investment (see for example **Deller Chapter four**). An array of factors influence a firm's location choice apart from a firm's investment, technology, and demand for the product. These factors include market accessibility, physical and telecommunication

infrastructure, cost of inputs and other related services, and the incentives that are provided by state or local governments. From a modeler's point of view, it is important to determine which factors are crucial in influencing a firm's location choice decision. This is particularly important from a Targeted Regional Economic Development (TRED) perspective because the results of these empirical studies form the foundation upon which policy recommendations are based. Further, we are interested in understanding the extent to which economic activities remain geographically clustered versus dispersing across space.

The discrete nature of the outcome (selecting one location over other locations in the region) limits the use of conventional regression models. Binomial and multinomial models are commonly used discrete choice models. The decision being a rational choice process, the modeling can be guided by economic theory. Given the discrete nature of the choice decisions, count data models are commonly used in empirical studies.

## **DISCRETE CHOICE MODELS**

The modeling of firm location choice begins with selecting from among regions wherein a firm chooses a particular location as its most desirable operating site. In choosing a particular location, there are location-specific factors that were attractive to the firm. These location-specific factors along with other factors are used to model location choice decisions of firms using discrete choice models.

For example, Probit or ordered probit (Basile et al. 2003), Tobit (Devereux, et al. 2003), logit or multinomial logit (Gunther, et al. 1998), conditional logit (Guimarães, et al. 2000), negative binomial (Coughlin and Segev 2000) and Poisson (Guimarães, et al. 2004) models have been used in this empirical work. Theoretical and empirical investigations continue, and are supported by advances in econometric techniques (Guimarães, et al. 2004). With more sophisticated computer power, large volumes of data and complex spatial dependency models are being applied.

## **RANDOM UTILITY MAXIMIZATION MODEL**

An industry will seek a location within a region where it has the greatest competitive advantage or has potential to maximize expected profit. It is assumed that there are  $i = 1, 2, \dots, I$  industries, and the firms in those industries can choose to locate in  $j = 1, 2, \dots, J$  regions. Industry  $i$  has an expected profit in location  $j$  ( $\pi_{ij}$ ) and an expected profit in location  $k$  ( $\pi_{ik}$ ). Firms in the industry are likely to choose location  $j$  only if ( $\pi_{ij} \geq \pi_{ik}$ ). The expected profit of industry  $i$  in location  $j$  ( $\pi_{ij}$ ) is assumed to be a linear function of industry, establishment, and regional characteristics ( $Z$ ), estimated coefficients ( $\alpha$  and  $\beta$ ), and an industry location-specific error term ( $\varepsilon$ ).

$$\pi_{ij} = f(Z). \tag{1}$$

$$\pi_{ij} = \alpha + \beta'Z + \varepsilon. \tag{2}$$

If the error terms in (2) are assumed to be independently and identically distributed according to the Weibull distribution, then the odds ratio of the probability of choosing location  $i$  over location  $j$  can be represented by a conditional logit (McFadden 1974). McFadden's (1974) conditional logit distribution provides a basis for modeling industrial locations decisions. An indicator variable is used to identify firms in industry  $i$  choosing location  $j$  ( $m_{ij} = 1$ ) otherwise ( $m_{ij} = 0$ ). The probability of a firm in industry  $i$  choosing  $j$  is defined as  $p_{ij}^*$  and the probability of finding the firm at another location  $j$  is  $(1 - p_{ij}^*)$ .

## **MODEL AND REGIONAL SPECIFICATIONS**

### **CONDITIONAL LOGIT MODEL**

The Conditional Logit Model (CLM) has been considered to be superior among choice models, given its ability to accommodate alternative location choices, including the present location of existing firms. The merits of the CLM stem from its solid grounding in microeconomic theory: the resulting econometric model is based on a random utility maximization framework. The choice characteristics are considered in modeling the location choice of firms rather than individual characteristics. In the conditional logit model, the individual establishment's industry location choices are modeled using industry, establishment, and community characteristics as explanatory variables.

If it is assumed that a firm's selection of a particular location is choice-specific rather than industry-specific, the conditional logit model is considered to be the more

appropriate than a logit model (Greene 2000, p. 862). Using the conditional logit model approach described in Greene (2000), the probability for firm  $i$  choosing location  $j$  can be written as:

$$\pi_{ij}^* = \frac{\exp\{\alpha + \beta'Z + \varepsilon\}}{\sum_{j=1}^J \exp\{\alpha + \beta'Z + \varepsilon\}}, \quad (7)$$

and the probability of not choosing the location is:

$$1 - \pi_{ij}^* = \frac{\left( \sum_{j=1}^J \exp\{\alpha + \beta'Z + \varepsilon\} \right) - \exp\{\alpha + \beta'Z + \varepsilon\}}{\sum_{j=1}^J \exp\{\alpha + \beta'Z + \varepsilon\}}. \quad (8)$$

Although the estimated parameters and their level of significance are important, this may not provide accurate information about specific variables' impacts on the probabilities of choosing one location against another. The marginal effect of a variable can be estimated by differentiating (7) with respect to the variable.

$$\frac{\partial \pi_{ij}^*}{\partial Z} = \frac{\exp\{\alpha + \beta'Z + \varepsilon\} \beta'}{\sum_{j=1}^J \exp\{\alpha + \beta'Z + \varepsilon\}} - \frac{\exp\{\alpha + \beta'Z + \varepsilon\} \beta'}{\left( \sum_{j=1}^J \exp\{\alpha + \beta'Z + \varepsilon\} \right)^2}, \quad (11)$$

or

$$\frac{\partial \pi_{ij}^*}{\partial Z} = (\Omega(\alpha + \beta'Z + \varepsilon))(1 - \Omega(\alpha + \beta'Z + \varepsilon))\beta, \quad (12)$$

where  $(\Omega(\alpha + \beta'Z + \varepsilon))$  is the probability density function of CLM.

## **REGIONAL SPECIFICATION**

The U.S. Bureau of the Census uses a dichotomous system to classify geographic areas as Metropolitan Statistical Areas (MSA) and non-metropolitan areas. A metropolitan area is defined as a collection of one or more cities with a population greater than 50,000; all other areas are classified as non-metropolitan (Morrissey 1987).

The counties that are in an MSA are considered to be metro counties (here designated as county type =1); counties that are immediately adjacent to metro counties are identified as metro-adjacent counties (county type =2); all other counties are classified as non-metro counties (county type =3). Applying this classification system to Kansas yields 17 metro counties, 21 metro-adjacent counties, and 67 non-metro counties. Specific county designations are presented in Appendix I.

## **INDUSTRY SPECIFICATION**

In this study, industries are classified either as Goods-Producing or Service-Producing. All industry data are specific to a four-digit Standard Industry Classification (SIC), the most detailed industry-scale level in the SIC system. Industry counts are specific to the state of Kansas.

## **Goods-Producing Industries**

Goods-Producing Industries include manufacturing, construction and agricultural services. A total of 401 industries are included in the goods-producing industry group. The list of industries that were identified as goods-producing industries is presented in Appendix II.

## **Service-Producing Industries**

Service-Producing Industries include services; retail trade; wholesale trade; finance, insurance, and real estate; and transportation, communications, and public utilities. A total of 339 industries constituted the service-producing industry category. The list of industries that were identified as service-producing industries is in Appendix III.

## **DATA AND VARIABLES**

The response and explanatory variables can be grouped into two categories. The first group of variables is specific to industries (either to the goods-producing industry or service-producing industry), and the other variables are common to both industries. The number of establishments in the region, average establishment size, industry clustering, and vertical integration are the variables included in the former category. Population

density, quality of the labor force, and county employment growth rate are included in the latter group. The sources and description of data are presented in Table one. Summary statistics for the goods-producing industry variables, service-producing industry variables, and the common variables are presented in Table two, three, and four respectively.

## **SOURCES AND DESCRIPTION OF DATA**

Kansas county-level establishment data were obtained from the U.S. Department of Labor, Bureau of Labor Statistics' Quarterly Census of Employment and Wages program (ES-202) files for the period 1990 to 2002. The ES-202 data file tracks monthly employment and quarterly wages of all employers with employees eligible for unemployment insurance compensation. The response variable was the count of establishments that choose to locate in a particular county within a region (i.e. metro, metro-adjacent, non-metro). If a firm chose a county in a particular region, the location choice indicator variable for that county was assigned a value of one (1), and all the other counties in that region were assigned a zero (0). If a firm had two branches in different counties, each was considered a separate business entity, creating two different establishment location choices. There were three groups of explanatory variables representing community/regional, industry, and establishment characteristics. All three groups of variables were used in all models to explain the location choice decision of firms in metro, metro-adjacent, and non-metro counties.

The location choice decisions were examined from 1990 to 2002 in all three regions for service-producing and good producing industries. However, the results reported here are for 1990, 1996 and 2002. Three years were selected to avoid a proliferation of results presentation. These years were selected because they represent perhaps the extremes in national economic performance. At the start of the 1990s, the U.S. economy had been in a relatively long but mild economic recession, which ended in 1991. From 1992 on, the economy started to take off. By the mid-1990s the economy's performance was at its peak. Economic performance again started to slow dramatically in 2000 and by 2002 the economy once again was in a short-term recession. Summary statistics for the data are presented in Table two and Table three for service-producing and goods-producing industries, respectively.

Population density (POP) was considered a potentially important variable in firm location decisions. Coughlin and Segev (2000) suggested that population density can be used as a proxy for either economic urbanization or for land costs.

The quality of the labor force (QUAL) reflects the knowledge and skill level of the community. Firms are likely to move to locations where the required quality of labor is readily available. College educational attainment had been used as a proxy (Pigeon and Wray, 1999). In this research, the percentage of workers in high-knowledge industries<sup>i</sup> was used as a proxy for quality of the labor force.

Average industry establishment size (SIZE) for industry  $i$  was estimated by summing county employment by industry and then dividing by total county establishments by industry. The average establishment size is an important variable that would indicate which types of establishments were most frequently found in a particular region. It was hypothesized that non-metro regions are attractive to smaller business establishments.

The location quotient was used as a proxy measure of industry clustering (CLUS) within counties. The location quotient measures the relative share of county industry employment to national share of employment in that industry. As noted by Woodward and Guimarães in Chapter five, while the location quotient is widely used within our context it is far from an ideal measure. The location quotient for industry  $i$  in region  $j$  is given by:

$$LQ_i = \frac{(E_{ij} / E_{in})}{(E_j / E_n)},$$

where  $E$  designates employment and the subscripts  $i$ ,  $j$  and  $n$  designate industry, region and national, respectively. It is well known that a location quotient above one indicates that the region has a higher share of employment in that industry than the nation as a whole.

Vertical integration (INT) measures both upstream and downstream relationships. These inter- and intra-industry relationships are likely to affect availability of inputs for firms'

production processes. Vertical integration may arise for a variety of reasons (improved efficiency, technological economies, etc.). Some of the potential disadvantages associated with vertical integration are the creation of barriers to entry and expansion of competitors (Waterson 1993), which may have implications for new establishment entry. Regional social accounting matrices were constructed from the IMPLAN economic modeling system (MIG, Inc., 1999), and used to track inter-industry transactions by industry sector. The indirect multiplier, which measures the strength of inter-industry linkages, was used as a proxy for vertical integration (Ribeiro and Warner, 2004).

Growth rates of county employment (CEMP) represent local economic growth conditions for existing industries. Conditions can be either favorable or unfavorable depending on the relative industry employment share in the county. County employment growth was estimated using total employment in all industries in a county that were reported in the ES-202 data files.

The presence of an interstate **highway (HIGHWAY)** has long been considered as an important factor in location choice decisions.<sup>ii iii</sup> Interstate highways are an important element in the larger multi-modal transportation system that links urban centers and various other transportation modes. The highway variable is an indicator variable (1 if present, 0 otherwise). The presence or absence of interstate highways in a county is reported in Appendix I.

Urbanization (URBA) promotes regional economic growth. Indicator variables were used based on the Urban Influence Code (Coughlin and Segev 2000). A modified Urban Influence Code (Beale code) was used to represent the rural-urban continuum ranging from one to nine.<sup>iv</sup> The value one (1) indicated the most urban and nine (9) was the most rural. Definitions for the Urban Influence Code used here are presented in Appendix IV.

## **EMPIRICAL ESTIMATION AND RESULTS**

The model described in equation (7) was estimated using a maximum likelihood estimator. The Multinomial Discrete Choice procedure was chosen. The location choice of an industry (e.g., goods-producing) in a year (e.g., 1990) for a particular region (e.g., metro) was estimated independently from other industries, years, and regions. The error term in the model was assumed to be independent and identical with a type I Extreme Value (or Gumbel) distribution. These results present a broader picture of aggregation industries and regions. For example, one model was estimated (i.e., goods-producing industry) for the entire non-metro region in a particular year (i.e., 1990), and represent the results for the combined 67 counties. The goods-producing industry alone consists of 391 industry sectors at the four-digit SIC. The coefficients from the CLM for goods-producing industries and the marginal effects of the variables on the location choice of firms in metro, metro-adjacent, and non-metro regions are presented in Tables five and six. The results for service-producing industries are presented in Tables seven and eight. Although, the models were estimated for metro, metro-adjacent and non-metro regions,

the discussion is primarily focused on the non-metro region for ease of exposition and comprehension.

Most of the coefficient estimates (Tables five and seven) are significantly different from zero (five per cent significance level). The marginal impacts (Tables six and eight) of population density and labor force quality on the probability of a goods-producing firm choosing the region were generally quite small, while the influence of an interstate highway and urbanization were somewhat larger. Given the direction and the magnitude of marginal impacts, it is possible to indicate which industries were attracted to each region.

The results are discussed in two sections, primarily focusing on industries suitable for rural economic development (the non-metro counties) in Kansas. The first section focuses on the factors that had a persistent impact across industries and over time. For example, a one unit increase in population density was likely to increase the probability of a goods-producing and a service-producing firm locating in the non-metro region by about 3.5% and 3.3% respectively in 2002. While policy makers have little ability to influence the demography of a region, this highlights the importance of population density in firm location decisions, an effect that was persistent through time and across space.

The quality of the labor force was also expected to have a positive impact in all regions. However, it was true only in the metro region. The negative impact of labor force quality

in the metro-adjacent and non-metro regions indicates that for goods- and service-producing industries seeking locations in these regions, a low-skill, low-wage work force may be attractive rather than a higher-quality labor force. Counties or regions with a relatively less-educated labor force can still target goods- and service-producers of a certain type, perhaps implying something about the type of cluster development suitable for these types of locales. Based on the marginal impacts for 2002, service-producing industries were, in fact, attracted to metro-adjacent and non-metro regions.

The presence of an interstate **highway (Highway)** was expected to have a positive impact on all industries over time, as it facilitates the movement of people and the goods. The results showed that an interstate increased the probability of goods- and service-producing industry location in all regions, with the exception for service industries in the metro-adjacent region in 1996 and 2002. It might be speculated we are observing a “congestion penalty” for service-producing industries by the latter time periods. The persistent positive impact for goods-producing industries in all regions indicates that an interstate highway was relatively more important for these firms. The 2002 marginal effect suggests that the upgrade of a highway to interstate standards could increase the probability of a goods-producing firm choosing a non-metro location by about 23.2% compared to about 11.7% for a service-producing firm.

Urbanization has a positive impact in all regions and industries (as the numbers increase, the level of urbanization decreases). The direction of the marginal impacts indicates that

urbanization was likely to increase the probability of both goods- and service-producing firms. However, the magnitude of the marginal effect showed that service-producing industries were especially likely to benefit from urbanization, specifically in the metro-adjacent region (transportation penalties notwithstanding). As a region becomes more urbanized, there is greater demand for goods and services. However, one finds the demand for services to be relatively greater compared to the demand for goods. Similarly, county employment growth generally had a positive impact on goods- and service-producing firms choosing the non-metro region, except in 1996. However, for service-producing industries, it had a persistent negative impact.

Considering these results in total, the picture to emerge thus far would seem to be one that suggests agglomeration economies and levels of demand are key overall drivers in industry location decisions, a result with unhappy consequences for remote rural areas. Somewhat contradictory findings across the regions for transportation and labor force quality make for interesting speculation. Transportation is hugely important for rural areas, but has its limits in the urbanizing metro-adjacent counties. The findings for labor force quality in the non-metro region suggest that with the appropriate infrastructure in place, rural areas may be attractive for lower-skilled service-type activities. Thus, building out cluster-based strategies focusing on back-office type operations may yet be a viable alternative to firms considering outsourcing certain functions.

The second set of variables considered are those more specific to industries. For example, based on the 1996 and 2002 estimates, average establishment size had a negative impact on goods-producing industries choosing a non-metro location. One unit increase in the establishment size was likely to decrease the probability of a goods-producing firm locating in the non-metro region by about 1.0% and 0.7%, respectively. However, a similar increase would result in an increase in the probability of a service-producing industry firm location by 10.4% and 22.2%. Thus, the effect of concentration in within industry sectors is quite different and may imply the influence of larger national and international trends affecting these industries. With increasing customization and just-in-time deliveries, smaller goods-producers may seek closer quarters with their markets, whether that is an urban market or a major manufacturing activity somewhere. Service industries, perhaps due to newer telecommunication technologies, do have the ability to locate in low-cost locations and, in fact, may do quite well in a rural locale.

Our clustering variable is of particular relevance to our discussion within the context of TRED and clustering approaches. Once again, we observe quite different results across industries in the non-metro region. Our results show that industry clustering was important for service-producing industry location than goods-producing industry location. The 1996 and 2002 marginal effect estimates show that a unit increase in industry clustering was likely to result in an increase in service-producing firms choosing a non-metro location by about 18.2% and 3.1%, respectively. Yet, a similar increase in goods producing industries resulted in about 41.7% and 12.7% reduction of the

probability of a goods-producing firm choosing a non-metro location. We might conclude that service-type activities attract more in-kind activity, while a similar increase in the number of goods-producing industries may lead to a crowding-out effect for other goods-producing firms. This implies that clustering strategies based broadly on service activities would have greatest potential for rural regions.

Although, we expected a positive impact associated with vertical integration in the likelihood of goods- and service-producing firms choosing a location, it had the largest negative impact of all the variables in all regions and years. The result for the goods-producing industry reinforces the notion of the clustering of independent interrelated goods-producing activities rather than firms internalizing related functions if the objective is increased regional employment and economic opportunity. However, the negative impact for the service-producing industry contradicts positive impact associated with the industry clustering variable for service-producing firms. A general weakening of service linkages such as those measured by economic multipliers has occurred. This is due to the fairly ubiquitous trend toward increasing use of imported inputs to production, the overseas outsourcing of many business activities, and the internalization of many functions that previously had been purchased from outside suppliers. Thus, it is not surprising that a relatively large (one unit) increase in a county indirect output multiplier would lead to a large employment decline overall. It may, in fact, indicate a relatively non-competitive industry in a globally-competitive market place.

## CONCLUSIONS

In this chapter we focused on the location choice decisions of goods- and service-producing industries in metro, metro-adjacent, and non-metro regions in three economically-distinct time periods. A conditional logit approach was used in modeling location choice decisions. Selected industry, establishment, and community characteristics were used to explain the location decisions of firms. Population density, urbanization, and highways were three important characteristics that have positive impact on goods- and service-producing industry firm's choosing a non-metro location.

Enhancing highway infrastructure would likely attract more goods and service producing firms to the non-metro region. However, service-producing would seem to hold greater overall promise for rural areas where lower-cost labor, transportation system enhancements, trends toward the concentration of service activities, clustering and vertical integration all are associated with service-producers seeking non-metro locations.

From the standpoint of building out clustering strategies, rural areas and regions will best position themselves by marketing their communities as a viable alternative to outsourcing back-office service operations. This may require some adjustment in conceptualizing what it means to be "clustered." While the Porter-type conceptualization might suggest relatively compact "bubbles" of economic activity on a map, it may well be that much larger and geographically-dispersed clusters can exist through the web of connections represented by advanced telecommunications. The traditional rural advantages of lower

cost factor inputs and high quality of life can yet remain its competitive strength as it continues pursuit of economic opportunity in a globally-competitive environment.

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**Table 1: Description of Variables and Data Sources**

<b>Descriptor</b>	<b>Dependent Variable</b>	<b>Source</b>
Firm or establishment	Annual average counts with 1 indicating location in a region and 0, otherwise.	ES-202 data
<b>Independent Variables</b>		
Population Density	Population density: population per square mile	Woods and Poole Economics, Inc.
Labor Quality	Quality of the labor force: Percent of employees in knowledge industries	ES-202 and Beck (1992)
Estab. Size	Average industry establishment size: total county employment / total number of establishments Industry clustering: location quotient (LQ)	ES-202 data
Ind. Clustering	$LQ = \frac{\frac{\text{County industry employment}}{\text{Total county employment}}}{\frac{\text{National industry employment}}{\text{Total national employment}}}$	ES-202 and County Business Patterns
Vert. Integration	Vertical integration: indirect output multiplier in million dollars	IMPLAN software (MIG, Inc., 1999)
Co. Employment	County employment growth in percentage	ES-202 data
Highway	Presence of an interstate highway in the region's county	State Highway Map
Urbanization	Measure of urbanization: Modified 1993 Urban Influence Code	U.S.D.A. Economic Research Service

**Table 2: Summary Statistics for the Goods-producing Industry**

<b>Region</b>	<b>Variable</b>	<b>Mean</b>	<b>Standard Dev</b>	<b>Minimum</b>	<b>Maximum</b>
<b>Metro</b>	Number of Establishments	7,562	670	6,709	8,474
	Average Establishment Size	17.5	3.2	0.0	23,960.5
	Industry Clustering	52.6	16.6	1.323	1.756
	Vertical Integration	24.0	3.04	0.209	0.325
<b>Metro - Adjacent</b>	Number of Establishments	1,884	118	1,732	2,064
	Average Establishment Size	16.4	79.3	0.0	2,963.7
	Industry Clustering	59.5	18.1	1.357	1.865
	Vertical Integration	43.3	6.05	0.105	3.815
<b>Non-Metro</b>	Number of Establishments	3,265	174	3,032	3,577
	Average Establishment Size	15.5	2.9	0.0	3,229.0
	Industry Clustering	59.5	20.6	1.291	1.902
	Vertical Integration	19.6	3.06	0.150	0.378

Source: Calculations found in Table 1.

**Table 3: Summary Statistics for the Service-producing Industry**

<b>Region</b>	<b>Variable</b>	<b>Mean</b>	<b>Std Dev</b>	<b>Minimum</b>	<b>Maximum</b>
<b>Metropolitan</b>	Number of Establishments	29,490	1,248	27,805	31,506
	Average Establishment Size	12.8	8.8	0.0	8,093.0
	Industry Clustering	2.211	0.203	1.948	2.540
	Vertical Integration	0.287	0.306	0.228	0.363
<b>Metropolitan-Adjacent</b>	Number of Establishments	7,047	2,505	6,452	7,469
	Average Establishment Size	11.6	7.4	0.0	4,306.0
	Industry Clustering	2.141	0.206	1.923	2.454
	Vertical Integration	0.223	0.299	0.172	0.275
<b>Non-Metropolitan</b>	Number of Establishments	13,261	4,802	12,421	14,270
	Average Establishment Size	9.6	2.3	0.0	2,107.2
	Industry Clustering	2.074	0.101	1.823	2.401

			9		
			9		
			0.		
			0		
	Vertical	0.2	6		
	Integration	41	2	0.144	0.382

Source: Calculations found in Table 1.

**Table 4: Summary Statistics for the Common Variables**

<b>Region</b>	<b>Variab le</b>	<b>Me an</b>	<b>Std De v</b>	<b>Minim um</b>	<b>Maxim um</b>
<b>Metro</b>	Populat ion	196	30		
	Density	.2	4.5	8.1	1072.7
	Quality of the Labor Force County Empl.	35. 95	6.3 6	24.34	55.22
<b>Metro- Adjace nt</b>	Growth Rate	1.3 1	5.2 3	-27.91	22.58
	Populat ion	27.	25.		
	Density Quality of the Labor Force County Empl.	1 98	05 8.6 3	3.79 21.32	112.56 67.42
<b>Non- Metro</b>	Growth Rate	0.7 4	4.9 3	-12.74	27.05
	Populat ion	12.	14.		
	Density	4	6	1.8	74.9
	bor Force	36. 74	8.3 7	11.97	63.16
	owth Rate	0.6 7	11. 26	-76.09	285.58

Source: Calculations found in Table 1.

**Table 5: Coefficients for the goods-producing industries**

	Metro			Metro-Adjacent			Non-Metro		
	1	1	2	1	1	2	1	1	2
<b>Variables</b>	<b>9</b>	<b>9</b>	<b>0</b>	<b>9</b>	<b>9</b>	<b>0</b>	<b>9</b>	<b>9</b>	<b>0</b>
	<b>9</b>	<b>9</b>	<b>0</b>	<b>9</b>	<b>9</b>	<b>0</b>	<b>9</b>	<b>9</b>	<b>0</b>
	<b>0</b>	<b>6</b>	<b>2</b>	<b>0</b>	<b>6</b>	<b>2</b>	<b>0</b>	<b>6</b>	<b>2</b>
	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0	0	0	0	0	0	0	0.	0
<b>Pop. Density</b>	0	0	0	1	1	1	1	0	1
	2	1	2	2	7	6	9	2	8
	*	*	*	*	*	*	*	*	*
	(0	(0	(0	(0	(0	(0	(0	(0	(0
	.0	.0	.0	.0	.0	.0	.0	.0	.0
	0)	0)	0)	2)	2)	2)	2)	1)	1)
	-	-	-	-	-	-	-	-	-
	0.	0.	0.	0.	0.	0.	-	0.	0.
	0	0	1	0	0	0	0.	0	0
<b>Labor Quality</b>	5	9	0	4	5	3	0	3	1
	6	5	2	8	1	8	2	5	3
	*	*	*	*	*	*	*	*	*
	(0	(0	(0	(0	(0	(0	(0	(0	(0
	.0	.0	.0	.0	.0	.0	.0	.0	.0
	0	0	0	0	0	0	0	0	0
	5)	6)	5)	6)	6)	7)	4)	4)	4)
	-	0.	0.	0.	-	-	-	-	-
	0.	0	0	0	0.	0.	0.	0.	0.
	0	1	3	1	0	0	0	0	0
<b>Estab. Size</b>	1	9	9	7	0	0	0	0	0
	1	*	*	*	4	4	1	5	3
	(0	(0	(0	(0	(0	(0	(0	(0	(0
	.0	.0	.0	.0	.0	.0	.0	.0	.0

	0	0	0	0	0	0	0	0	0
	7)	2)	2)	5)	3)	4)	4)	3)	2)
	0.		-	-	-	0.	-	0.	-
	6		0.	0.	0.	0.	0.	0.	0.
	5	0.	8	3	2	4	0.	2	0.
<b>Ind. Clustering</b>	6	0.	6	3	8	5	0	1	0
	*	0	9	2	9	5	3	3	6
	(0	1	*	*	*	*	6	*	4
	.1	(0	(0	(0	(0	(0	(0	(0	(0
	4	.0	.0	.1	.0	.0	.0	.0	.0
	9)	3	7	1	7	6	6	3	4
	-	9)	6)	9)	6)	7)	5)	2)	2)
	0.		-	0.	0.	1.	0.	-	1.
	3	-	0.	0	0	6	0	0.	1
<b>Vert. Integration</b>	0	0.	2	5	5	1	0	0	6
	5	2	8	9	1	1	6	0	4
	*	*	8	*	*	*	*	2	*
	(0	(0	(0	(0		(0	(0	(0	(0
	.0	.0	.2	.0	(0	.2	.0	.0	.1
	2	1	5	1	.0	1	0	0	2
	1)	2)	6)	4)	1)	1)	2)	1)	6)
	-		-	-	-	-	-	-	-
	0.	0.	0.	0.	0.	0.		-	0.
	1	0	0	0	0	0	0.	0.	0
<b>Co. Employment</b>	3	2	6	8	1	3	0	0	1
	7	7	5	2	3	7	0	0	1
	*	*	*	*	*	*	5	2	*
	(0	(0	(0	(0	(0	(0	(0	(0	(0
	.0	.0	.0	.0	.0	.0	.0	.0	.0
	0	0	0	1	0	1	0	0	0
<b>Highw</b>	4)	8)	9)	5)	5)	1)	5)	1)	4)
	0.	1.	0.	0.	0.	0.	0.	0.	0.

<b>ay</b>	6	4	9	1	0	0	2	1	1
	6	0	8	8	6	5	4	1	1
	3	9	8	4	9	8	*	2	6
	*	*	*	*				*	*
	(0	(0	(0	(0	(0			(0	(0
	.0	.0	.0	.0	.0	(0	(0	.0	.0
	7	7	6	7	7	.0	.0	4	4
	9)	7)	6)	1)	5)	8)	5)	9)	6)
	-	-	-	-	-	-	-	-	-
	1.	1.	1.	0.	0.	0.	0.	0.	0.
<b>Urban izatio n</b>	0	5	1	1	2	1	4	3	3
	3	5	5	1	3	3	4	6	1
	8	9	3	5	7	8	1	2	5
	*	*	*	*	*	*	*	*	*
	(0	(0	(0	(0	(0	(0	(0	(0	(0
	.1	.0	.0	.0	.0	.0	.0	.0	.0
	8	4	5	3	2	2	4	3	3
	1)	5)	1)	5)	6)	6)	1)	2)	3)
	-	-	-	-	-	-	-	-	-
	1	1	1	-	-	-	1	1	1
<b>Log Likeli hood</b>	4	5	7	4	5	5	1	2	2
	0	1	5	7	0	5	7	3	3
	7	1	3	9	5	5	8	6	9
	2	7	4	3	9	5	0	3	8

\* Asterisks indicate significance at the 0.05 probability level. The values in parentheses are standard errors.

**Table 6: Marginal effects of the variables for the good producing industries**

	Metro			Metro-Adjacent			Non-Metro		
	1	1	2	1	1	2	1	1	2
	9	9	0	9	9	0	9	9	0
	9	9	0	9	9	0	9	9	0
	0	6	2	0	6	2	0	6	2
	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0	0	0	0	0	0	0	0	0
<b>Pop. Density</b>	0	0	0	6	9	9	3	3	3
	9	6	9	6	1	1	7	8	5
	-	-	-	-	-	-	-	-	-
	0.	0.	0.	0.	0.	0.	0.	0.	0.
	3	5	5	2	2	2	0	0	0
<b>Labor Quality</b>	0	2	6	6	8	0	4	6	2
	8	6	2	7	5	9	0	9	7
	-	-	-	-	-	-	-	-	-
	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0	1	2	0	0	0	0	0	0
<b>Estab. Size</b>	6	0	1	9	2	2	0	1	0
	0	5	5	2	4	4	1	0	7
	-	-	-	-	-	-	-	-	-
	3.	0.	4.	1.	1.	2.	0.	0.	0.
<b>Ind. Clustering</b>	6	0	8	8	5	5	0	4	1
	3	5	1	3	9	1	7	1	2
	1	5	1	9	8	7	1	7	7
	-	-	-	-	-	-	-	-	-
	1.	1.	1.	0.	0.	8.	0.	0.	2.
<b>Vert. Integration Co.</b>	6	1	5	3	2	9	0	0	3
	9	0	9	2	8	1	1	0	2
	0	7	6	7	1	7	2	4	3
	-	0.	0.	-	-	0.	0.	-	-

<b>Employment</b>	0.7593	1.4436	3.0000	0.4436	0.7593	2.0000	0.0000	0.4436	0.0000
	7	4	6	4	0	0	1	0	0
	5	8	0	5	7	7	0	0	2
	9			3	4			4	1
	3.67	7.81	5.44	1.00	0.33	0.00	0.44	0.00	0.00
<b>Highway</b>	6.71	8.00	4.66	0.11	3.88	2.22	7.77	2.22	3.33
	1	1	8	6	1	3	6	0	2
	-	-	-	-	-	-	-	-	-
	5.77	8.66	6.33	0.66	1.33	0.77	0.88	0.77	0.66
<b>Urbanization</b>	4.77	2.99	8.66	3.77	1.11	6.66	7.77	0.00	2.22
	7	9	6	7	2	6	5	8	8

**Table 7: Coefficients for the service-producing industries**

	Metro			Metro-Adjacent			Non-Metro		
	1	1	2	1	1	2	1	1	2
	9	9	0	9	9	0	9	9	0
	9	9	0	9	9	0	9	9	0
	0	6	2	0	6	2	0	6	2
	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0	0	0	0	0	0	0	0	0
<b>Pop.</b>	0	0	0	1	2	2	1	1	1
<b>Densit</b>	3	2	1	8	3	4	2	3	7
<b>y</b>	*	*	*	*	*	*	*	*	*
	(0	(0	(0	(0	(0	(0	(0	(0	(0
	.0	.0	.0	0	0	0	0	0	0
	0)	0)	0)	1)	1)	1)	1)	1)	1)
	-	-	-	-	-	-	-	-	-
	0.	0.	0.	0.	0.	0.	-	0.	0.
	0	0.	0	0	0	0	0.	0	0
<b>Labor</b>	6	0	7	4	5	4	0	2	2
<b>Qualit</b>	8	7	2	7	7	2	2	5	2
<b>y</b>	*	*	*	*	*	*	*	*	*
	(0	(0	(0	(0	(0	(0	(0	(0	(0
	.0	.0	.0	.0	.0	.0	.0	.0	.0
	0	0	0	0	0	0	0	0	0
	3)	3)	3)	3)	3)	3)	1)	1)	1)
	-	-	-	-	-	-	-	-	-
	0.	0.	0.	0.	0.	0.	0.	0.	0.
	1	-	0	0	0	0	0	0	1
	9	0.	7	5	4	5	3	5	1
<b>Estab.</b>	4	0	2	2	9	5	8	3	1
<b>Size</b>	*	1	*	*	*	*	*	*	*
	(0	(0	(0	(0	(0	(0	(0	(0	(0

	.0	.0	.0	.0	.0	.0	.0	.0	.0
	1	0	0	1)	1	0	0	0	0
	2)	7)	6)		4)	8)	8)	7)	6)
		-		-		-	-		
	0.	0.	1.	0.		0.	0.	0.	
	6	4	8	7	0.	6	2	0	0.
<b>Ind.</b>	0	5	3	9	5	8	5	9	0
<b>Cluste</b>	8	3	7	7	1	1	7	3	1
<b>ring</b>	*	*	*	*	*	*	*	*	5
	(0	(0	(0	(0	(0	(0	(0	(0	(0
	.1	.0	.0	.1	.1	.1	.0	.0	.0
	1	8	7	2	0	1	4	4	4
	1)	5)	6)	1)	8)	7)	5)	7)	7)
	-			-					
	3	-	-	1	-	-	-	-	-
	0.	8.	1	0.	1.	4.	1.	1.	3.
	1	2	4.	2	6	2	2	1	1
<b>Vert.</b>	7	7	6	3	7	3	3	7	4
<b>Integr</b>	5	9	7	9	8	9	4	6	2
<b>ation</b>	*	*	*	*	*	*	*	*	*
		(0	(0	(1	(0	(0	(0	(0	(0
	(1	.5	.6	.0	.5	.5	.2	.1	.2
	.0	2	3	8	5	5	6	9	7
	0)	7)	1)	2)	8)	4)	2)	8)	9)
	-	-		-	-			-	
	0.	0.	0.	0.	0.	-	0.	0.	0.
	1	0	0	0	0	0.	0	0	0
<b>Co.</b>	7	5	1	2	0	0	1	0	0
<b>Emplo</b>	9	3	4	4	5	0	4	1	7
<b>yment</b>	*	*	*	*	*	5	*	*	*
	(0	(0	(0	(0	(0	(0	(0	(0	(0
	.0	.0	.0	.0	.0	.0	.0	.0	.0
	0	0	0	0	0	0	0	0)	0

	2)	3)	5)	4)	2)	4)	2)		2)
	0.	1.	0.	0.	0.	-	0.	0.	0.
	8	3	4	1	1	0.	2	2	0
	6	8	4	4	2	0	3	3	5
<b>Highway</b>	6	5	7	7	1	8	8	3	9
	*	*	*	*	*	6	*	*	*
	(0	(0	(0	(0	(0	(0		(0	(0
	.0	.0	.0	.0	.0	.0	(0	.0	.0
	3	3	3	3	3	4	.0	2	2
	5)	8)	1)	1)	2)	6)	2)	1)	2)
	-	-	-	-	-	-	-	-	-
	1.	2.	2.	0.	0.	0.	0.	0.	0.
	1	1	7	3	2	2	4	3	2
<b>Urbanization</b>	0	4	0	1	2	0	9	9	1
	2	9	2	7	2	6	5	7	1
	*	*	*	*	*	*	*	*	*
	(0	(0	(0	(0	(0	(0	(0	(0	(0
	.0	.0	.0	.0	.0	.0	.0	.0	.0
	4)	6)	3)	7)	4)	4)	9)	6)	9)
	-	-	-	-	-	-	-	-	-
	6	6	6	2	2	2	6	5	5
	2	6	7	2	2	2	2	9	5
<b>Log Likelihood</b>	9	5	9	4	8	0	1	1	9
	4	5	8	9	7	2	6	6	8
	4	1	9	5	2	6	7	1	8

\* Asterisks indicate significance at the 0.05 probability level. The values in parentheses are standard errors.

**Table 8: Marginal effects of the variables for the service-producing industries**

	Metro			Metro-Adjacent			Non-Metro		
	1	1		1	1	2	1	1	2
	9	9		9	9	0	9	9	0
	9	9	20	9	9	0	9	9	0
	0	6	02	0	6	2	0	6	2
	0.	0.		0.	0.	0.	0.	0.	0.
	0	0		0	1	1	0	0	0
<b>Pop. Density</b>	1	0	0.0	9	2	3	2	2	3
	4	9	04	7	8	4	5	5	3
				-	-	-	-	-	-
	0.	0.		0.	0.	0.	0.	0.	0.
	3	3		2	3	2	0	0	0
<b>Labor Quality</b>	7	9	0.3	5	1	3	4	5	4
	5	0	98	7	4	4	2	0	5
	-	-		-	-	-	-	-	-
	1.	0.		0.	0.	0.	0.	0.	0.
	0	0		2	2	3	0	1	2
<b>Estab. Size</b>	7	5	0.3	8	6	0	7	0	2
	6	7	96	8	9	7	7	4	2
		-		-	-	-	-	-	-
	3.	2.		4.	2.	3.	0.	0.	0.
<b>Ind. Clustering</b>	3	5	10.	4	8	7	5	1	0
	6	0	17	1	2	7	2	8	3
	7	6	0	5	2	2	6	2	1
	-	-		-	-	-	-	-	-
	1	4	-	5	9.	2	2.	2.	6.
<b>Vert. Integration</b>	6	5.	81.	6.	2	3.	5	3	2
	7.	8	21	6	8	4	2	1	7
	0	3	9	8	9	7	8	2	3

	5	4		7		1			
	8								
	-	-		-	-	-		-	
	0.	0.		0.	0.	0.	0.	0.	0.
<b>Co.</b>	9	2		1	0	0	0	0	0
<b>Employ</b>	8	9	0.0	3	2	2	2	0	1
<b>ment</b>	8	6	80	3	6	7	9	3	3
					-	-			
	4.	7.		0.	0.	0.	0.	0.	0.
	7	6		8	6	4	4	4	1
<b>Highwa</b>	9	7	2.4	1	6	7	8	5	1
<b>y</b>	4	0	75	2	8	7	8	7	7
		-							
	-	1		-	-	-	-	-	-
	6.	1.	-	1.	1.	1.	1.	0.	0.
	1	8	14.	7	2	1	0	7	4
<b>Urband</b>	0	9	96	5	2	3	1	8	2
<b>zation</b>	2	6	1	2	7	8	4	0	1

## Appendix I

### County type, urban influence code and interstate highway

FIPS	Name	MSA	URINF_Code*	Highway	FIPS	Name	MSA	URINF_Code*	Highway
1	Allen	2	6	0	107	Linn	1	2	0
3	Anderson	2	6	0	109	Logan	3	9	0
5	Atchison	2	5	0	111	Lyon	2	5	1
7	Barber	3	9	0	113	Marion	2	5	1
9	Barton	3	7	0	115	Marshall	3	6	0
11	Bourbon	2	6	0	117	McPherson	2	8	0
13	Brown	2	6	0	119	Meade	3	9	0
15	Butler	1	2	1	121	Miami	1	2	1
17	Chase	2	5	1	123	Mitchell	3	8	0
19	Chautauqua	3	9	0	125	Montgomery	3	7	0
21	Cherokee	3	8	0	127	Morris	2	6	0
23	Cheyenne	3	9	0	129	Morton	3	9	0
25	Clark	3	9	0	131	Nemaha	2	6	0
27	Clay	3	8	0	133	Neosho	3	8	0
29	Cloud	3	8	0	135	Ness	3	9	0
31	Coffey	2	6	1	137	Norton	3	8	0
33	Comanche	3	9	0	139	Osage	1	2	1
35	Cowley	2	3	0	141	Osborne	3	9	0
37	Crawford	3	7	0	143	Ottawa	3	7	0
39	Decatur	3	9	0	145	Pawnee	3	8	0
41	Dickinson	3	8	1	147	Phillips	3	8	0
43	Doniphan	1	2	0	149	Pottawatomie	2	5	0
45	Douglas	1	2	1	151	Pratt	3	8	0
47	Edwards	3	9	0	153	Rawlins	3	9	0
49	Elk	2	6	0	155	Reno	2	3	0
51	Ellis	3	7	1	157	Republic	3	9	0
53	Ellsworth	3	8	1	159	Rice	3	8	0
55	Finney	3	7	0	161	Riley	2	5	1
57	Ford	3	7	0	163	Rooks	3	9	0
59	Franklin	1	2	1	165	Rush	3	9	0
61	Geary	2	5	1	167	Russell	3	8	1
63	Gove	3	9	1	169	Saline	3	7	1
65	Graham	3	9	0	171	Scott	3	8	0
67	Grant	3	8	0	173	Sedgwick	1	1	1
69	Gray	3	9	0	175	Seward	3	7	0
71	Greeley	3	9	0	177	Shawnee	1	2	1
73	Greenwood	2	6	0	179	Sheridan	3	9	0
75	Hamilton	3	9	0	181	Sherman	3	8	1
77	Harper	2	4	0	183	Smith	3	9	0
79	Harvey	1	2	1	185	Stafford	3	9	0
81	Haskell	3	9	0	187	Stanton	3	9	0
83	Hodgeman	3	9	0	189	Stevens	3	8	0
85	Jackson	1	2	0	191	Sumner	1	2	1
87	Jefferson	1	2	0	193	Thomas	3	8	1
89	Jewell	3	9	0	195	Trego	3	9	1
91	Johnson	1	1	1	197	Wabaunsee	1	2	1
93	Kearny	3	9	0	199	Wallace	3	9	0
95	Kingman	2	4	0	201	Washington	3	9	0
97	Kiowa	3	9	0	203	Wichita	3	9	0
99	Labette	3	7	0	205	Wilson	3	8	0
101	Lane	3	9	0	207	Woodson	3	9	0
103	Leavenworth	1	2	0	209	Wyandotte	1	2	1
105	Lincoln	3	9	1					

Counties within a MSA (Metro) = 1; metro-adjacent = 2; non-metro non-adjacent =3

\* Urban Influence Code in 1996

Highway 1= presence

## Appendix II

### Urban Influence Codes

Code	Definition
	<u>Metropolitan</u>
1	Central and fringe counties of metro areas of 400,000 population or more
2	Small - Counties in metro areas of fewer than 400,000 population non-metropolitan counties
	<u>Non-Metropolitan</u>
3	Adjacent to a large metro area with a city of 10,000 or more
4	Adjacent to a large metro area and without a city of at least 10,000
5	Adjacent to a small metro area with a city of 10,000 or more
6	Adjacent to a small metro area and without a city of at least 10,000
7	Not adjacent to a metro area and with a city of 10,000 or more
8	Not adjacent to a metro area and with a city of 2,500 to 9,999 population
9	Not adjacent to a metro area and with no city or a city with a population less than 2,500

Appendix III

Standard Industry Classification (SIC) codes for the Goods-producing Industries

S I C	S I C	S I C	S I C	S I C	S I C	S I C	S I C	S I C
7	2	2	2	2	3	3	3	3
1	0	2	5	8	2	4	5	6
1	2	3	9	4	6	2	3	3
	3	1	9	3	2	3	7	5
7	2	2	2	2	3	3	3	3
2	0	2	6	8	2	4	5	6
1	2	4	1	4	6	2	4	3
	4	1	1	4	3	5	1	9
7	2	2	2	2	3	3	3	3
2	0	2	6	8	2	4	5	6
2	2	5	2	5	6	2	4	4
	6	1	1	1	4	9	2	7
7	2	2	2	2	3	3	3	3
2	0	2	6	8	2	4	5	6
3	3	5	3	6	6	3	4	4
	2	4	1	1	9	1	3	8
7	2	2	2	2	3	3	3	3
2	0	2	6	8	2	4	5	6
4	3	5	5	6	7	3	4	9
	3	7	2	5	1	2	4	1
7	2	2	2	2	3	3	3	3
4	0	2	6	8	2	4	5	6
1	3	5	5	6	7	3	4	9
	4	8	3	9	2	3	5	2
7	2	2	2	2	3	3	3	3
4	0	2	6	8	2	4	5	6
2	3	5	5	7	7	4	4	9
	5	9	5	3	3	1	6	4
7	2	2	2	2	3	3	3	3
5	0	2	6	8	2	4	5	7
1	3	6	5	7	7	4	4	2
	7	1	6	4	4	2	7	8
7	2	2	2	2	3	3	3	3
5	0	2	6	8	2	4	5	8
2	3	6	5	7	7	4	4	1
	8	2	7	5	5	3	8	2
7	2	2	2	2	3	3	3	3
6	0	2	6	8	2	4	5	8
1	4	6	7	7	8	4	4	2
	1	9	1	9	1	4	9	1

7	2	2	2	2	3	3	3	3
6	0	2	6	8	2	4	5	8
2	4	7	7	9	9	4	5	2
	3	3	2	1	1	6	2	2
7	2	2	2	2	3	3	3	3
8	0	2	6	8	2	4	5	8
1	4	8	7	9	9	4	5	2
	4	1	4	2	2	8	3	3
7	2	2	2	2	3	3	3	3
8	0	2	6	8	2	4	5	8
2	4	8	7	9	9	4	5	2
	5	2	5	3	5	9	4	4
7	2	2	2	2	3	3	3	3
8	0	2	6	8	2	4	5	8
3	4	8	7	9	9	5	5	2
	6	4	6	5	6	1	5	7
1	2	2	2	2	3	3	3	3
5	0	2	6	8	2	4	5	8
2	4	9	7	9	9	5	5	2
1	7	5	7	9	7	2	6	9
1	2	2	2	2	3	3	3	3
5	0	2	6	9	2	4	5	8
2	4	9	7	1	9	6	5	4
2	8	7	8	1	9	2	9	1
1	2	2	2	2	3	3	3	3
5	0	4	6	9	3	4	5	8
3	5	1	7	5	1	6	6	4
1	1	1	9	1	2	3	1	2
1	2	2	2	2	3	3	3	3
5	0	4	7	9	3	4	5	8
4	5	2	1	5	1	6	6	4
1	2	1	1	2	3	5	2	3
1	2	2	2	2	3	3	3	3
5	0	4	7	9	3	4	5	8
4	5	2	2	9	1	6	6	4
2	3	6	1	2	5	6	3	4
1	2	2	2	2	3	3	3	3
6	0	4	7	9	3	4	5	8
1	6	2	3	9	1	6	6	4
1	1	9	1	9	6	9	4	5
1	2	2	2	3	3	3	3	3
6	0	4	7	0	3	4	5	8
2	6	3	3	1	1	7	6	5
2	2	1	2	1	7	1	5	1
1	2	2	2	3	3	3	3	3
6	0	4	7	0	3	4	5	8

2	6	3	4	2	2	7	6	6
3	3	4	1	1	1	9	6	1
1	2	2	2	3	3	3	3	3
6	0	4	7	0	3	4	5	8
2	6	3	5	5	2	8	6	7
9	4	5	2	2	2	2	7	3
1	2	2	2	3	3	3	3	3
7	0	4	7	0	3	4	5	9
1	6	3	5	5	2	8	6	1
1	6	6	4	3	4	3	8	1
1	2	2	2	3	3	3	3	3
7	0	4	7	0	3	4	5	9
2	6	3	5	6	2	8	6	1
1	7	9	9	1	5	4	9	4
1	2	2	2	3	3	3	3	3
7	0	4	7	0	3	4	5	9
3	6	4	6	6	3	8	8	1
1	8	1	1	9	1	9	1	5
1	2	2	2	3	3	3	3	3
7	0	4	7	0	3	4	5	9
4	7	4	7	8	3	9	8	3
1	4	8	1	1	4	1	2	1
1	2	2	2	3	3	3	3	3
7	0	4	7	0	3	4	5	9
4	7	4	8	8	3	9	8	4
2	5	9	2	2	9	2	5	2
1	2	2	2	3	3	3	3	3
7	0	4	7	0	3	4	5	9
4	7	5	8	8	4	9	8	4
3	6	1	9	3	1	3	6	4
1	2	2	2	3	3	3	3	3
7	0	4	7	0	3	4	5	9
5	7	5	9	8	5	9	8	4
1	7	2	1	4	1	4	9	9
1	2	2	2	3	3	3	3	3
7	0	4	7	0	3	4	5	9
5	7	9	9	8	5	9	9	5
2	9	1	6	5	3	5	2	1
1	2	2	2	3	3	3	3	3
7	0	4	8	0	3	4	5	9
6	8	9	1	8	5	9	9	5
1	7	3	2	6	4	6	3	2
1	2	2	2	3	3	3	3	3
7	0	4	8	0	3	4	5	9
7	9	9	1	8	5	9	9	5
1	1	9	3	7	5	7	4	3

1	2	2	2	3	3	3	3	3
7	0	5	8	0	3	4	5	9
8	9	1	1	8	5	9	9	5
1	2	1	6	8	6	8	6	5
1	2	2	2	3	3	3	3	3
7	0	5	8	0	3	4	5	9
9	9	1	1	8	5	9	9	6
1	5	2	9	9	7	9	9	1
1	2	2	2	3	3	3	3	3
7	0	5	8	2	3	5	6	9
9	9	1	2	1	6	1	1	6
3	6	4	1	1	3	1	2	5
1	2	2	2	3	3	3	3	3
7	0	5	8	2	3	5	6	9
9	9	1	2	2	6	1	1	9
4	7	5	2	1	4	9	3	1
1	2	2	2	3	3	3	3	3
7	0	5	8	2	3	5	6	9
9	9	1	2	2	6	2	2	9
5	8	7	3	9	5	3	1	3
1	2	2	2	3	3	3	3	3
7	0	5	8	2	3	5	6	9
9	9	1	2	3	6	2	2	9
6	9	9	4	1	6	4	4	5
1	2	2	2	3	3	3	3	3
7	1	5	8	2	3	5	6	9
9	1	2	3	4	6	3	2	9
9	1	1	3	1	9	1	5	6
2	2	2	2	3	3	3	3	3
0	1	5	8	2	3	5	6	9
1	2	2	3	5	9	3	2	9
1	1	2	4	1	8	2	9	9
2	2	2	2	3	3	3	3	
0	1	5	8	2	3	5	6	
1	3	3	3	5	9	3	3	
3	1	1	5	3	9	3	1	
2	2	2	2	3	3	3	3	
0	1	5	8	2	4	5	6	
1	4	4	3	5	1	3	3	
5	1	1	6	5	1	4	2	
2	2	2	2	3	3	3	3	
0	2	5	8	2	4	5	6	
2	1	4	4	5	1	3	3	
1	1	2	1	9	2	5	3	
2	2	2	2	3	3	3	3	
0	2	5	8	2	4	5	6	

2	2	9	4	6	2	3	3
2	1	1	2	1	1	6	4

Source: U.S. Department of Commerce

#### Appendix IV

##### SIC codes for the Service-producing Industries

SI C	SI C	SI C	SI C	SI C	SI C	SI C	SI C
41	49	51	55	59	70	75	84
11	32	13	21	95	21	15	12
41	49	51	55	59	70	75	84
19	39	31	31	99	32	19	22
41	49	51	55	60	70	75	86
21	41	36	41	11	33	21	11
41	49	51	55	60	70	75	86
31	52	37	51	19	41	32	21
41	49	51	55	60	72	75	86
41	53	39	61	21	11	33	31
41	49	51	55	60	72	75	86
42	59	41	71	22	12	34	41
41	49	51	55	60	72	75	86
51	61	42	99	29	13	36	51
41	49	51	56	60	72	75	86
73	71	43	11	35	15	37	61
42	50	51	56	60	72	75	86
12	12	44	21	36	16	38	99
42	50	51	56	60	72	75	87
13	14	45	32	61	17	39	11
42	50	51	56	60	72	75	87
14	15	46	41	62	18	42	12
42	50	51	56	60	72	75	87
15	21	47	51	81	19	49	13
42	50	51	56	60	72	76	87
21	23	48	61	82	21	22	21
42	50	51	56	60	72	76	87
22	31	49	99	91	31	23	31
42	50	51	57	60	72	76	87
25	32	53	12	99	41	29	32
42	50	51	57	63	72	76	87
26	33	54	13	11	51	31	33
42	50	51	57	63	72	76	87
31	39	59	14	21	61	41	34
43	50	51	57	63	72	76	87
11	43	62	19	24	91	92	41

44	50	51	57	63	72	76	87
12	44	69	22	31	99	94	42
44	50	51	57	63	73	76	87
24	46	71	31	51	11	99	43
44	50	51	57	63	73	79	87
32	47	72	34	61	12	11	44
44	50	51	57	63	73	79	87
49	48	81	35	71	13	22	48
44	50	51	57	63	73	79	88
81	49	82	36	99	19	29	11
44	50	51	58	64	73	79	89
82	51	91	12	11	22	33	99
44	50	51	58	65	73	79	
89	52	92	13	12	23	41	
44	50	51	59	65	73	79	
91	63	93	12	13	31	48	
44	50	51	59	65	73	79	
92	64	94	21	14	34	91	
44	50	51	59	65	73	79	
93	65	98	32	15	35	92	
44	50	51	59	65	73	79	
99	72	99	41	17	36	93	
45	50	52	59	65	73	79	
12	74	11	42	19	38	96	
45	50	52	59	65	73	79	
13	75	31	43	31	42	97	
45	50	52	59	65	73	79	
22	78	51	44	41	49	99	
45	50	52	59	65	73	81	
81	82	61	45	52	52	11	
47	50	52	59	65	73	82	
29	83	71	46	53	53	11	
47	50	53	59	67	73	82	
31	84	11	47	12	59	21	
47	50	53	59	67	73	82	
41	85	31	48	19	61	22	
47	50	53	59	67	73	82	
83	87	99	49	22	63	31	
47	50	54	59	67	73	82	
85	88	11	62	26	78	43	
47	50	54	59	67	73	82	
89	91	21	63	32	81	44	
49	50	54	59	67	73	82	
11	92	31	83	33	82	99	
49	50	54	59	67	73	83	
22	93	41	84	92	83	22	

49	50	54	59	67	73	83
23	94	51	89	94	84	31
49	50	54	59	67	73	83
24	99	61	92	98	89	51
49	51	54	59	67	75	83
25	11	99	93	99	13	61
49	51	55	59	70	75	83
31	12	11	94	11	14	99

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Source: U.S. Department of Commerce

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## ENDNOTES

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<sup>i</sup> An industry is identified as a high-knowledge industry if the industry has more than 40 percent of occupations in managerial, professional and technical positions (Beck, 1992).

<sup>ii</sup> This acknowledges that there is no way to definitively know whether the presence of highways leads to growth, or whether growth leads to more highways. In either instance, the two invariably exist together.

<sup>iii</sup> Many would argue today that even more important than the concrete highways of yesterday are the information superhighways of today. And, if so, why did we not include information related to the spread of Internet or cellular service in our model? While we agree with the relative and growing importance of telecommunications infrastructure, we are aware of no reliable and detailed information source chronicling the growth and spread of these technologies that dates to the early 1990s. The state and federal government only began publishing these data in the early 2000s.

<sup>iv</sup> In the original 1993 coding system, metropolitan counties were defined by a population of one million or more. This criterion was scaled back to 400,000 for this research due to the paucity of such counties in Kansas.