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Essays on Agglomeration Trends in the U.S. Manufacturing Industries, 1988-2003

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ESSAYS ON AGGLOMERATION TRENDS IN THE U.S. MANUFACTURING INDUSTRIES, 1988-2003

BY

ABDULLAH M. KHAN

A Dissertation Submitted in Partial Fulfillment
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ACCEPTANCE

This dissertation was prepared under the direction of the candidate's Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Economics in the Andrew Young School of Policy Studies of Georgia State University.

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ABSTRACT

ESSAYS ON TRENDS IN INDUSTRIAL AGGLOMERATION: THE CASE OF U.S. MANUFACTURING INDUSTRIES FROM 1988 TO 2003

By

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This dissertation consists of two essays dealing with the trends in industrial agglomeration and changes in the influence of micro-determinants of agglomeration due to globalization in the U.S. manufacturing agglomeration and the second essay discusses the impact of globalization on the micro-determinants of agglomeration. The first essay explores recent agglomeration trends in the U.S. manufacturing industries between 1988 and 2003 using employment and employment-based agglomeration measures such as Ellison-Glaeser Index and Gini index, and using Herfindahl index as a measure of industrial concentration due to scale economies. Between 1988 and 2003, forty two states lost and eight states gained manufacturing employment with a net loss of more than 5.13 million jobs nationwide. Middle Atlantic, New England, and South Atlantic are the three divisions with highest drops in manufacturing employment with Middle Atlantic division's loss of 45 percent jobs, New England division's loss of 44 percent and South Atlantic division's loss of 28 percent of jobs in the manufacturing industries. Three states that experienced the most decrease in manufacturing jobs in 2003 measured in percent of their 1988 employment are New Jersey (51 percent), New York (51 percent),

and Connecticut (48 percent). Textile and apparel industries, metal related industries and leather and leather goods industries etc. are among the industries that experienced relatively higher attrition in manufacturing jobs in 2003. Three trends are apparent. First, employment has declined across regions, years and industries. Second, the industries that were among the most agglomerated industries in 1988 have generally displayed decrease in agglomeration indices (both in terms of EGI and Gini measures) in later years including 2003. This trend may imply that for these industries, attrition of manufacturing employment in later years mainly occurred from the counties with relatively higher share of employment in the concerned industries in 1988. Third, industries that are found to be least agglomerated in 1988 have often displayed increase in agglomeration in later years including 2003. This trend may imply that for these industries, attrition of manufacturing employment in 2003. This trend may imply that for these industries, attrition of manufacturing employment in 2003 mainly occurred from the counties with lower employment share of the concerned industries in 1988. Similar trends are observed for the Herfindahl indices. Changes in the Herfindahl indices may be due to changes in traditional scale economies caused by advancements in the ICTs.

The second essay explores the differential impacts of technological advancements and trade liberalization on the three Marshallian determinants of industrial agglomeration for U.S. manufacturing industries. These three micro-determinants of agglomeration are goods pooling (input sharing), labor pooling (availability of labor), and idea pooling (knowledge spillover). The impact of decrease in employment on industrial agglomeration is ambiguous, and warrants empirical investigation. An index of agglomeration is regressed on proxies for three micro-determinants of agglomeration,

after controlling for transportation costs, natural advantage and other state level economic variables, and after inclusion of interaction variables for technological advancement and trade liberalization. The regression results for both the OLS and FE specifications are consistent with the hypothesis that there was a structural change in the effect of the micro-determinants of industrial agglomeration in the U.S. manufacturing industries beginning in 1995.

In the second essay, we decompose the impact of globalization on three micro-determinants of agglomeration into two separate segments: impact of technological advancements and impact of trade liberalization. The findings are partially consistent with the hypothesis that globalization has attenuated the effect of micro-determinants of agglomeration as the influence of two out of three micro-determinants of agglomeration diminished in the post-1995 years relative to their pre-1995 levels. For example, in the post 1995 period in our base line model, influence of labor pooling is diminished by about 4 percent and influence of idea pooling has attenuated by about 1 percent from their pre-1995 levels. Contrary to our hypothesis, we find that the influence of goods pooling has increased as a micro-determinant of agglomeration in the post-1995 years relative to its pre-1995 levels. The attenuation in influence for labor pooling and increase in influence of goods pooling in the post-1995 period are statistically significant when attenuation of influence of idea pooling is not statistically significant. Also, when we decompose the total effect of globalization, we find the impact of technology to be greater than that of international trade. The key findings are robust to alternative specifications of the econometric model, particularly to changes in the proxies used for LP.

CHAPTER I: INTRODUCTION

The study of the recent trends in manufacturing agglomeration in the U.S. and the impact of globalization on the micro-determinants of agglomeration is important from both academic and policy perspectives. The examination of these issues is academically important because there is a dearth of empirical studies analyzing recent trends in U.S. manufacturing agglomeration and the relative influence of micro-determinants of agglomeration. But analyses of trends in industrial agglomeration after mid-1990s is important as this period is marked with rapid advancement in information and communication technologies, specially the mass use of internet and liberalization in international trade facilitated by emergence of North American Free Trade Agreement (NAFTA) and the successful conclusion of the Uruguay round trade negation which was the harbinger of the World Trade Organization. Study of manufacturing agglomeration is also important from policy perspective.

Once regarded as one of the largest source of U.S. employment, this sector has lost about 5.13 million jobs between 1988 and 2003 as shown in Figure B1. During this period manufacturing output as percent of GDP declined, manufacturing output rose and manufacturing productivity per worker hour increased sporadically as shown in Figure B2, Figure B3 and Figure B4 respectively. Employment is one of the central focuses of economic development and macro-economic stabilization policy planning. Study of recent manufacturing agglomeration trend will also shed light on the employment situation across U.S. regions and states. Impact of loss in employment on agglomeration

is theoretically ambiguous as it may lead to increase or decrease of agglomeration in a jurisdiction depending on whether jobs are being lost from relatively more agglomerated regions or less agglomerated regions within the host jurisdiction. If attrition of employment in a particular manufacturing industry is occurring from relatively less agglomerated region (e.g. county), the relative density of agglomeration in the broader jurisdiction (e.g., state) may increase. On the other hand, if manufacturing jobs in a particular industry are being lost from more agglomerated jurisdiction, then agglomeration density of that industry in the broader jurisdiction may decline. Because of this ambiguity, we need to empirically examine the trends in manufacturing agglomeration and the relative influence of three micro-determinants of agglomeration.

Thus, study of agglomeration would not only be informative to the academic community but also to policy planners engaged in formulation of fiscal, as well as, socio-economic infrastructure development policies.

In Chapter 2 we discuss the trends in U.S. manufacturing industries at the national level and across nine Census divisions using employment data, the Ellison-Glaeser Index of agglomeration (henceforth EGI), and the Gini index. We also examine the trends in industrial concentration using the Herfindahl index. In this chapter, we find that Middle Atlantic region lost highest percent (45 percent) of manufacturing jobs between 1988 and 2003. During the same time, New England region lost 44 percent jobs and South Atlantic division and Pacific regions lost 28 percent of jobs. Out of fifty states, forty two states experienced a loss of manufacturing jobs and only eight states experienced slight increase in manufacturing employment with a net loss of over five million jobs nationwide. In this chapter we explore trends in industrial employment, agglomeration due to external

economies and concentration due to internal economies or scale economies. We examine agglomeration trends using both the EGI and the Gini index. We use the Herfindahl index to examine trends in industrial concentration due to internal economies or scale economies.[1]

According to EGI, the most agglomerated 3-digit SIC industry is aircraft and parts (SIC 372), followed by glass and glassware (SIC 322), structural clay products (SIC 325), industrial organic chemicals (SIC 286) and others. All of these industries' agglomeration density decreased between 1988 and 2003. On the other hand, some of the industries those were among the least agglomerated in 1988 displayed increase in agglomeration in 2003. These industries include primary and nonferrous metal (SIC 333), cement (SIC 324), soaps, cleaners and toilet goods (SIC 284), special industry machinery (SIC 355) and others.

Using Gini as a measure of agglomeration we find that structural clay products (SIC 325), industrial organic chemicals (SIC 286), wood buildings and mobile homes (SIC 245), glass and glassware (SIC 322) etc. are among the most agglomerated industries in 1988. Here we also find that industries that were least agglomerated in 1988 per the Gini index have displayed increase in agglomeration in 2003.

Herfindahl index measures industrial concentration in manufacturing industries that arises due to internal economies of scale. Using this measure we find that guided

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[1] Internal economies of scale economies are internal to firms and refer to cost savings that accrue due to mass productions using large plants. External economies refer to cost savings that agglomerated firms receive from a larger diversity of activities and a higher specialization. (Fujita & Thisse, 2002, p.8).

missile and space vehicles (SIC 376), handbags and personal leather products (SIC 317), primary nonferrous metal (SIC 333), engines and turbines (SIC 351) etc. are among the industries displaying most industrial concentration. It seems that capital and technology intensive manufacturing industries have more opportunity to achieve internal economy of scale.

As revealed in the employment trend analysis over sixteen years (1988-2003), manufacturing jobs are attenuating across regions and industries. From agglomeration trend analysis using the EGI measure, we find that most industries displayed decrease in agglomeration between 1988 and 2003. This finding implies that manufacturing jobs are being lost from the relatively more agglomerated regions causing the agglomeration index to decline for the concerned 3-digit SIC industries in the host states. At the regional level, industries that displayed agglomeration in 1988 displayed deagglomeration in recent years. On the other hand, industries that displayed the least agglomeration in 1988 displayed more agglomeration in recent years. Using patent count in 1988 as a measure of industrial innovativeness we find that for several regions, industries that displayed increase in agglomeration over the period under study were more innovative (i.e., had more patent certifications in 1988) than industries that displayed decrease in agglomeration between the same period.

In Chapter 3 we explore the impact of globalization on the three micro-determinants of agglomeration. These three micro-determinants of industrial agglomeration are labor pooling (availability of workers), goods pooling (input sharing), and idea pooling (knowledge spillover). Globalization in recent years has been facilitated through the dual channels of technological advancement in the information and

communication technologies (ICTs) and trade liberalization. Recent advancements in the ICTs, especially that in the internet and other web based communication tools, have significantly altered the old paradigm of manufacturing landscape in the U.S. and around the world. Internet and other web-based communication tools have arguably enhanced sharing of knowledge and performance of economic activities over long distances. The enactment of the North American Free Trade Agreement (NAFTA), and World Trade Organization have contributed to further liberalization of international trade.

As shown in the estimation results in Chapter 3, we find that the influence of labor pooling and idea pooling are diminished due to globalization, whereas the influence of goods pooling is increased due to it . This makes intuitive sense because, with the advent of modern ICTs including the internet, it is possible to share ideas and perform some routinized task from long distance via web based ICTs and industrial robots. But for material input heavy manufacturing firms, location near sources of raw materials remain to be a critical consideration for agglomeration. In this chapter we decompose the total effect of globalization into two separate effects. It turns out that technological advancement effects are generally stronger than trade liberalization effects on LP and IP and mixed influence of these dual channels on GP.

CHAPTER II: TRENDS IN INDUSTRIAL AGGLOMERATION: THE CASE OF U.S. MANUFACTURING INDUSTRIES, 1988-2003

Introduction

Manufacturing industries in the U.S. are going through significant changes in response to globalization, such as technological change and trade liberalization. These changes are generally marked by increases in labor productivity and manufacturing output and by decreases in manufacturing employment and by decreases in the relative contributions of the manufacturing sector to Gross Domestic Product (GDP).[2] Technological advancement increases labor productivity and thus allows the production of target levels of output with fewer workers. Trade liberalization exposes domestic industries to increased foreign competition. This exposure forces U.S. firms to be more cost-effective and innovative in order to survive and thrive. Thus, trade liberalization forces firms to cut back on production, move plants off-shore, or close.

Globalization is being driven by technological advancements that facilitate communication and trade liberalizations. Recent advances in the internet and other web-based information and communication technologies (ICTs) have reduced the costs and increased the quality of distant communication and thus have contributed to more cost-effective management of supply chains over long distances.[3] The internet was officially

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[2] These trends are shown in Figures B1 through B4, in Figure B8, and in Tables A1 through A4.

[3] In fact, data show that the growth rate of U.S. labor productivity fell in the 1970s and 1980s but began to increase again in the mid-1990s. The recent increase in U.S. labor

open for commercial usage after the decommissioning of the National Science Foundation–managed NSFNet in 1995. Additionally, recent trade agreements have reduced tariff and non-tariff barriers to international trade. Since 1994, tariffs and quantitative restrictions on international trade between the U.S., Canada, and Mexico have declined, and eventually all remaining tariff and quantitative restrictions were phased out under the provisions of the North American Free Trade Agreement (NAFTA).[4] The U.S. further lowered tariffs on goods imported from a large number of countries in 1995 as a result of the successful conclusion of the Uruguay round of the General Agreement on Tariffs and Trade (GATT). These events have effectively facilitated the ease of communication and increased international trade, which in turn has increased the outsourcing by domestic companies and by U.S.-origin multi-national corporations (MNCs) of the production of many intermediate and final goods. .

Technological advancement increases labor productivity and has positive effects on the comparative advantage of the incumbent country.[5] Recent technological

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productivity is discussed in several books and articles, including Krugman and Wells (2006, p. 597) and Jimeno and Saiz (2006), who attribute the observed increase in labor productivity to technological advancements, such as the ICT revolution.

[4] As per the information provided at the website of the Office of the United States Trade Representative, the remaining tariffs and quantitative restrictions were eliminated in January 2008 (Retrieved from http://www.ustr.gov/trade-agreements/free-trade-agreements/north-american-free-trade-agreement-nafta November 08, 2008).

[5] There is a wealth of theoretical and empirical papers on the labor-productivity enhancing impact of technological advancements. A well-cited theoretical paper on this

advancements may boost U.S. manufacturing output and thus may increase U.S. manufacturing exports. Under such a scenario with increased trade liberalization, export-intensive manufacturing industries would grow, which could lead to increased agglomeration of these manufacturing industries in the U.S. On the other hand, technological advancement and trade liberalization may cause the agglomeration of U.S. manufacturing industries to decline if such firms lose their cost-competitiveness to their foreign counterparts. Because of this ambiguity in the potential impact of technological advancement and trade liberalization on manufacturing employment agglomeration, it is important that we empirically analyze recent trends in the agglomeration of U.S. manufacturing industries. Kim (1995) examines the trend in U.S. regional manufacturing structure from 1870 to 1987. However, the period since 1987 is of particular interest, since the three major events mentioned above (i.e., enactment of NAFTA and GATT and commercial use of the internet) happened after this period.

We find that, during the period between 1988 and 2003, the U.S. has lost about five million manufacturing jobs, most of them in Middle Atlantic (-45 percent), New England (-44 percent), South Atlantic (-28 percent), and Pacific (-28 percent) divisions. Also, we find that the agglomeration for most of the manufacturing industries has declined during this period as measured by EGI and Gini indices.

Following Marshall (1890), three types of agglomeration externalities are well known in the literature. One type is Marshall-Arrow-Romer externalities, also known as

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issue is Solow (1956). Some recent empirical work on this topic includes Matteucci et al. (2005) and Atrostic and Nguyen (2002).

"MAR externalities." This type of externalities mainly arise from special concentration of similar firms.

Another type is "Jacob externalities" that occur mainly from the co-agglomeration of firms from different industries, thus providing opportunities for inter-industry collaboration and knowledge-sharing. Now let us briefly explore why the benefits of Jacobs externalities decline as industries mature. The main source of Jacob externalities is inter-industry collaboration, which allows firms to tap into economic knowledge from different sources. This sharing of knowledge among different kinds of industries is more relevant for product innovations. But as industries mature, their innovation intensity shifts from product innovation to process innovation, where inter industry knowledge-sharing is arguably less relevant. For this reason, the benefits of agglomeration in the form of Jacob externalities would decline as industries mature.

A third type of externalities are known as "urbanization externalities" which refer to benefits of agglomeration that can arise due to city size or density of agglomeration. Frequently used measures of agglomeration are Ellison-Glaeser Index (EGI) and Gini Index, and a measure of industrial concentration is the Herfindahl Index. The EGI is constructed using the Gini index and the Herfindahl index. We discuss agglomeration trends using these three indices as well as in terms of employment data. In this dissertation we mainly examine agglomeration due to Marshall-Arrow-Romer agglomeration externalities via goods pooling (GP, labor pooling (LP) and idea pooling (IP).

Economies of GP are the cost savings that agglomerated 'input-heavy' firms acquire from sharing expensive and indivisible inputs and facilities. For example,

suppose a firm has a crane and a forklift. When the firm is using the forklift, the crane is idle. If the firm is spatially isolated, it cannot lease the idle crane to another firm. However, if firms using cranes and forklifts collocate, then these indivisible inputs can be shared. As Duranton and Puga (2004) contend, such 'input-heavy' agglomerated firms can also save costs by sharing many indivisible public goods, production facilities, and market places which might be prohibitively expensive to access for an isolated firm. For example, it may be prohibitively expensive to set up power plant for a firm located in isolation. But agglomerated firms can share the expenses of setting up of such plants with heavy fixed costs and thus can minimize production costs. Thus, proximity to one another reduces the costs of production to each agglomerated firm relative to the case of dispersed firms. Cost savings from such input sharing is an important motivation of agglomeration for input-heavy firms. Arguably, the more 'input-heavy' a firm is the more interested it may be in agglomerating due to goods pooling reasons.

Economies of LP are the cost savings available to agglomerated firms from efficient matching of the demand and supply sides of the labor market. For example, when firms locate nearby an abundant supply of labor with skills matching the requirements of the industry, there are cost savings as a result of lower hiring costs and/or productivity increases. Furthermore, Helsley and Strange (1990) and Overman and Puga (2009) contend that large labor markets improve the chances of matching the skill requirements of firms with the particular skills of workers. Increasing the average quality of matches increases the productivity of labor and thus lowers the costs of producing a unit of output.

Economies of IP are the cost savings that accrue to agglomerated firms from sharing knowledge about industrial best practices and sharing knowledge about the results of research and development (R&D) activities. For example, when firms are agglomerated, industrial workers and researchers of similar interests and abilities have greater opportunities to share knowledge and ideas critical for successful innovation. Such innovations reduce the costs of production and allow firms to differentiate their products and thereby increase their market shares.

Measured by the Ellison-Glaeser Index (EGI), the most agglomerated 3-digit SIC industries in 1988 included aircraft and parts (SIC 372), glass and glassware (SIC 322), structural clay products (SIC 325), industrial organic chemicals (SIC 286), miscellaneous furniture and fixtures (SIC 259), ship- and boat-building (SIC 373), and miscellaneous primary metal products (SIC 339).[6] All of these industries display deagglomeration in 2003 relative to the level in 1988. The least agglomerated industries as measured by EGI include primary non-ferrous metal (SIC 333), hydraulic cement (324), miscellaneous plastic products (SIC 308), fabricated structural metal products (SIC 344), Bakery products (SIC 205), and Metalworking machinery (SIC 354). Out of these six industries four industries (miscellaneous plastic products, fabricated structural metal, bakery products, metalworking machinery) displayed deagglomeration; two of these (primary nonferrous metal and hydraulic cement) display further agglomeration.[7]

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[6] National average EGI values are calculated by averaging state-level EGI values.

[7] National trends in agglomeration of the twenty most agglomerated industries and twenty least agglomerated industries as measured by EGI are listed in Tables 8 and Table 9, respectively.

Using the Gini Index as a measure of agglomeration, we find that structural clay products (SIC 325), industrial organic chemicals (286), wood buildings and mobile homes (SIC 245), glass and glassware (SIC 322), books (SIC 373), miscellaneous petroleum and coal products (SIC 299), and textile finishing (SIC 226) are the most agglomerated industries in 1988.[8] The least agglomerated industries as measured by Gini indices include: miscellaneous plastic products (SIC 308), industrial machinery (SIC 359), metalworking machinery (SIC 354), fabricated structural metal (SIC 344), miscellaneous manufacturing (SIC 399), millwork and plywood (SIC 243), and miscellaneous fabricated metal products (SIC 349). Of the industries mentioned, three (miscellaneous plastic products, metalworking machinery, and miscellaneous fabricated metal products) display further agglomeration, three (industrial machinery, miscellaneous manufacturing, and millwork and plywood) display further deagglomeration, and one industry (fabricated structural metal products) displays no change in agglomeration.[9]

The Herfindahl Index is a measure of industrial concentration. When using this measure, we find the following to be among the most concentrated industries in 1988:: guided missile and space vehicles (SIC 376), handbags and personal leather products (SIC 317), primary nonferrous metals (SIC 333), engines and turbines (SIC 351), and ordnance and accessories (SIC 348). All five of these most concentrated industries display less concentration in 2003 than in 1988. Measured by Herfindahl indices, the

[8] National average Gini indices are calculated by averaging the state-level Gini indices.

[9] National trends in agglomeration of the twenty most agglomerated and twenty least agglomerated industries as measured by Gini indices are listed in Tables 10 and Table 11, respectively.

least concentrated industries in 1988 include hydraulic cement (SIC 324), industrial machinery (SIC 359), miscellaneous manufacturing (SIC 399), millwork and plywood (SIC 243), and commercial printing (SIC 275). All of these industries displayed further concentration in 2003, except commercial printing (SIC 275), which demonstrated a decrease in concentration.[10]

As discussed in greater detail below, , three trends are quite apparent at both the national and regional levels. First, there has been a significant drop in manufacturing employment in recent years. Second, industries displaying the most agglomeration (according to both the EGI and the Gini indices) in 1988 display decreased agglomeration in subsequent years. Third, industries displaying the least agglomeration in 1988 generally display increased agglomeration in the study's later years.

The remainder of this chapter is organized as follows. Section 2 describes a review of the literature. Section 3 discusses the data and the bridging of industries across SIC and NAICS regimes. Section 4 analyzes the trends in employment, agglomeration, and industrial concentration for 3-digit SIC manufacturing industries at the national and regional levels. This section also briefly discusses the agglomeration trends for information and communication technology (ICT)-intensive industries. Section 5 concludes.

[10] National trends in the twenty most concentrated industries and twenty least concentrated industries as measured by Herfindahl indices are reported in Tables 12 and A66, respectively.

Literature Review

Kim (1995) discusses the long-run trends in the regional specialization and localization economies for U.S. manufacturing industries from 1860 to 1987. This study compares relative regional specialization among nine census regions and reports that the degree of regional specialization in U.S. manufacturing industries increased between 1860 and World War I after a slight decline between 1860 and 1890. Kim also examines regional localization patterns for U.S. manufacturing industries for the same period for SIC 2-digit industries and reports a slight decrease in overall U.S. regional specialization.[11] His study finds that localization indices rose for eleven 2-digit industries and decreased for nine 2-digit SIC industries.[12]

The level of regional specialization reached its peak between the 1910s and 1920s and decreased significantly from then until 1987. According to Kim (1995), degree of regional specialization increased between 1880 following a modest decline between 1860

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[11] Kim (1995) uses Krugman's (1991) index of regional specialization and Hoover's (1996) index of regional localization in his analyses, which are shown in the appendix section of this paper.

[12] Industries for which localization increased over the 1860–1987 period include tobacco (SIC 21), textiles (SIC 22), apparel (SIC23), furniture, fixtures (SIC 25), petroleum and coal (SIC 29), primary metals (SIC 33). Industries for which localization indices decreased include food (SIC 20), paper (SIC 26), chemicals (SIC 28), electrical machinery (SIC 36), and instruments (SIC 38), etc.

and 1890. The level of regional concentration reached its peak between the interwar years (i.e., from 1919 to 1938) before falling continuously through 1987.

Kim (1999) also analyzes the regional comparative advantages measured by relative factor endowments for U.S. manufacturing industries from 1880 to 1987. He regresses the industrial output of twenty SIC 2-digit industries on seven measures of factor endowments over several decades and finds that the model's R^2 value diminishes as time progresses, implying the growing importance of agglomeration economies in influencing industrial productivity.[13] Besides reporting regression results, Kim (1999) also reports results regarding factor intensities using a capital-to-labor ratio and cost-of-materials-to-labor ratio. Industries such as petroleum (SIC 29), chemicals (SIC 28), and primary metals (SIC 33) are capital intensive; industries such as apparel (SIC 23), furniture (SIC 25), instruments (SIC 38), etc., are labor intensive.

Ellison and Glaeser (1997) examine the industrial localization of U.S. manufacturing industries at 4-digit SIC levels and find evidence of industry localization for natural advantage reasons and of co-agglomeration in industries with strong upstream-downstream linkages. They propose a new measure of industrial agglomeration known as the Ellison-Glaeser Index (EGI), which they contend does a better job in controlling for effects of internal economies of scale or large plant sizes. They find textile mill products (SIC 22) to be one of the most highly agglomerated industries and food and

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[13] The seven factor endowments are labor, capital, agriculture, tobacco, timber, petroleum and minerals. The regression results suggested that regional variations in productivity of manufacturing industries are significantly influenced by variations in regional factor endowments.

kindred products (SIC 20) to be one of the least agglomerated industries. Rosenthal and Strange (2001) examine the micro-determinants of agglomeration using manufacturing employment data for the year 2000. Using EGI as a measure of industrial agglomeration, they find a positive and statistically significant relationship between industrial agglomeration and the micro-determinants of agglomeration. As in Rosenthal and Strange (2001), some of the most agglomerated industries in the state-level analysis (4-digit SIC industries) include Schiffli machine embroideries (SIC 2397), the carpet industry (SIC 2273) and thread and handwork yarns (SIC 2284).

Rork (2005) explores the long-run impact of fiscal-incentive-driven economic development policy on regional industrial structure in terms of factor intensity and the skill level of workers for the Southern region of the United States. He finds that primarily labor-intensive firms did respond to such fiscal incentives. As a result, Southern states became a hub of low-skilled-labor-intensive manufacturing industries when the national trend was to move from unskilled to skilled labor.

Several papers attribute the decline in U.S. manufacturing employment to the growth in the foreign outsourcing of manufactured goods. For example, Burke et al. (2004) link U.S. manufacturing job losses to the concurrent increase in foreign outsourcing. Using national input-output data, they examine the sources of inputs of 19 major manufacturing industries for the period between 1987 and 2002. The share of foreign-sourced inputs in total manufactured inputs almost doubled between 1987 and 2002, from 12.4 percent to 22.1 percent. Similarly, Vogiatzoglou (2006) reports evidence that U.S. manufacturing was increasingly relocating to Mexico during the same period. Finally, Deitz (2004) and Deitz and Orr (2006) attribute the decline in U.S.

manufacturing employment to labor-productivity growth as a result of recent advances in ICTs and to the increase in global competition as a result of trade liberalization. In short, the combined effects of the ICT revolution and trade liberalization are contributing to the erosion of employment among U.S. manufacturing industries.[14] The resulting increase in global competitiveness forces less-competitive U.S. manufacturers to scale down their operations, move their plants to off-shore locations, or leave the industry.

The effect of foreign outsourcing on industrial agglomeration in the U.S. is ambiguous. O'Brien (1992) and Cairncross (1997) contend that increased globalization is eroding the importance of location for economic activity. In contrast, Ohmae (1995), Porter (1998), and Fujita et al. (1999) contend that globalization is in fact increasing the importance of location. These competing views warrant further examination of agglomeration trends in the U.S. manufacturing industries using more recent data.

[14] Henceforth, outsourcing as a result of trade liberalization and technological advancement will be referred to as globalization. However, these two mechanisms (i.e., trade liberalization and technological advancement) are likely to affect the micro-determinants of agglomeration differently. We explain this issue in chapter III.

Data

We calculate the agglomeration of manufacturing industries using data provided by the U.S. Bureau of Census. The period of this study spans 1988 through 2003, which necessitates the use of industry data over two different industrial classification systems: the Standard Industrial Classification System (SIC) and the North American Industrial Classification System (NAICS). The NAICS was adopted in order to give the NAFTA signatory countries (i.e., USA, Canada and Mexico) a common set of industrial codes. The NAICS replaced SIC in 1997. The SIC system initially classified U.S. manufacturing industries into twenty 2-digit "major industry groups," which were then disaggregated into 140 3-digit "industry groups." These were further disaggregated into 574 4-digit "industries." In contrast, NAICS disaggregates manufacturing industries from 2-digit to 6-digit levels.

We bridge data across SIC and NAICS regimes for comparability purposes. The U.S. Census Bureau provides a bridge table between 4-digit SIC industries and 6-digit NAICS industries, using a system of three legends that indicates the relative comparability of SIC industries and the corresponding NAICS industries. A "complete bridge" legend indicates that the corresponding SIC and NAICS industries are perfectly bridgeable. For these industries, we are able to construct a complete time series. A "slightly open drawbridge" indicates that the corresponding SIC and NAICS industries do not deviate by more than 3 percent based on sales. An "open drawbridge" indicates that the corresponding data may contain a deviation of more than 3 percent based on sales when bridged across SIC and NAICS regimes.

Due to this feature of our data, we must weigh the trade-off in calculating the agglomeration indices for the manufacturing industries. Understandably, a strong bridge sample represents a smaller portion of the entire manufacturing industry (a maximum of 76 industries out of 139 SIC 3-digit industries). But analyses of trends in agglomeration of manufacturing industries would be more representative if we included more SIC industries. From this consideration, we choose to discuss the trends in manufacturing agglomeration using both strong bridge and weak bridge samples. The weak bridge sample captures 139 SIC industries at the 3-digit level.[15]

Next we turn to a discussion of the measures of industrial agglomeration and concentration used in this analysis. In the next section we discuss the trends in employment, industrial agglomeration and concentration as measured by these indices.

[15] For the econometric analysis of the impact of globalization on micro-determinants of agglomeration, we use both the strong bridge data and the weak bridge data for robustness check purposes.

Agglomeration Measures

Following Ellison and Glaeser (1997), we use EGI as a measure of industrial agglomeration because of its ability to isolate industrial agglomeration due to the micro-determinants of agglomeration from industrial concentration due to increasing returns to scale.[16] EGI is a function of the Ellison and Glaeser's Gini Index (EGG_i) and the Herfindahl Index (HI_i) of industry i.[17] To better appreciate the construction of EGI, we briefly describe Hoover's (1936) locational Gini quotient (LQ_{im}), Gini coefficient (G_i), and Ellison and Glaeser's Gini Index (EGG_{im}), where the subscripts refer to industry i and region m.

To illustrate the construction of LQ_{im}, we propose an economy with m regions (m = 1, …, M, where S_{im} represents industry i's share of total manufacturing employment in region m, and X_m represents total manufacturing employment in region m. We define industry i's location quotient in region m to be $LQ_{im} = S_{im}/X_m$. This measure can be further illustrated by a four-quadrant figure where each quadrant represents a region. As

[16] As noted by Ellison and Glaeser (1997), many industries consist of a few large firms producing the bulk of the output in a particular industry because of increasing returns to scale; e.g., the vacuum cleaner industry (SIC 3635). About 75 percent of the workers in this industry are concentrated in only four states. But as they explain, the observed concentration of the vacuum cleaner industry is not due to external economies of scale or the micro-determinants of agglomeration; rather, it is due to internal economies of scale, which generate a heavily skewed plant-size distribution.

[17] This Gini index is also known as Ellison-Glaeser's index of raw geographical concentration.

shown in Figure B6, total manufacturing employment is uniformly distributed across the four regions (e.g., $X_1 = X_2 = X_3 = X_4 = 0.25$), but employment in industry i is distributed as follows: $S_{i1} = 0.10$, $S_{i2} = 0.20$, $S_{i3} = 0.30$, $S_{i4} = 0.40$. Using the formula given above, the location quotients are $LQ_{i1} = 0.4$, $LQ_{i2} = 0.80$, $LQ_{i3} = 1.20$, and $LQ_{i4} = 1.60$. From these quotients, it is evident that employment in industry i is more agglomerated in region 4 than in region 1 because $LQ_{i4} > LQ_{i3} > LQ_{i2} > LQ_{i1}$.[18]

Spatial concentration also can be measured using a locational Gini coefficient (G_i). Figure B7 is a graphical representation of the locational Gini coefficient. In Figure B7, we plot the shares of total manufacturing employment (X_m) by region on the horizontal axis and industry i's employment shares on the vertical axis of a 1 x 1 square. The diagonal line AB bisects the square. The area of the lower triangle ABC is equal to 0.5. The piece-wise linear curve represents the case when values of S_{im} and X_m are as given in Figure B6. The diagonal line in Figure B7 represents the case when $S_{im} = X_m = 0.25$. In Figure B7, the area of the space between the diagonal and the piece-wise linear curve is labelled θ_1; the remaining area of the lower triangle ABC is labelled θ_2. By construction, the total area of the triangle ABC indicated by θ_1 and θ_2 is 0.5. Thus, the overall locational Gini coefficient (G_i) in a given region is $G_i = \theta_1 / (\theta_1 + \theta_2) = \theta_1 / 0.5$.

[18] Gallagher (2007) has a similar four-quadrant exposition of the construction of the locational quotient (LQ_{im}) and a brief discussion of other measures of agglomeration and co-agglomeration. In this paper we discuss the construction of locational quotient (LQ_{im}) and the Ellison-Glaeser index of raw geographic concentration (EGGi) in similar fashion but using different numbers.

If $S_{im} = X_m = 0.25$—i.e., if industry i's employment shares (to be measured on the vertical axis) are equal to the shares of total manufacturing employment (measured on the horizontal axis) across the 4 regions—then plots of these shares would result in the disappearance of the piece-wise linear curve as this line will coincide with the diagonal line AB, resulting in $\theta_1 = 0$; thus, $G_i = 0$. When the shares of manufacturing employment across regions are equal but industry i's employment shares vary across the four regions as in the example in Figure B6, the piece-wise linear curve will emerge as illustrated in Figure B7. Using the ratios shown in Figure B6, we can calculate $\theta_1 = 0.163$ and $G_i = 0.163/0.50 = 0.326$. Now, suppose that industry i's employment is solely concentrated in a single region in our hypothetical four-region economy. In this case, $\theta_2 = 0$, $\theta_1 = 0.5$, and thus $G_i = 1.0$. Therefore, the locational Gini coefficient varies between 0 and 1.0, and agglomeration is increasing in G_i.

Ellison and Glaeser's Gini Index (EGG_i) is another well-known measure of industrial agglomeration, which is defined as $EGG_i \equiv \sum_{m=1}^{M} (X_m - S_{im})^2$ where, as before, X_m is region m's share of total manufacturing employment and S_{im} is industry i's share of total manufacturing employment in region m. EGG_i ranges between 0 and 1.0, and agglomeration is increasing in EGG_i. Returning to our previous example, $EGG_i = (0.25 - 0.10)^2 + (0.25 - 0.20)^2 + (0.25 - 0.30)^2 + (0.25 - 0.40)^2 = 0.05$. Due to its ease of construction this index appeals to many researchers.

The problem with this approach to measuring agglomeration is that a value of $EGG_i > 0$ does not necessarily mean that industry i is agglomerated as a result of external economies of scale. For example, suppose an industry is made up of a small number of large plants, and its industrial structure is the result of increasing returns to scale. In this

case, EGG_i will take on a large value, but it results from economies of scale rather than the micro-determinants of agglomeration.[19] To overcome this issue, Ellison and Glaeser (1997) propose the following measure of agglomeration:

$EGI_{is} = \frac{EGG_{is} - (1 - \sum X_{is}^2)H_{is}}{(1 - \sum X_{is}^2)(1 - H_{is})}$, where $H_{is} = \sum_{k=1}^{K} Z_{isk}^2$ is a Herfindahl index for the k plants of industry i in state s, and Z_{isk} represents the employment share of the *k*th plant of industry i in state s.[20] In the case of a perfectly competitive industry with a large number of small plants, H_{is} approaches zero, and EGI_{is} approaches $EGG_{is}/(1-\sum X_{is}^2)$.[21] In this case, EGI measures spatial concentration and, unlike the Ellison and Glaeser's Gini index

[19] As an example, Ellison and Glaeser (1997) refer to the situation of the U.S. vacuum cleaner industry (SIC code 3635). Roughly 75 percent of total employment in this sector is contained in one of the four largest plants, but this concentration is driven by the industry's inherent organization and not necessarily by the agglomeration forces. The EGI was developed "to facilitate comparisons across industries, across countries or over time. When plants' location decisions are made as in the model, differences in the size of the industry, the size and distribution of plants, or the fineness of the geographic data that are available should not affect the index" (Ellison & Glaeser, 1997, p. 890).

[20] Rosenthal and Strange (2001), Bertinelli and Decrop (2005) and many other researchers have utilized this measure of agglomeration known as Ellison-Glaeser Index (EGI). The Herfindahl index is calculated for the plant size distribution of each industry using the county business pattern data.

[21] We calculate Herfindahl index using the median employment for different plant size levels for each industry and year covered in the study.

(EGG_{is}), is independent of industrial organization due to internal economies of scale.[22] According to this measure, EGI_{is} takes on a value of zero when industry i is not concentrated in some region(s) but is uniformly distributed as might result of a random location process. EGI_{is} takes on a positive value when industry i is concentrated in some region(s). In short, we use EGI because this measure of industrial agglomeration controls for industry-specific agglomeration due to internal economies of scale and thus provides a better measure of industrial agglomeration due to external economies of scale related to the micro-determinants of agglomeration, natural advantage, transportation costs, and other external factors.[23]

We measure agglomeration for all the 3-digit SIC manufacturing industries using two measures—Ellison-Glaeser index (EGI) and Ellison and Glaeser's Gini index (EGG_i). We also measure the market concentration of these industries using the Herfindahl index (HI). We trends in industrial agglomeration and in industrial concentration for the U.S. and for nine U.S. census divisions using these three measures.

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[22] Innovative use of the Herfindahl index in constructing EGI controls for the influence of skewed plant-size distribution on the measurement of relative density of agglomeration.

[23] One drawback of the Ellison-Glaeser index is the difficulty in interpreting the values. For example, an agglomeration index of 0.20 does not have an obvious meaning, except for comparison purposes. However, the advantages of this measure seem to outweigh its drawbacks, particularly in the current context. We also use the Gini index as a measure of agglomeration because this traditional measure is simpler, with its value ranging between 0 and 1. The value of EGI can be either positive or negative, indicating agglomeration or deagglomeration, respectively.

Figure B9 provides a list of these census divisions and regions, including a list of U.S. states that belong to these divisions..

Now we proceed with discussing national and regional employment trends in the manufacturing industries for the period 1988-2003.

Trends in Employment, Agglomeration, and Industrial Concentration

Trends in Employment in the Manufacturing Industries

National Trends

Manufacturing employment in the U.S. has been decreasing in recent years. Table A1 presents state- and national-level aggregate manufacturing employment for the years 1988, 1993, 1998, and 2003. Column 6 of Table A1 shows the change in employment in 2003 as a share of 1988's employment level. We see that manufacturing employment in the U.S. decreased from 19.3 million in 1988 to 14.1 million in 2003 (a decrease of 27 percent), which means about five million manufacturing jobs disappeared in the U.S. during this sixteen year period. Table A1 also shows the state-level change in employment over time. We see in column 6 of Table A1 that, out of the fifty U.S. states, forty-two states experienced attrition in manufacturing employment between 1988 and 2003; whereas eight states gained manufacturing employment during this period.

Table A2 presents a list of ten states that lost the most manufacturing employment in 2003 as a percent share of that in 1988. The five that lost the most were New Jersey (decreased by 51 percent), New York (decreased by 51 percent), Connecticut (decreased by 48 percent), Massachusetts (decreased by 47 percent), and Rhode Island (decreased by 47 percent). Table A3 presents the change in employment in nine U.S. census divisions

between 1988 and 2003. All the census divisions lost manufacturing employment in 2003 as compared to their 1988 levels. The five census divisions with the highest loss in manufacturing employment in 2003 as a percent share of the 1988 employment level were the Middle Atlantic (45 percent decrease), New England (44 percent decrease), the South Atlantic and Pacific (28 percent decreased each), and the East North Central (23 percent decrease).

Table A4 presents twenty 3-digit SIC industries with the highest manufacturing employment numbers in 1988. The ten highest industries in the table were motor vehicles and equipment, miscellaneous plastic products, aircraft and parts, commercial printing, electronic components, newspapers, fabricated structural metal, search and navigation equipment, meat products, and women's and juniors' outerwear. Column 7 of Table A4 presents the change in employment in 2003 as a percent share of the 1988 employment level, which decreased in all but one industry listed in this table. The only industry that gained employment between 1988 and 2003 was miscellaneous plastic products, with a 12 percent increase. The five industries that lost the most in 2003 as a percent share of 1988 employment were men's and boys' furnishings (74 percent), women's and juniors' outerwear (66 percent), aircraft and parts (50 percent), computer and office equipment (44 percent) and metalworking machinery (37 percent). From this table it is evident that textile mill products, industrial machinery and equipment, and transportation equipment were among the industries hit hardest with the massive attrition of manufacturing employment in 2003 as a percent share of 1988's employment level.

Table A5 ranks twenty 3-digit SIC industries with the highest job attrition rates in 2003 as a percent share of their 1988 levels. The ten highest decreases in employment

between 1988 and 2003 were observed in the following 3-digit SIC industries: printing and trade services (89 percent); watches, clocks, watchcases (80 percent); footwear (79 percent) women's and children's garments (78 percent); rubber and plastic footwear (76 percent); blankbooks and bookbinding (75 percent); men's and boy's furnishings (74 percent); ordnance and accessories (70 percent); leather goods and mittens (70 percent); and guided missiles (70 percent).

Now let us examine to which the broader 2-digit SIC industries belong. From the list of twenty 3-digit industries shown in Table 4, 4 comprise textile mill products (SIC 23), 3 comprise apparel and other textile products (SIC 22), 3 comprise leather and leather products (SIC 31), 3 comprise instruments and related products (SIC 38), 2 comprise printing and publishing (SIC 27), 1 comprises tobacco products (SIC 21), 1 comprises rubber and miscellaneous plastic products (SIC 30), another comprises fabricated metal products (SIC 34), another comprises transportation equipment (SIC 37), and yet another comprises miscellaneous manufacturing (SIC 39). Out of the 20 3-digit SIC industries listed in this table, 7 belong to textile mill products, apparel, and other textiles (SIC 22 and SIC 23)—illustrating that textile-mill-products-manufacturing industries demonstrated the most attrition in manufacturing jobs. Another hard-hit sector was leather and leather products, as 3 3-digit SIC industries belong to this 2-digit category.

Table A6 presents a list of 20 3-digit SIC industries that experienced the highest increases in manufacturing employment in 2003 as a percent share of manufacturing employment in 1988. The industries with the 10 highest employment increases between 1988 and 2003 were cigars (167 percent); chewing and smoking tobaccos (165 percent);

engines and turbines (139 percent); miscellaneous transportation (114 percent); public building and related furniture (103 percent); motorcycles, bicycles, and parts (almost 100 percent); cut stone and stone products (88 percent); fats and oils (77 percent); ordnance and accessories (74 percent); and drugs (44 percent).

Regional Trends

Division 1: New England

Table A7 presents the top 10 3-digit SIC industries in the New England division as ranked by manufacturing employment numbers in 1988. This table also presents the employment trends for these 10 industries in 5-year intervals through 2003 and reports the changes in employment in 2003 as percent shares of their 1988 levels. These 10 industries are aircraft and parts (84 percent), electronic components (69 percent), computer and office equipment (93 percent), miscellaneous plastic products (75 percent), measuring and controlling devices (70 percent), commercial printing (40 percent), metalworking machinery (80 percent), special industry machinery (76 percent), fabricated structural metal products (71 percent), and medical equipment (5 percent). In 2003, each of these industries experienced a decrease in employment from their 1988 levels. Out of the 10 industries listed in Table A7, 3 belong to industrial machinery and equipment (SIC 35), 2 to instruments and related materials (SIC 38), and the remaining 5 belong to 5 2-digit SIC industries.[24]

Table A8 lists the lowest 10 3-digit SIC industries in New England as ranked by manufacturing employment levels in 1988 as compared to their employment levels in

[24] Table 2 in the appendix section contains the list of all 2-digit SIC industries related to manufacturing.

successive 5-year intervals up through 2003. The table also reports the changes in employment in 2003 as percent shares of their 1988 levels. These 10 industries are miscellaneous primary metal products; industrial inorganic chemicals; women's and children's underwear; sugar and confectionary; hose, belting, and gaskets; children's outerwear partitions and fixtures; meat products; ship and boat building; and printing trade services. All of these industries lost manufacturing employment in 2003 in relation to their 1988 levels. Out of these, 2 belong to food and kindred products (SIC 20), 2 to primary metal products (SIC 33), and the remaining 6 to 6 2-digit SIC industries.

Division 2: Middle Atlantic

Table A9 presents the top 10 3-digit SIC industries in the Middle Atlantic division as categorized by manufacturing employment numbers in 1988 as well as the employment trends for these industries in 5-year intervals up through 2003. It also reports the changes in employment in 2003 as percent shares of the industries' 1988 levels: women's and juniors' outerwear, commercial printing, electronic components, miscellaneous plastic products, fabricated structural metal products, drugs, blast furnaces and basic steel, motor vehicles and equipment, measuring equipment, and miscellaneous paper products. All 10 of the 3-digit SIC industries demonstrating decreases in employment (ranging between 33 percent and 99 percent) in 2003 relative to their 1988 levels belong to 10 2-digit SIC industries, which reflects the region's manufacturing diversity.

Table A10 displays the 10 lowest 3-digit SIC industries in the Middle Atlantic according to manufacturing employment levels in 1988 versus their levels in successive five-year intervals through 2003. This table also reports the changes in employment in

2003 for the following industries as percent shares of their 1988 employment levels: miscellaneous petroleum and coal; hydraulic cement; hose, belting, and gaskets; yarn and thread mills; asphalt paving and roofing; miscellaneous transportation equipment; handbags and personal leather products; costume jewelry and notions; textile finishing; and household audio and video equipment. These 10 industries demonstrated decreases in employment, ranging from 51 percent to 98 percent, between 1988 and 2003. Two of the 10 3-digit SIC industries belong to textile mill products (SIC 22), another 2 to petroleum and coal products (SIC 29), and the remaining 6 to 2-digit SIC industries. In this division we again see that the textile mill products sector was one of the hardest hit industries in terms of manufacturing job attrition.

Division 3: East North Central

Table A11 presents the 10 highest 3-digit SIC industries in the East North Central division according to 1988 manufacturing employment numbers. This table also presents the employment trends for these industries in 5-year intervals up through 2003 and reports the changes in employment in 2003 as percent shares of their 1988 levels. These industries are motor vehicles and equipment, miscellaneous plastic products, metal forgings and stampings, partitions and fixtures, commercial printing, blast furnace and basic steel, industrial machinery, general industrial machinery, fabricated structural metal, and miscellaneous fabricated metal. Each of these industries demonstrated decreases in manufacturing employment, ranging from 33 percent to 87 percent, between 1988 and 2003. Three of these 3-digit SIC industries belong to fabricated metal (SIC 34), another 3 to industrial machinery and equipment (SIC 35), and the remaining 4 belong to 2-digit SIC manufacturing industries.

Table A12 lists the lowest 10 3-digit SIC industries ranked by manufacturing employment in 1988 and their employment levels in five-year intervals up through 2003 in East North Central Division. This table also reports the changes in employment in 2003 as percent shares of these industries' 1988 levels: costume jewelry and notions, textile finishing, jewelry and silverware, miscellaneous petroleum products, miscellaneous apparel and accessories, asphalt paving materials, structural clay products, public building furniture, women's and juniors' outerwear, and photographic equipment. Decreases in employment ranged from 71 percent to 99 percent between 1988 and 2003. Two of these industries belong to apparel and other textile mill products (SIC 23), another 2 to petroleum and coal products, yet another 2 to miscellaneous manufacturing (SIC 39). The remaining 4 belong to other 2-digit SIC manufacturing industries.

Division 4: West North Central

Table A13 displays the 10 highest 3-digit SIC industries in the West North Central division according to manufacturing employment in 1988. This table also presents the employment trends for these 10 industries in five-year intervals through 2003 and reports the changes in employment in 2003 as percent shares of their 1988 employment levels. These industries are meat products, motor vehicles, commercial printing, aircraft and parts, miscellaneous plastic products, computer and office, fabricated structural metal, industrial machinery, construction machinery, and electronic components. The decreases in employment ranged from 26 percent to 99 percent between 1988 and 2003. Three of these industries belong to industrial machinery and equipment (SIC 35), 2 to transportation equipment, and the remaining 5 3-digit SIC industries belong to other 2-digit SIC industries.

Table A14 presents the lowest 10 3-digit SIC industries in the West North Central division based on 1988 manufacturing employment numbers. This table also presents the employment ratings for these industries in five-year intervals through 2003 and reports the 2003 changes in employment as percent shares of their 1988 levels. These industries are miscellaneous manufacturing products; plumbing and heating; hoses, belting, and gaskets; screw machine products; fabricated rubber products; miscellaneous nonmetallic minerals; ship and boat building; paperboard containers; partitions and fixtures; and books. Nine of the 10 industries displayed decreases in employment (ranging from 6 percent to 99 percent) between 1988 and 2003, except the screw machine products industry, for which employment increased by 27 percent. Two of these 3-digit SIC industries belong to rubber and miscellaneous plastic products (SIC 30), 2 to fabricated metal products (SIC 34), and the remaining 6 to separate 2-digit SIC industries.

Division 5: South Atlantic

Table A15 displays the 10 highest 3-digit SIC industries in the South Atlantic division ranked by manufacturing employment in 1988. This table also presents the employment trends for these industries in five-year intervals through 2003 and lists the changes in employment in 2003 as percent shares of their 1988 employment levels. These industries are knitting mills, household furniture, yarn and thread mills, commercial printing, men's and boys' furnishings, meat products, miscellaneous plastic products, women's and juniors' outerwear, fabricated structural metal products, and motor vehicles and equipment . These industries' decreases in employment ranged from 35 percent to almost 100 percent between 1988 and 2003. Two of these 3-digit SIC industries belong to

textile mill products (SIC 22), 2 to apparel and other textile products (SIC 23), and the remaining 6 industries belong to 2-digit SIC industries.

Table A16 presents the lowest 10 3-digit SIC industries in the South Atlantic division according to manufacturing employment levels in 1988. This table also presents employment numbers for these industries in five-year intervals through 2003 and reports the 2003 employment changes as percent shares of their 1988. These industries are miscellaneous primary metal products; jewelry, silverware, and plated ware; household audio and video; pens, pencils and office supplies; costume jewelry and notions; miscellaneous transportation equipment; asphalt paving and roofing; metal services; miscellaneous apparel and accessories; and printing trade services. All of the industries displayed employment decreases, ranging from 69 percent to 99 percent, between 1988 and 2003. Three of these industries belong to miscellaneous manufacturing (SIC 39); the remaining 7 3-digit SIC industries belong to different 2-digit SIC industries.

Division 6: East South Central

Table A17 displays the highest 10 3-digit SIC industries in the East South Central division based on manufacturing employment in 1988. This table also presents the employment trends for these industries in five-year intervals through 2003 and reports the changes in employment in 2003 as percent shares of their 1988 employment levels. These industries are motor vehicles and equipment, household furniture, women's and juniors' outerwear, miscellaneous plastic products, fabricated structural metal, sawmills and planing mills, commercial printing, knitting mills, miscellaneous fabricated metal products, and plastics and synthetic materials. Employment decreases in these industries ranged from 52 percent to almost 100 percent between 1988 and 2003. Two of the

industries belong to fabricated metal products (SIC 34); the remaining 8 3-digit SIC industries belong to 8 2-digit SIC industries.

Table A18 presents the lowest 10 3-digit SIC industries in the East South Central division as ranked by manufacturing employment in 1988. This table also presents the employment for these industries in five-year intervals through 2003 and reports the changes in employment in 2003 as percent shares of their 1988 employment levels: screw machine products; blankbooks and bookbinding; printing and fixtures; soap, cleaners, and toiletries; miscellaneous nonmetallic mineral products; metal services; miscellaneous furniture and fixtures; special industry machinery; and miscellaneous textile goods. These industries had decreases in employment (ranging from 78 percent to 99 percent) between 1988 and 2003. Two of these industries belong to furniture and fixtures (SIC 25), 2 others belong to printing and publishing (SIC 27), and yet another 2industries belong to fabricated metal products (SIC 34). The remaining 4 3-digit SIC industries belong to separate 2-digit SIC industries.

Division 7: West South Central

Table A19 displays the 10 highest 3-digit SIC industries in the West South Central division according to 1988 manufacturing employment levels. This table also presents the employment trends for these industries in 5-year intervals through 2003 and reports the changes in employment in 2003 as percent shares of their 1988 levels: aircrafts and parts, meat products, fabricated structural metal, electronic components, industrial organic chemicals, miscellaneous plastic products, construction machinery, commercial machinery, commercial printing, men's and boys' furnishings, and miscellaneous fabricated metal. All of these industries displayed decreases in

employment, ranging from 27 percent to 99 percent, between 1988 and 2003. Two of these industries belong to fabricated metal products (SIC 34) and the remaining 8 to 2-digit SIC industries.

Table A20 presents the 10 lowest 3-digit SIC industries in the West South Central division as ranked by manufacturing employment in 1988. This table also presents employment numbers for these industries in 5-year intervals through 2003 and reports employment changes in 2003 as percent shares of their 1988 levels. These industries are pens, pencils, and office supplies; medical instruments; miscellaneous primary metal products; hydraulic cement; miscellaneous furniture and fixtures; household audio and video; screw machine products; miscellaneous apparel and accessories; jewelry and silverware; and plumbing and heating equipment. Employment decreased in 6 of these industries (ranging from 50 percent to 99 percent) between 1988 and 2003. Four of these industries displayed increases in employment, ranging from 4 percent to 580 percent, between 1988 and 2003. Two of these industries belong to fabricated metal products (SIC 34), another 2 to miscellaneous manufacturing industries (SIC 39), and the remaining 6 to 2-digit SIC industries.

Division 8: Mountain

Table A21 displays the 10 highest 3-digit SIC industries in the Mountain division based on manufacturing employment levels in 1988. This table also presents the employment trends for these industries in 5-year intervals through 2003 and shows changes in employment in 2003 as percent shares of their 1988 employment levels. These industries are electronic components, computer and office equipment, commercial

printing, fabricated structural metal, measuring and controlling equipment, millwork and plywood, sawmills and planing mills, medical instruments, meat products, and industrial machinery. All of these industries displayed attrition in employment, ranging from 26 percent to 97 percent, between 1988 and 2003. Two of these industries belong to lumber and wood products, 2 to printing and publishing (SIC 27), and the remaining 6 to 2-digit SIC industries.

Table A22 presents the 10 lowest 3-digit SIC industries in the Mountain division as ranked by manufacturing employment in 1988. This table also conveys the employment for these industries in 5-year intervals through 2003 and shows 2003 employment changes as percent shares of the 1988 levels: blast furnace and basic steel products, glass and glassware, miscellaneous apparel and accessories, household audio and video products, electric lighting and wiring, costume jewelry and notions, pottery and related products, sugar and confectionary, screw machine products and bolts, and soaps, cleaners, and toilet goods. These industries lost employment (ranging from 50 percent to 93 percent) between 1988 and 2003. Two of these industries belong to stone, clay, and glass products (SIC 32), another 2 to electronic and other electrical equipment (SIC 36), and the remaining 6 to 2-digit SIC industries.

Division 9: Pacific

Table A23 exhibits the 10 highest 3-digit SIC industries in the Pacific division based on manufacturing employment in 1988. This table also presents the employment trends for these industries in 5-year intervals through 2003 and reports 2003 employment changes as percent shares of their 1988 employment levels. These industries are electronic components, aircraft and parts, computer and office equipment, miscellaneous

plastic products, women's and juniors' outerwear, commercial printing, measuring and controlling devices, millwork and plywood, industrial machinery, and fabricated structural metal products. All of these industries demonstrated reductions in employment, ranging from 18 percent to 80 percent, between 1988 and 2003. Two of these industries belong to industrial machinery and equipment (SIC 35) and the remaining 8 to 2-digit SIC industries.

Table A24 presents the 10 lowest 3-digit SIC industries in the Pacific division by manufacturing employment levels in 1988. This table also reports employment numbers for these industries in five-year intervals through 2003 and shows 2003 employment changes as percent shares of 1988 levels: handbags and personal leather products, textile finishing, costume jewelry and notions, hydraulic cements, structural clay products, agricultural chemicals, industrial inorganic chemicals, plastic and synthetic materials, miscellaneous primary metal products, and hose, belting, and gaskets. Eight of these industries displayed decreases in employment (ranging from 22 percent to 86 percent) between 1988 and 2003. Two of the industries (textile finishing and hose, belting, and gaskets) experienced employment gains, ranging from 1 percent to 70 percent, between 1988 and 2003. Out of these 10 industries, 3 belong to chemicals and allied products (SIC 28), 2 to stone, clay, and glass products (SIC 32), and the remaining 5 to 2-digit SIC industries.

Conclusion

The most obvious trend in manufacturing employment is its attrition across industries and regions. Industries where this attrition occurred most often include textile, apparel, and allied industries; printing and publishing; leather and leather products;

instruments and related products; fabricated metal products; and miscellaneous manufacturing goods, etc. Now we will discuss national and regional agglomeration trends as measured by in EGI.

Agglomeration Trends Measured by EGI

National Trends

Table A25 displays the 20 most agglomerated 3-digit SIC industries in the U.S. by EGI rankings in 1988. This table also conveys agglomeration trends for these industries in 5-year intervals through 2003 and gives 2003 changes in EGIs as percent shares of their 1988 agglomeration levels. Out of these industries, the 10 most agglomerated are aircraft and parts, glass and glassware, structural clay products, industrial organic chemicals, miscellaneous furniture and fixtures, ship and boat building, miscellaneous primary metal products, iron and steel foundries, sugar and confectionary products, and metal cans. All 20 of the industries listed in Table A25 experienced decreases in agglomeration, ranging from 6 percent to 246 percent, between 1988 and 2003. Of these industries, 3 belong to primary metal industries (SIC 33), 2 to furniture and fixtures (SIC 25), 2 to chemical and allied products (SIC 28), 2 to transportation equipment (SIC 37), 2 to stone, clay, and glass products, and the remaining 9 to 2-digit SIC industries.

Table A26 displays the 20 least agglomerated 3-digit SIC industries in the U.S. by 1988 EGI rankings. This table also presents agglomeration trends for these industries in 5-year increments through 2003 and reports 2003 changes in EGIs as percent shares of their 1988 agglomeration levels. Of these industries, the 10 most agglomerated are primary nonferrous metal; hydraulic cement; miscellaneous plastic products; fabricated

structural metal products; bakery products; metalworking machinery; paperboard containers and boxes; industrial machinery; soaps, cleaners, and toilet goods; and miscellaneous manufacturing. Thirteen of the 20 industries listed in Table A26 exhibited agglomeration losses, ranging from 2 percent to 219 percent, between 1988 and 2003. Seven of the 20 industries exhibited increases in agglomeration, ranging from 11 percent to 468 percent, between 1988 and 2003. Of the 20, 4 industries belong to primary metal industries (SIC 34), 4 to industrial machinery and equipment (SIC 35), 2 to miscellaneous manufacturing products (SIC 39), and the remaining 10 to 2-digit SIC industries.

Now we will discuss the regional trends in agglomeration measured by EGIs.

Regional Trends

Division 1: New England

Table A27 displays the 10 most agglomerated 3-digit SIC industries in the New England division according to 1988 EGIs. This table also conveys the agglomeration trends for these industries in 5-year intervals through 2003 and reports the changes in EGIs in 2003 as percent shares of their 1988 agglomeration levels. These industries are miscellaneous chemical products; blankbooks and bookbinding; women's and kids' underwear; miscellaneous primary metal products; books; hose, belting, and gaskets; aircraft and parts; nonferrous rolling and drawing; commercial printing; and costume jewelry and notions. All of these industries demonstrated reductions in agglomeration ranging from 73 percent to 132 percent between 1988 and 2003. Three of these industries belong to printing and publishing (SIC 27), two to primary metal products (SIC 33), and the remaining five to 2-digit SIC industries.

Table A28 presents the 10 least agglomerated 3-digit SIC industries in the New England division as ranked by manufacturing employment in 1988. This table also reports agglomeration trends for these 10 industries in 5-year intervals through 2003 and reports the changes in EGIs in 2003 as percent shares of their 1988 agglomeration levels: electronic components, general industrial machinery, metal services, miscellaneous nonmetallic mineral, medical instruments, paperboard containers, meat products, fabricated structural metal, miscellaneous fabricated metal, and metalworking machinery. Six of these industries exhibited decreases in agglomeration, ranging from 31 percent to 407 percent, between 1988 and 2003. Four industries demonstrated increases in agglomeration, ranging from 3 percent to 1,234 percent, between 1988 and 2003. Five of the 10 belong to fabricated metal products (SIC 34) and industrial machinery and equipment (SIC 35). The remaining five belong to 2-digit SIC industries.

Division 2: Middle Atlantic

Table A29 shows the 10 most agglomerated 3-digit SIC industries in the Middle Atlantic division ranked by 1988 EGIs. This table also reports agglomeration trends for these 10 industries in 5-year increments through 2003 and gives changes in EGIs in 2003 as percent shares of their 1988 agglomeration levels. These industries are glass and glassware, pottery and related products, plumbing and heating products, nonferrous rolling and drawing, miscellaneous petroleum and coal products, beverages, office furniture, aircraft and parts, wood buildings and mobile homes, and asphalt, paving, and roofing materials. All of these industries' agglomeration levels reduced between 24 percent and 111 percent during the period from 1988 through 2003. Two of these

industries belong to petroleum and coal products (SIC 29), 2 to store, clay, and glass products (SIC 32), and the remaining 6 to 2-digit SIC industries.

Table A30 presents the 10 least agglomerated 3-digit SIC industries in the Middle Atlantic division ranked by 1988 manufacturing employment numbers. This table also shows agglomeration trends for these industries in 5-year intervals through 2003 and reports 2003 changes in EGIs as percent shares of their 1988 agglomeration levels. These industries are miscellaneous plastic products, paperboard containers, fabricated structural metal products, miscellaneous fabricated metal products, miscellaneous manufacturing, hydraulic cement, metalworking machinery, metal services, miscellaneous chemical products, and industrial machinery. Five of these industries exhibited decreases in agglomeration, ranging from 18 percent to 237 percent, between 1988 and 2003. Five other industries demonstrated increases in agglomeration, ranging from 21 percent to 874 percent, between 1988 and 2003. Three of these 10 industries belong to fabricated metal products (SIC 34), 2 to industrial machinery and equipment (SIC 35), and the remaining 5 to 2-digit SIC industries.

Division 3: East North Central

Table A31 displays the 10 most agglomerated 3-digit SIC industries in the East North Central division according to 1988 EGI rankings. This table also conveys agglomeration trends for these industries in 5-year increments through 2003 and reports changes in EGIs in 2003 as percent shares of their 1988 agglomeration levels. These industries are wood building and mobile homes; pottery and related products; ship and boat building; books; aircraft and parts; plastic and synthetic materials; miscellaneous primary metal products; hose, belting, and gaskets; miscellaneous furniture and fixtures;

and miscellaneous transportation equipment. All but one of these industries demonstrated decreases in agglomeration, ranging from 14 percent to 143 percent, between 1988 and 2003. The only industry whose agglomeration increased, by 19 percent, between 1988 and 2003 was the plastic and synthetic materials industry (SIC 282). Three out of the 10 industries belong to transportation equipment (SIC 37) and the remaining 7 to 2-digit SIC industries.

Table A32 presents the 10 least agglomerated 3-digit SIC industries in the East North Central division as ranked by manufacturing employment in 1988. This table also gives agglomeration trends for these industries in 5-year intervals through 2003 and reports the changes in EGIs in 2003 as percent shares of their 1988 agglomeration levels. These industries are industrial machinery, metalworking machinery, miscellaneous fabricated metal, drugs, fabricated structural metal, metal services, metal forgings and stampings, general industrial machinery, miscellaneous manufacturing, and bakery products. Seven of the 10 industries exhibited decreases in agglomeration between 1988 and 2003, ranging from 2 percent to 7,866 percent, while 3 others showed increases, ranging from 27 percent to 626 percent. Four of these 10 industries belong to fabricated metal products (SIC 34), 3 to industrial machinery and equipment (SIC 35), and the remaining 3 to 2-digit SIC industries. It is apparent that the fabricated metal– and industrial machinery–related industries dominate the list of the least agglomerated industries in this division.

Division 4: West North Central

Table A33 lists the 10 most agglomerated 3-digit SIC industries in the West North Central division according to 1988 EGI rankings. This table also presents the

agglomeration trends for these industries in 5-year increments through 2003 and reports the changes in 2003 EGIs as percent shares of their 1988 agglomeration levels: ship and boat building, partitions and fixtures, meat products, nonferrous foundries, household furniture, miscellaneous nonmetallic minerals, miscellaneous primary metal products, pharmaceuticals/prescription drugs, measuring and controlling devices, and computer and office equipment. Each of these industries lost agglomeration, ranging from 10 percent to 285 percent, between 1988 and 2003. Two of the industries belong to furniture and fixtures (SIC 25), 2 to primary metal products (SIC 33), and the remaining 6 to 2-digit SIC industries.

Table A34 reports the 10 least agglomerated 3-digit SIC industries in the West North Central division ranked by manufacturing employment in 1988. This table also presents the agglomeration trends for these industries in 5-year intervals through 2003 and gives 2003 changes in EGIs as percent shares of 1988 agglomeration levels. These industries are metal services; miscellaneous chemical products; screw machine products; miscellaneous electrical equipment; miscellaneous plastic products; miscellaneous manufacturing; cutlery, hand tools, and hardware; industrial machinery; medical instruments; and metal forgings and stampings. Six of the 10 industries demonstrated increases in agglomeration between 1988 and 2003, ranging from 122 percent to 3,587 percent, while 4 of the 10 had decreases, ranging from 12 percent to 170 percent. Four of the 10 least agglomerated industries belong to fabricated metal products (SIC 34) and the remaining 6 to 2-digit SIC industries.

Division 5: South Atlantic

Table A35 displays the 10 most agglomerated 3-digit SIC industries in the South Atlantic division ranked by EGIs in 1988. This table also presents agglomeration trends for these industries in 5-year intervals through 2003 and conveys changes in EGIs in 2003 as percent shares of their 1988 agglomeration levels. These industries are meat products; asphalt, paving, and roofing; fabricated rubber products; sugar and confectionary; costume jewelry and notions; industrial organic chemicals; sawmills and planing mills; grain mill products; preserved fruits and vegetables; and office furniture. All but one of these industries showed decreases in agglomeration, ranging from percent to 106 percent, between 1988 and 2003. The only industry whose agglomeration increased (by 12 percent) was preserved fruits and vegetables (SIC 203). Three of the 10 industries belong to food and kindred products (SIC 20) and the remaining 7 to 2-digit SIC industries.

Table A36 gives the 10 least agglomerated 3-digit SIC industries in the South Atlantic division according to 1988 manufacturing employment levels. This table also presents agglomeration trends for these industries in 5-year increments through 2003 and reports the changes in EGIs in 2003 as percent shares of their 1988 agglomeration levels. These industries are bakery products; industrial machinery; pens, pencils, and office supplies; fabricated structural metal products; miscellaneous plastic products; special industry machinery; printing trade services; yarn and thread mills; sawmills and planing mills; and miscellaneous fabricated textile products. Six of these industries had increased agglomeration, ranging from 86 percent to 5,140 percent, between 1988 and 2003. Four of the industries displayed decreased agglomeration, ranging from 26 percent to 1,824

percent, between 1988 and 2003. Two of the 10 industries belong to industrial machinery and equipment (SIC 35) and the remaining 8 belong to 2-digit SIC industries.

Division 6: East South Central

Table A37 lists the 10 most agglomerated 3-digit SIC industries in the East South Central division as ranked by EGIs in 1988. This table also reports agglomeration trends for these 10 industries in 5-year intervals through 2003 and gives changes in 2003 EGIs as percent shares of their 1988 agglomeration levels. These industries are women's and juniors' outerwear, partitions and fixtures, miscellaneous furniture and fixtures, construction machinery, industrial organic chemicals, metal forgings and stampings, knitting mills, grain mill products, ship and boat building and repairing, and plastic and synthetic materials. All but one of the 10 industries demonstrated decreases in agglomeration, ranging from 22 percent to 137 percent, between 1988 and 2003. The only industry gained in agglomeration was knitting mills (SIC 225). Agglomeration increased in this industry by 6 percent between 1988 and 2003. Two of the 10 most agglomerated industries in the division belong to furniture and fixtures (SIC 25), 2 to chemicals and allied products (SIC 28), and the remaining 6 to 2-digit SIC industries.

Table A38 shows the least agglomerated 3-digit SIC industries in the East South Central division as ranked by manufacturing employment in 1988. This table also presents agglomeration trends for these industries in 5-year increments through 2003 and reports the changes in 2003 EGIs as percent shares of their 1988 agglomeration levels: sawmills and planing mills, industrial machinery, metalworking machinery, wood buildings and mobile homes, miscellaneous plastic products, fabricated structural metal, miscellaneous manufacturing, medical instruments, household furniture, and

miscellaneous chemical products. Six of these industries had decreases in agglomeration, ranging from 35 percent to 764 percent, between 1988 and 2003. Four of the industries demonstrated increases in agglomeration, ranging from 11 percent to 1,324 percent, between 1988 and 2003. Two of the 10 least agglomerated industries in this division belong to lumber and wood products (SIC 24), 2 to industrial machinery and equipment (SIC 35), and the remaining 6 to 2-digit SIC industries.

Division 7: West South Central

Table A39 displays the 10 most agglomerated 3-digit SIC industries in the West South Central division ranked by EGIs in 1988. This table also presents the agglomeration trends for these 10 industries in 5-year intervals through 2003 and reports the changes in EGIs in 2003 as percent shares of their 1988 agglomeration levels. These industries are men's and boys' furnishings, sugar and confectionary, miscellaneous primary metal products, plastic and synthetic materials, books, men's and boys' suits and coats, meat products, motor vehicles and equipment, industrial inorganic chemicals, and miscellaneous furniture and fixtures. All of the industries demonstrated decreased agglomeration, ranging from 8 percent to 108 percent, between 1988 and 2003. Two of the industries belong to food and kindred products (SIC 20), 2 to chemicals and allied products (SIC 28), and 2 to primary metal products (SIC 33). The remaining 4 to 2-digit SIC industries.

Table A40 ranks the 10 least agglomerated 3-digit SIC industries in the West South Central division according to manufacturing employment in 1988. This table also conveys agglomeration trends for these industries in five-year increments through 2003 and reports changes in 2003 EGIs as percent shares of their 1988 agglomeration levels:

drugs, beverages, medical instruments, hydraulic cements, miscellaneous foods and kindred products, sawmills and planing mills, miscellaneous furniture and fixtures, general industrial machinery, miscellaneous electrical equipment, and partitions and fixtures. All but one of these industries demonstrated increases in agglomeration, ranging from 21 percent to 5,560 percent, between 1988 and 2003. The only industry that experienced a decrease in agglomeration between 1988 and 2003 was industrial machinery (SIC 359), by 167 percent. Two of these 10 least agglomerated industries belong to food and kindred products (SIC 20), 2 to industrial machinery and equipment industry (SIC 35), and the remaining 6 to 2-digit SIC industries.

Division 8: Mountain

Table A41 reports the 10 most agglomerated 3-digit SIC industries in the Mountain division as ranked by 1988 EGIs. This table also presents agglomeration trends for these industries in 5-year increments through 2003 and gives the changes in 2003 EGIs as percent shares of their 1988 agglomeration levels: sawmills and planing mills, medical instruments and supplies, partitions and fixtures, women's and juniors' outerwear, construction machinery, jewelry, silverware and plated ware, measuring and controlling devices, books, grain mill products, and meat products. Eight of these industries demonstrated decreases in agglomeration, ranging from 27 percent to 139 percent, between 1988 and 2003, while 2 had increases in agglomeration, ranging from 47 percent to 80 percent. Two industries from the in this division belong to food and kindred products (SIC 20), 2 to instruments and related products (SIC 38), and the remaining 6 to 2-digit SIC industries.

Table A42 presents the 10 least agglomerated 3-digit SIC industries in the Mountain division according to manufacturing employment in 1988. This table also shows agglomeration trends for these industries in 5-year intervals through 2003 and reports changes in 2003 EGIs as percent shares of their 1988 agglomeration levels. These industries are soaps, cleaners, and toilet goods; pottery and related products; screw machine products and bolts; books; miscellaneous electrical equipment; miscellaneous plastic products; miscellaneous apparel and accessories; wood buildings and mobile homes; miscellaneous food and kindred products; and miscellaneous converted paper products. Six of these industries demonstrated increases in agglomeration between 1988 and 2003, ranging from 89 percent to 1,200 percent, while 4 had decreases, ranging from 93 percent to 1,537 percent. All 10 of these 3-digit SIC industries belong to 2-digit SIC industries.

Division 9: Pacific

Table A43 displays the 10 most agglomerated 3-digit SIC industries in the Pacific division according to 1988 EGIs. This table also exhibits agglomeration trends for these industries in 5-year intervals through 2003 and reports 2003 changes in EGIs as percent shares of their 1988 agglomeration levels. These industries are wood building and mobile homes, industrial organic chemicals, industrial inorganic chemicals, sugar and confectionery, miscellaneous furniture and fixtures, metal cans and shipping, structural clay products, iron and steel foundries, blankbooks and bookbinding, and meat products. All but one of these industries demonstrated decreases in agglomeration, ranging from 56 percent to 92 percent, between 1988 and 2003. One industry (iron and steel foundries) experienced an increase in agglomeration by 14 percent during this period. Two of these

10 industries belong to food and kindred products (SIC 20), 2 to chemicals and allied products (SIC 28), and the remaining 6 to 2-digit SIC industries.

Table A44 presents the 10 least agglomerated 3-digit SIC industries in the Pacific division as ranked by manufacturing employment in 1988. It also provides agglomeration trends for these industries in 5-year increments through 2003 and reports the changes in 2003 EGIs as percent shares of their 1988 agglomeration levels: electric lighting and wiring equipment; household furniture; miscellaneous plastic products; girls' and children's outwear; miscellaneous manufacturing; asphalt, paving, and roofing; men's and boys' furnishings; plastic and synthetic materials; and millwork and plywood. All but one of these industries demonstrated increases in agglomeration, ranging from 33 percent to 407 percent, between 1988 and 2003. Miscellaneous manufacturing's agglomeration decreased by 52 percent between 1988 and 2003. Two of the ten 3-digit SIC industries listed above belong to apparel and other textile products (SIC 23) and the remaining 8 to 2-digit SIC industries.

Conclusion

Out of the 40 3-digit SIC industries shown in Tables 25 and 26, 33 experienced decreases in agglomeration between 1988 and 2003, while only 7 displayed increases during this time. This finding suggests a general trend of deagglomeration in U.S. manufacturing industries.

Tables A27 and A28 report that, while most of the 3-digit SIC industries experienced deagglomeration in the New England division, a few industries—such as meat products (SIC 201), miscellaneous nonmetallic minerals (SIC 329), metal services

(SIC 347), and electronic components (SIC 367)—experienced increases in agglomeration. When we consider the historical decreases in aggregate employment in these 4 New England industries in conjunction with the indices of increased agglomeration, we come to the conclusion that employment attrition must have occurred in the counties where these 4 industries had a low density of employment.

In Tables A29 and A30 we observe the same pattern for the Middle Atlantic division, where agglomeration increased for 5 of the 3-digit SIC industries despite their decreases in employment. In the East North Central division, the transportation equipment industry (SIC 37) is one of the most agglomerated. In the West North Central division, fabricated metal products industries (SIC 34) are among the most deagglomerated, as revealed in Table A34. According to Table A35, the food and kindred products industry is relatively more agglomerated in the South Atlantic division and are among this division's most agglomerated industries. Of the 10 most agglomerated industries in the South Atlantic division in 1988, the 3 that experienced the highest decreases in agglomeration in 2003 were sugar and confectionery (EGI decreased by 106 percent), office furniture (EGI decreased by 79 percent), and fabricated rubber products (EGI decreased by 73 percent).

Of the East South Central division's 10 most agglomerated industries in 1988, the three that experienced the highest decreases in agglomeration in 2003 were women's and juniors' outerwear (EGI decreased by 137), metal forging and stamping (EGI decreased by 102 percent) and miscellaneous furniture and fixtures (EGI decreased by 95 percent). Of the 10 most agglomerated industries in 1988 in the West South Central division, the three whose deagglomeration increased the most in 2003 were meat products (EGI

decreased by 108 percent), books (EGI decreased by 94 percent), and men's and boys' furnishings (EGI decreased by 86 percent). For the Mountain division, the 3 of the 10 most agglomerated industries in 1988 that experienced the most deagglomeration in 2003 were books (EGI decreased by 139 percent), partitions and fixtures (EGI decreased by 114 percent), and medical instruments and supplies (EGI decreased by 111 percent). The Pacific division's agglomeration trend is mixed. Out of the 20 3-digit industries listed in tables 8I and 9I, 10 displayed deagglomeration in 2003, while the other 10 demonstrated agglomeration. Of the 20, the 3 industries with the highest decreases in agglomeration between 1988 and 2003 were blankbooks and bookbinding (EGI decreased by 92 percent), industrial inorganic chemicals (EGI decreased by 91 percent), and meat products (EGI decreased by 90 percent). Within the pool of 20 industries, the 3 that displayed the highest increases in agglomeration between 1988 and 2003 were asphalt paving and roofing products (EGI increased by 407 percent), girls' and children's outerwear (EGI increased by 350 percent), and household furniture (EGI decreased by 264 percent). We will now proceed to a discussion of national and regional agglomeration trends measured in Gini indices.

Agglomeration Trends Measured by Gini Indices

National Trends

Table A45 shows the 20 most agglomerated 3-digit SIC industries in the U.S. as ranked by Gini indices in 1988. This table also presents the agglomeration trends for these industries in 5-year intervals through 2003 and reports the changes in 2003 Gini indices as percent shares of their 1988 agglomeration levels. The 10 most agglomerated industries, according to the Gini indices, are structural clay products, industrial organic

chemicals, wood building and mobile homes, glass and glassware, books, miscellaneous petroleum and coal products, textile finishing, metal cans and shipping containers, miscellaneous furniture and fixtures, and miscellaneous primary metal products. All but 2 of the 20 demonstrated decreases in agglomeration, ranging from 1 percent to 66 percent, between 1988 and 2003. The 2 that had increases during this period were miscellaneous petroleum and coal products (Gini increased by 4 percent) and glass and glassware (Gini increased by 16 percent). Three of these industries belong to chemicals and allied products (SIC 28), another 3 to primary metal industries (SIC 33), 2 to the furniture and fixtures industry (SIC 25), 2 to stone, clay, and glass products (SIC 32), and 2 more to the transportation equipment industry (SIC 37). The remaining 8 3-digit SIC industries belong to 8 2-digit SIC industries.

Table A46 presents the 20 least agglomerated 3-digit SIC industries in the U.S. as ranked by 1988 Gini indices. This table also conveys agglomeration trends for these industries in 5-year increments through 2003 and reports the changes in 2003 Gini indices as percent shares of their 1988 agglomeration levels. The 10 least agglomerated industries on this list are miscellaneous plastic products, industrial machinery, metalworking machinery, fabricated structural metal products, miscellaneous manufacturing products, millwork and plywood, miscellaneous fabricated metal products, general industrial machinery, metal services, and bakery products. Twelve of the 20 industries demonstrated increased agglomeration, ranging from 2 percent to 32 percent, between 1988 and 2003. Seven industries experienced decreased agglomeration, ranging from 2 percent to 40 percent during the same period, while agglomeration level for one industry (fabricated metal products) remained unchanged. Five of the 20 industries

belong to fabricated metal products (SIC 34), 4 to industrial machinery and equipment (SIC 35), 2 to electronic and other electric equipment (SIC 36),2 to instruments and related products (SIC 38), and the remaining 7 to 2-digit SIC industries.

Regional Trends

Division 1: New England

Table A47 shows the 10 most agglomerated 3-digit SIC industries in the New England division as ranked by Gini indices in 1988. This table also reports agglomeration trends for these industries in 5-year intervals through 2003 and gives changes in 2003 Gini indices as percent shares of their 1988 agglomeration levels: women's and children's underwear; blankbooks and bookbinding; books; hose, belting, and gaskets; miscellaneous primary metal products; aircraft and parts; ship and boat building; miscellaneous chemical products; nonferrous rolling and drawing; and engines and turbines. All but one of these industries demonstrated decreases in agglomeration, ranging from 44 percent to 81 percent, between 1988 and 2003. On the other hand, agglomeration for engines and turbines increased by 2 percent. Two of the 10 most agglomerated industries belong to the printing and publishing industry (SIC 27), 2 to primary metals (SIC 33), 2 to transportation equipment (SIC 37), and 4 to 2-digit SIC industries.

Table A48 lists the 10 least agglomerated 3-digit SIC industries in the New England division as ranked by Gini indices in 1988. This table also exhibits agglomeration trends for these industries in 5-year intervals through 2003 and reports the changes in 2003 Gini indices as percent shares of their 1988 agglomeration levels. These industries are general industrial machinery, electronic components and accessories,

metalworking machinery, metal services, medical instruments, miscellaneous fabricated metal products, miscellaneous plastic products, fabricated rubber products, measuring and controlling devices, and women's and juniors' outerwear. All but 2 of these industries displayed increased agglomeration, ranging from 7 percent to 147 percent, between 1988 and 2003. The 2 that displayed deagglomeration were metalworking machinery (Gini decreased by 21 percent) and metal services (Gini decreased by 12). Two of the 10 industries belong to rubber and miscellaneous products (SIC 30), 2 to fabricated metal products (SIC 34), 2 to industrial machinery and equipment (SIC 35), 2 to instruments and related products (SIC 38), and the remaining 2 to 2-digit SIC industries.

Division 2: Middle Atlantic

Table A49 reports the 10 most agglomerated 3-digit SIC industries in the Middle Atlantic division according to 1988 Gini indices and presents these industries' agglomeration trends in 5-year increments through 2003, with changes in 2003 Gini indices given as percent shares of their 1988 agglomeration levels: glass and glassware, plumbing and heating products, textile finishing, nonferrous rolling and drawing, miscellaneous petroleum and coal products, beverages, office furniture, aircraft and parts, miscellaneous transportation equipment, and wood buildings and mobile homes. All of these industries deagglomerated, between 5 and 97 percent, between 1988 and 2003. Two of the industries belong to the stone, clay, and glass products industry (SIC 32), 2 to transportation equipment (SIC 37), and 6 to 2-digit SIC industries.

Table A50 presents the 10 least agglomerated 3-digit SIC industries in the Middle Atlantic division according to 1988 Gini indices. This table also gives agglomeration

trends for these industries in 5-year intervals though 2003 and reports the changes in Gini indices in 2003 as percent shares of their 1988 agglomeration levels. These industries are hydraulic cement, miscellaneous plastic products, fabricated structural metal products, miscellaneous manufacturing, miscellaneous fabricated metal products, metalworking machinery, special industry machinery, commercial printing, industrial machinery, and metal forgings and stampings. Six of the 10 industries demonstrated increases in agglomeration, ranging from 63 percent to 9,039 percent, between 1988 and 2003. Four industries had decreases in agglomeration, ranging from 3 percent to 79 percent, during this time period. Three of the 10 industries belong to fabricated metal products (SIC 34), 3 to industrial machinery and equipment (SIC 35), and the remaining 4 to 2-digit SIC industries.

Division 3: East North Central

Table A51 displays the 10 most agglomerated 3-digit SIC industries in the East North Central division as ranked by Gini indices in 1988. It also presents agglomeration trends for the 10 industries in 5-year increments through 2003 and gives changes in the 2003Gini indices as percent shares of their 1988 agglomeration levels: plastic and synthetic materials; ship and boat building and repairing; aircraft and parts; books; miscellaneous primary metal products; miscellaneous transportation equipment; hose, belting, and gaskets; miscellaneous furniture and fixtures; structural clay products; and household audio and video products. All of the industries experienced decreases in agglomeration, ranging from 2 percent to 95 percent, between 1988 and 2003. Three belong to transportation equipment (SIC 37), and the remaining 7 belong to 2-digit SIC industries.

Table A52 lists the 10 least agglomerated 3-digit SIC industries in the East North Central division as ranked by Gini indices in 1988. This table also shows agglomeration trends for these industries in 5-year intervals through 2003 and reports the changes in Gini indices in 2003 as percent shares of their 1988 agglomeration levels: miscellaneous plastic products, industrial machinery, metalworking machinery, fabricated structural metal products, miscellaneous fabricated metal, metal services, metal forgings and stampings, general industrial machinery, miscellaneous manufacturing, and special industry machinery. Five of these industries displayed decreases in agglomeration, ranging from 7 percent to 40 percent, between 1988 and 2003. The remaining five increased in agglomeration, ranging from 7 percent to 46 percent. Four of the 10 industries belong to fabricated metal products (SIC 34), 4 to industrial machinery and equipment (SIC 35), and 2 to 2-digit SIC industries.

Division 4: West North Central

Table A53 reports the 10 most agglomerated 3-digit SIC industries in the West North Central division according to 1988 Gini indices. This table also presents the agglomeration trends for these industries in 5-year increments through 2003 and reports the changes in Gini indices in 2003 as percent shares of their 1988 agglomeration levels. These industries are meat products, partitions and fixtures, nonferrous foundries, household furniture, miscellaneous nonmetallic minerals, miscellaneous primary metal products, drugs, books, beverages, and plastic materials and synthetics. All but one of these industries experienced decreased agglomeration, ranging from 20 percent to 94 percent, between 1988 and 2003. The Gini index of agglomeration for the drug industry did increase by 12 percent between 1988 and 2003. Two of the 10 industries belong to

food and kindred products (SIC 20), 2 to furniture and fixtures (SIC 25), 2 to primary metal products (SIC 33), and 4 to 2-digit SIC industries.

Table A54 provides a list of the 10 least agglomerated 3-digit SIC industries in the West North Central division according to 1988 Gini indices. This table also presents agglomeration trends for these industries in 5-year intervals through 2003 and reports the changes in 2003 Gini indices as percent shares of their 1988 agglomeration levels. These industries are miscellaneous chemical products; metal services; miscellaneous electrical equipment; miscellaneous plastic products; screw machine products and bolts; industrial machinery; miscellaneous manufacturing; soaps, cleaners, and toilet goods; metalworking machinery; and metal forgings and stampings. All but two of these industries displayed increases in agglomeration, ranging from 15 percent to 234 percent, between 1988 and 2003. During this period, the soaps, cleaners, and toilet goods industry and the metal forgings and stampings industry, decreased by 22 percent and 8 percent, respectively, on the Gini index of agglomeration. Three of the 10 industries belong to fabricated metal products (SIC 34), 2 to industrial machinery and equipment (SIC 35), and 5 to other 2-digit SIC industries.

Division 5: South Atlantic

Table A55 reports the 10 most agglomerated 3-digit SIC industries in the South Atlantic division ranked by Gini indices in 1988. This table also presents the agglomeration trends for these industries in 5-year intervals through 2003 and reports the changes in Gini indices in 2003 as percent shares of their 1988 agglomeration levels. These industries are fabricated rubber products, asphalt paving and roofing products, textile finishing, cutlery and hand tools, industrial organic chemicals, costume jewelry

and notions, grain mill products, meat products, office furniture, and blankbooks and bookbinding. All industries demonstrated decreases in agglomeration, ranging from 1 percent to 67 percent, between 1988 and 2003. Two of these industries belong to food and kindred products (SIC 20); the remaining 8 belong 2 2-digit SIC industries.

Table A56 exhibits the 10 least agglomerated 3-digit SIC industries in the South Atlantic division according to 1988 Gini indices. This table also shows agglomeration trends for these industries in 5-year increments through 2003 and reports the changes in 2003 Gini indices as percent shares of their 1988 agglomeration levels: industrial machinery; pens, pencils, and office supplies; fabricated structural metal; miscellaneous plastic products; printing trade services; yarn and thread mills; miscellaneous fabricated textile products; aircraft and parts; bakery products; and sawmills and planing mills. Four industries displayed decreases in agglomeration, ranging from 2 percent to 49 percent, between 1988 and 2003. Six industries experienced increases in agglomeration, ranging from 32 percent to 485 percent. All 10 industries listed in Table A56 belong to ten separate 2-digit SIC industries.

Division 6: East South Central

Table A57 displays the 10 most agglomerated 3-digit SIC industries in the East South Central division as ranked by Gini indices in 1988. This table also shows agglomeration trends for these industries in 5-year intervals through 2003 and reports the changes in Gini indices in 2003 as percent shares of their 1988 agglomeration levels. These industries are miscellaneous furniture and fixtures, partitions and fixtures, construction machinery, knitting mills, metal forgings and stampings, industrial organic chemicals, ship and boat building, grain mill products, plastic materials and synthetics,

and books. All but one of these industries demonstrated decreased agglomeration, ranging from 3 percent to 56 percent, between 1988 and 2003. For knitting mills, the Gini index of agglomeration rose by 5 percent during this time. Two of these 10 industries belong to furniture and fixtures (SIC 25), other two industries belong to chemicals and allied products (SIC 28), and the remaining six industries belong to other six 2-digit SIC industries.

Table A58 presents the 10 least agglomerated 3-digit SIC industries in the East South Central division according to 1988 Gini indices. This table also reports agglomeration trends for these industries in 5-year increments through 2003 and reports the changes in Gini indices in 2003 as percent shares of their 1988 agglomeration levels: industrial machinery; saw mills and planing mills; metalworking machinery; miscellaneous plastic products; fabricated structural metal products; miscellaneous manufacturing; household furniture; miscellaneous chemical products; millwork, plywood, and structural members; and commercial printing. Six of these industries displayed decreases in agglomeration, ranging from 6 percent to 53 percent, between 1988 and 2003. Four industries displayed increases in agglomeration, ranging from 7 percent to 72 percent. Two of the 10 industries belong to the lumber and wood industry (SIC 24), 2 to industrial machinery and equipment (SIC 35), and 6 to 2-digit SIC industries.

Division 7: West South Central

Table A59 presents the 10 most agglomerated 3-digit SIC industries in the West South Central division ranked by Gini indices in 1988. This table also presents the agglomeration trends for these 10 industries in 5-year intervals through 2003 and reports

the changes in Gini indices in 2003 as percent shares of their 1988 agglomeration levels. These industries are miscellaneous primary metal products, books, meat products, blast furnace and basic steel, plastic materials and synthetic, miscellaneous furniture and fixtures, industrial inorganic chemicals, pens, pencils, office supplies, miscellaneous apparel and accessories and household audio and video. All of these industries displayed decrease in agglomeration, ranging from 8 percent to 64 percent, between 1988 and 2003. Two of these industries belong to chemicals and allied products (SIC 28), two other industries belong to primary metal products (SIC 33), and the remaining six 3-digit SIC industries belong to six other 2-digit SIC industries.

Table A60 presents the 10 least agglomerated 3-digit SIC industries in the West South Central division ranked by Gini indices in 1988. This table also presents the agglomeration trends for these industries in 5-year intervals through 2003 and reports the changes in Gini indices in 2003 as percent shares of their 1988 agglomeration levels. These industries are medical instruments and supplies; miscellaneous food and kindred products; beverages; industrial machinery; miscellaneous electrical equipment; cutlery, hand tools, and hardware; general industrial machinery; partitions and fixtures; drugs; and blankbooks and bookbinding. Eight of these industries displayed increase in agglomeration, ranging from 5 percent to 372 percent, between 1988 and 2003. Two industries—beverages (SIC 208) and industrial machinery (SIC 359)—demonstrated decreases on the Gini index of agglomeration, by 83 percent and 34 percent, respectively. Two of the 10 industries belong to food and kindred products (SIC 20), 2 to industrial machinery and equipment industry (SIC 35), and 6 to 2-digit SIC industries.

Division 8: Mountain

Table A61 displays the 10 most agglomerated 3-digit SIC industries in the Mountain division as ranked by Gini indices in 1988. This table also presents the agglomeration trends for these 10 industries in 5-year intervals through 2003 and reports the changes in Gini indices in 2003 as percent shares of their 1988 agglomeration levels: sawmills and planing mills; glass and glassware; partitions and fixtures; medical instruments; women's and juniors' outerwear; construction and related machinery; jewelry, silverware, and plated ware; wood buildings and mobile homes; and books. Six of these industries demonstrated decreases in agglomeration, ranging from 43 percent to 76 percent, between 1988 and 2003. The remaining 4 industries displayed increases in agglomeration, ranging from 18 percent to 77 percent. Two of the 10 industries belong to lumber and wood products and the remaining 8 to 2-digit SIC industries.

Table A62 presents the 10 least agglomerated 3-digit SIC industries in the Mountain division according to 1988 Gini indices. This table also presents the agglomeration trends for these industries in 5-year intervals through 2003 and reports the changes in Gini indices in 2003 as percent shares of their 1988 agglomeration levels. These industries are metal forgings and stampings, household audio and video, miscellaneous plastics products, pottery and related products, screw machine products and bolts, miscellaneous transportation equipment, miscellaneous electrical equipment, costume jewelry and notions, metalworking machinery, and miscellaneous apparel and accessories. All of these industries displayed increases in agglomeration, ranging from 30 percent to 822 percent, between 1988 and 2003. Two of the industries belong to

fabricated metal products (SIC 34), 2 to electronic and other electric equipment (SIC 36), and the remaining 6 to other 2-digit SIC industries.

Division 9: Pacific

Table A63 displays the 10 most agglomerated 3-digit SIC industries in the Pacific division as ranked by Gini indices in 1988. This table also presents the agglomeration trends for these 10 industries in 5-year intervals through 2003 and reports the changes in Gini indices in 2003 as percent shares of their 1988 agglomeration levels. These industries are metal cans and shipping, miscellaneous furniture and fixtures, structural clay products, industrial inorganic chemicals, iron and steel foundries, blankbooks and bookbinding, miscellaneous primary metal products, meat products, computer and office equipment, and miscellaneous electrical equipment. All but one of these industries demonstrated decreases in agglomeration, ranging from 32 percent to 48 percent, between 1988 and 2003. For the iron and steel foundries industry, the Gini index of agglomeration increased by 9 percent between 1988 and 2003. Two of the 10 industries belong to primary metal products, while the remaining 8 belong to 2-digit SIC industries.

Table A64 presents the 10 least agglomerated 3-digit SIC industries in the Pacific division according to 1988 Gini indices. This table also presents the agglomeration trends for these 10 industries in 5-year intervals through 2003 and reports the changes in Gini indices in 2003 as percent shares of their 1988 agglomeration levels: hydraulic cement, millwork and plywood, miscellaneous plastic products, miscellaneous manufacturing, industrial machinery, household audio and video, plastic material and synthetics, special industry machinery, men's and boys' furnishings, and miscellaneous fabricated metal products. Five of these industries displayed decreases in agglomeration, ranging from 9

percent to 58 percent, between 1988 and 2003; the remaining 5 industries demonstrated increases in agglomeration, ranging from 17 percent to 1104 percent. Two of the 10 industries belong to industrial machinery and equipment (SIC 35), and the remaining 8 belong to 8 2-digit SIC industries.

Conclusion

As displayed by the national average of Gini indices shown in Tables 10 and 11, 25 industries experienced decreased agglomeration, 14 industries demonstrated increased agglomeration, and one industry maintained static between 1988 and 2003. As in Table 10, the 4 industries with the greatest decrease in agglomeration measured by Gini indices between 1988 and 2003 were miscellaneous primary metal products (66 percent), books (66 percent), miscellaneous metal and primary metal products (45 percent), and miscellaneous furniture and fixtures (37 percent). Of the New England division's 10 most agglomerated industries in 1988, 9 industries had decreased agglomeration in 2003. Of these nine, the three industries with the greatest decreases in agglomeration in 2003 were miscellaneous chemical products (81 percent), ship and boat building (71 percent), and hose, belting, and gaskets (68 percent). For these industries, employment levels dropped between 1988 and 2003, which indicates that employment must have dropped in the agglomerated counties, causing the Gini indices to fall. As shown in Table A50, the 3 industries with highest increases in agglomeration in the Middle Atlantic division are cement (9,039 percent), miscellaneous fabricated metal products (173 percent), and miscellaneous plastic products (160 percent). Despite the divisional drop in employment in these industries between 1988 and 2003, the Gini indices increased during this time. This information suggests that employment attrition in these industries must have

occurred in the counties with lower densities of employment in 1988, causing the Gini indices to increase for the division. This trend is quite common, as shown by the employment figures—in combination with the corresponding agglomeration indices—for rest of the 9 census divisions. Of the 10 most agglomerated industries in the Pacific division in 1988, 9 displayed decreased agglomeration in 2003. The 3 industries that experienced the most agglomeration were industrial inorganic chemicals (48 percent), miscellaneous furniture and fixtures (42 percent), and miscellaneous electrical equipment (41 percent). All 3 displayed decreased employment, implying that the division's 2003 employment attrition occurred in counties with low densities of employment.

Next follows a discussion of national trends in industrial concentrations according to Herfindahl index measurements.

Trends in Industrial Concentration Measured by Herfindahl Index

National Trends

Table A65 lists the 20 most concentrated 3-digit SIC industries in the U.S. as ranked by Herfindahl indices (HIs) in 1988. This table also presents the concentration trends for these industries in 5-year intervals through 2003 and reports the changes in HIs in 2003 as percent shares of their 1988 concentration levels. Of these, the 10 most concentrated industries are guided missiles and space vehicles, handbags and personal leather goods, primary nonferrous metal products, engines and turbines, ordnance and accessories, glass and glassware, miscellaneous petroleum and coal products, yarn and thread mills, bakery products, and household appliances. All 20 industries listed in table 12 experienced decreased concentrations when measured with HIs, ranging from 2

percent to 51 percent, between 1988 and 2003. Of these industries, 3 belong to apparel and other textile products (SIC 23), 2 to leather and leather products (SIC 31), 2 to stone, glass, and glassware (SIC 32), 2 to fabricated metal products (SIC 34), 2 to electronic and electric equipment (SIC 36), 2 to transportation equipment (SIC 37), and 7 to 2-digit SIC industries.

Table A66 reports the 20 least concentrated 3-digit SIC industries in the U.S. according to 1988 Herfindahl indices (HIs). This table also presents the concentration trends for these industries in 5-year intervals through 2003 and reports the changes in HIs in 2003 as percent shares of their 1988 concentration levels. Of these industries, the 10 most concentrated are hydraulic cement, industrial machinery, miscellaneous manufacturing, millwork and plywood, commercial printing, fabricated structural metal products, miscellaneous fabricated textile products, miscellaneous plastic products, miscellaneous fabricated metal products, and metalworking machinery. Sixteen out of the 20 industries listed in Table A66 demonstrated increased concentrations between 1988 and 2003 as measured by HIs, ranging from 1 percent to 496 percent. The remaining 4 demonstrated decreased concentrations on HIs, ranging from 2 percent to 15 percent. Of these twenty industries, 4 belong to the industrial machinery and equipment industry (SIC 35), 3 to food and kindred products (SIC 20), 2 to lumber and wood products (SIC 24), 2 to printing and publishing (SIC 27), and 2 to fabricated metal industry (SIC 34). The remaining 7 3-digit SIC industries belong to 2-digit SIC industries.

Now we make some concluding remarks.

Conclusion

Recent trends in the attrition of manufacturing employment in the U.S. are well documented. Recent attrition in U.S. manufacturing employment is robust since switching from the Standard Industrial Classification (SIC) system to the North American Industrial Classification System (NAICS) system, as this decline in employment is consistent even within the NAICS regime years since 1998.[25]

As Table A1 shows, over 1988 and 2003, 42 states lost and 8 gained manufacturing employment, with a net loss of more than 5.13 million. While 6 out of 9 census divisions experienced double-digit attrition in manufacturing employment, this decline is particularly large for the Middle Atlantic, New England, South Atlantic, Pacific, and East North Central divisions. The Middle Atlantic, New England, and South Atlantic are the three divisions with the highest attrition in manufacturing employment. Between 1988 and 2003, the Middle Atlantic division's manufacturing employment decreased by 45 percent, New England's by 44 percent, and the South Atlantic's by 28 percent. At the state level, the three states experiencing the greatest decreases in manufacturing jobs in 2003 as measured in percentages of their 1988 employment numbers were New Jersey (51 percent), New York (51 percent), and Connecticut (48 percent).

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[25] As per NAICS, total manufacturing employment numbers in 1998 and 2003 were 16.94 million and 14.12 million, respectively. Tables 3 and 4 in the appendix section provide additional evidence of this sustained decline in manufacturing employment in 3-digit SIC industries.

The textile and apparel industries, metal-related industries, and leather and leather goods industries are among the industries that experienced the biggest attrition in manufacturing jobs in 2003.

Both from the national as well as from regional points of view, three trends are apparent. First, employment has declined across regions, years, and industries. Second, industries that were the most agglomerated in 1988 often displayed deagglomeration in subsequent years. The third trend shows that the least agglomerated industries in 1988 often displayed agglomeration in later years.

The first trend is obvious from the data analysis. One intuitive explanation for the second trend is that employment has been dropping in counties with higher shares of employment in the incumbent industries between 1988 and 2003. Another possible explanation for the decline in agglomeration is similar to that argued by Neffke et al. (2008). The decline and increase in agglomeration can be influenced by industries' life cycles. The benefits of Jacob externalities of agglomeration decline as incumbent industries mature. Therefore, industries that primarily agglomerate in order to benefit from Jacobs externalities would tend to deagglomerate over time

A potential explanation for the third trend is that employment might have been dropping from counties with lower shares of employment in the incumbent industries. An alternative explanation is that these industries mainly agglomerate to tap the benefit of Marshall-Arrow-Romer externalities. For these industries, the benefits of agglomeration increase as they mature. An industry that has matured in its industrial life cycle is likely to focus more on process innovation than product innovation; therefore, intra-industry knowledge-sharing becomes more important.

Besides the impact of technological advancement and trade liberalizations, industrial life cycles and types of agglomeration externalities may account for these trends. According to the literature (e.g., Neffke 2008) Jacobs externalities decrease with the maturation of incumbent industries, and the Marshall-Arrow-Romer externalities increase as agglomerated industries mature. From these perspectives, the second trend can be ascribed to employment attrition in counties with higher shares of employment in incumbent industries and to decreases in Jacobs externalities of mature industries. On the other hand, the third trend can be attributed to employment attrition in counties with lower shares of employment in incumbent industries and to increases in the Marshall-Arrow-Romer externalities of mature industries.

More interesting insights can be gained from research using more recent data regarding trends in specific manufacturing industries that link the influence of globalization, industrial life cycles, and regional idiosyncrasies.

CHAPTER III: IMPACT OF GLOBALIZATION ON MICRO-DETERMINANTS OF AGGLOMERATION: THE CASE OF U.S. MANUFACTURING INDUSTRIES, 1988-2003

Introduction

According to Marshall (1890) and others, industrial agglomeration, or the spatial concentration of industrial activity, in a region is due to external economies of scale. Prominent examples of such agglomeration include the concentration of the computer and software industries in Silicon Valley and the concentration of the automobile manufacturing industry in the state of Michigan. Marshall (1890), Fujita (2000), Rosenthal and Strange (2001), and Duranton and Puga (2004), among others, contend that such patterns of industrial location occur due to three types of economies: those from goods pooling (GP), from labor pooling (LP), and from idea pooling (IP).

Economies of GP are the cost savings that agglomerated 'input-heavy' firms acquire from sharing expensive and indivisible inputs and facilities. For example, suppose a firm has a crane and a forklift. When the firm is using the forklift, the crane is idle. If the firm is spatially isolated, it cannot lease the idle crane to another firm. However, if firms using cranes and forklifts collocate, then these indivisible inputs can be shared. As Duranton and Puga (2004) contend, such 'input-heavy' agglomerated firms can also save costs by sharing many indivisible public goods, production facilities, and market places which might be prohibitively expensive to access for an isolated firm. For example, it may be prohibitively expensive to set up power plant for a firm located in isolation. But agglomerated firms can share the expenses of setting up of such plants with heavy fixed costs and thus can minimize production costs. Thus, proximity to one another

reduces the costs of production to each agglomerated firm relative to the case of dispersed firms. Cost savings from such input sharing is an important motivation of agglomeration for input-heavy firms.

Economies of LP are the cost savings available to agglomerated firms from matching the demand and supply sides of the labor market. For example, when firms locate nearby an abundant supply of labor with skills matching the requirements of the industry, there are cost savings as a result of lower costs of hiring and/or productivity increases.[26] Furthermore, Helsley and Strange (1990) and Overman and Puga (2009) contend that large labor markets improve the chances of matching the skill requirements of firms with the particular skills of workers. Increasing the average quality of matches increases the productivity of labor and thus lowers the costs of producing a unit of output.

Economies of IP are the cost savings that accrue to agglomerated firms via sharing the results of research and development (R&D) activities. For example, when firms are agglomerated, researchers of similar interests and abilities will have a greater opportunity to exchange ideas that are critical for successful innovation. Such innovations reduce the costs of production and allow firms to differentiate their products and thereby increase their market shares.

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[26] Greenstone, Hornbeck, and Moretti (2008) report that when a large manufacturing plant

moves into an existing agglomeration, the total factor productivity (TFP) and skills-adjusted wage rate both rise, which may cause the net cost savings or net increase in profit to be smaller than the nominal productivity gain.

Although there is an extensive theoretical and empirical literature on the economic determinants of industrial agglomeration, there is little or no analysis of recent trends in agglomeration. An important exception is Kim (1995), who examines industrial agglomeration in the U.S. from 1870 to 1987. However, the period since 1987 is particularly interesting because of the potential effect of the decline in U.S. manufacturing employment on industrial agglomeration. This decline in manufacturing employment over the past ten to fifteen years is well documented. For example, Burke et al. (2004) report the loss of 3.3 million manufacturing sector jobs between 1997 and 2003. This declining trend is also evident in Figure B1, which shows a steady decline in manufacturing employment since 1995. Table A67 depicts the trend in U.S. manufacturing employment for the top ten industries by level of employment for 1988 and 2003. During this period, U.S. manufacturing employment decreased by 26.6 percent, while total manufacturing employment decreased from 19.3 million in 1988 to 14.1 million in 2003. However, manufacturing output showed a consistent growth up to the year 2000. Since 2000, the output growth has either declined or started to rise at a slower rate perhaps due to a recessionary spell that lasted from 2000 to 2002.

Figure B2 shows a declining trend in U.S. manufacturing output as a share of gross domestic product (GDP) for the period 1988–2003. As shown in Figure B3, U.S. manufacturing output rose between 1988 and 2000 and then decreased between 2000 and 2002 due to a recession ; it then rose slightly afterward, which was evidently not enough to alter the decreasing trend in the relative contribution of the manufacturing sector to overall U.S. economic activity. However, despite the declining trend in manufacturing employment (as shown in Figure B1), manufacturing output grew due to an increase in

labor productivity. As shown in Figure B4, U.S. manufacturing worker productivity grew intermittently between 1989 and 1998 within a range of 1 to 5.5 percent. Beginning in 1998, the U.S. manufacturing labor productivity growth rate decreased consistently up to 2001 and then increased sharply until 2002, when the rate dropped again. Arguably, this intermittent growth in manufacturing output and labor productivity is influenced by technological progress and trade liberalization. In Figure B5 we show the employment density in the U.S. manufacturing industries by state for 1988 and 2003. As presented in Figure B5, the relative manufacturing employment in 1988 was denser than in 2003. This reflects the fact that, in 1988, total U.S. manufacturing employment was 19.25 million, which dropped to 14.13 million in 2003.

Despite this important economic trend, there is very little analysis of the impact of this loss in manufacturing employment on industrial agglomeration. More specifically, the decline in U.S. manufacturing employment could increase agglomeration if the attrition in manufacturing employment is occurring among firms that are spatially isolated. In this case, incumbent firms may remain cost competitive with foreign firms as a result of the cost advantages due to agglomeration. This could help limit the loss in U.S. manufacturing employment over time. Conversely, if the attrition is occurring among firms located in agglomerated areas, the incumbent firms could lose cost competitiveness as agglomeration decreases. In this case, the competitive advantage of U.S. manufacturing firms may steadily erode as industrial agglomeration declines over time, and this could accelerate the decline in U.S. manufacturing employment. Therefore, understanding the impact of the loss in manufacturing jobs due to globalization on

industrial agglomeration is important not only from an academic point of view, but also from the point of view of economic policy.

The purpose of this study is to examine the effect of globalization on the micro-determinants of agglomeration in the U.S. There is a general perception among the public that manufacturing jobs are disappearing in the U.S. due to increased globalization. Arguably, there is a new phase of globalization fostered by recent technological advances and trade liberalization.[27] Recent advances in the internet and other web-based information and communication technologies (ICTs) have reduced the costs and increased the quality of long-distance communication, which is important for managing supply chains over long distances.[28] The internet was officially open for commercial

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[27] It may be quite relevant here to revisit the comments of former chairperson of the Federal Reserve Bank Allan Greenspan when referring to the concurrence of recent increases in the U.S. trade deficit, labor productivity, outsourcing, and globalization. In a speech to Bank of Mexico officials on 14 November 2005, Greenspan commented: "The rise of our deficit and our ability to finance it appears to coincide with a pronounced new phase of globalization that has emerged in the past decade. This phase is characterized by a major acceleration in U.S. productivity growth and the decline in what economists call home bias, the parochial tendency to invest domestic savings in one's home country." (Retrieved from http://www.federalreserve.gov/boarddocs/speeches/2005/20051114/default.htm November 08, 2008).

[28] In fact, data show that the growth rate of U.S. labor productivity fell in the 1970s and 1980s but began to increase again in the mid-1990s. The recent increase in U.S. labor

usage since the decommissioning of the National Science Foundation–managed NSFNet in 1995. Additionally, recent trade agreements have reduced tariff and non-tariff barriers to international trade. Since 1994, tariffs and quantitative restrictions on international trade between the U.S., Canada, and Mexico have declined, and eventually all remaining tariff and quantitative restrictions will be phased out under the provisions of the North American Free Trade Agreement (NAFTA).[29] The U.S. further lowered tariffs on goods imported from a large number of countries in 1995 as a result of the successful conclusion of the Uruguay round of the General Agreement on Tariffs and Trade (GATT).

These events have arguably facilitated the ease of communication and international trade, thus increasing the outsourcing of the production of many intermediate and final goods by U.S.-based national and multi-national corporations. The fact that these three events (enactments of NAFTA and GATT and commercial access to the internet) all occurred in or about 1995 provides us with a natural experiment

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productivity is discussed in several books and articles, including Krugman and Wells (2006, p. 597) and Jimeno and Saiz (2006), who attribute the observed increase in labor productivity to technological advancements, such as the ICT revolution.

[29] As per the information provided on the website of the Office of the United States Trade Representative, the remaining tariffs and quantitative restrictions were eliminated in January 2008 (Retrieved from http://www.ustr.gov/trade-agreements/free-trade-agreements/north-american-free-trade-agreement-nafta November 20, 2008).

opportunity in which to identify the effects of globalization on the micro-determinants of agglomeration in the U.S.[30]

To test the hypothesis that there has been a structural change in the effect of the micro-determinants of agglomeration in 1995 as a result of globalization, we estimate a number of ordinary least squares (OLS) regression models and fixed effects (FE) regression models. The dependent variable in these regressions is the Ellison-Glaeser index of agglomeration (EGI). This index has several advantages over other measures commonly used in the empirical literature on agglomeration. First, EGI is easy to compute using industrial employment data that are widely available. Second, the scale of the index allows us to compare degrees of agglomeration against a benchmark in which industries make random location decisions. Third, this index also controls for industrial-organization-driven spatial concentrations (i.e., large plants due to extensive economies of scale), allowing us to identify spatial concentration according to the three channels of agglomeration identified above. Fourth, this index is comparable across industries and levels of geographic aggregation.

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[30] The U.S. Congress passed the NAFTA Implementation Act on 17 November 1993, and the Senate passed it on 20 November 1993. NAFTA officially became effective on 1 January 1994. After the successful conclusion of the Uruguay Round negotiations of the GATT, a declaration known as the Marrakesh Declaration was signed on 15 April 1994 by representatives of the governments of the U.S. and 123 other countries. The internet became available to mass subscription following the National Science Foundation's decommissioning of the NSFNet in 1995.

The independent variables in these regressions include proxies widely used in the literature for GP, LP, and IP, as well as a set of control variables for natural cost advantages and transportation costs. Natural cost advantages are best understood through a couple of simple illustrative examples. For instance, the wine industry tends to agglomerate in areas with climates favorable for growing grapes. A favorable climate obviously provides cost advantages bestowed by nature. Likewise, shipbuilding is located in regions with seaports. We do not see an agglomeration of the shipbuilding industry in land-locked states. Again, access to large bodies of water is a cost advantage bestowed by nature. As mentioned by Rosenthal and Strange (2001), transportation costs can affect the location decisions of firms. They contend that industries with relatively greater shipment costs would locate themselves near cities or target markets to minimize transportation costs.

This study analyzes data spanning the period from 1988 to 2003, covering 76 industrial sectors and the lower forty-eight continental states. [31] The data used in this

[31] In calculating the agglomeration index, we use data from the Annual Survey of Manufacturers and skip the data from the economic census years, which occur twice in every ten years (e.g., 1992 and 1997 were economic census years for the decade 1991–2000). The years in our sample are 1988, 1990, 1993, 1994, 1996, 1998, 2000, and 2003. We aggregate the data at the 3-digits Standard Industrial Classification (SIC) level, for which there is bridge between SIC and NAICS (North American Industrial Classification System). As the economic structures of Alaska and Hawaii are arguably different from those of the lower forty-eight continental states, we exclude Alaska and Hawaii from this study.

study are obtained from a variety of sources, including the County Business Pattern (CBP) data series, the Current Population Survey (annual demographic series), the Annual Survey of Manufacturers, and the U.S. Patent and Trademark Organization (USPTO) database.

The regression results for both the OLS and FE specifications are consistent with the hypothesis that there was a structural change in the effect of the micro-determinants of industrial agglomeration in the U.S. manufacturing sector beginning in 1995. The results are generally consistent with the hypothesis that globalization has attenuated the effect of GP, LP, and IP on agglomeration of U.S. manufacturing industries. These key findings are robust to alternative specifications of the econometric model, particularly for changes in the proxies used for LP. The remainder of this chapter is organized as follows. In next section we discuss literature review and then we discuss empirical model, variable construction and data. In the next section we discuss the empirical results followed by a concluding section.

Literature Review

The literature on agglomeration economies can be broadly classified into localization economies and urbanization economies. Localization economies are external to firms but internal to an industry in a geographic region. According to Glaeser et al. (1992), localization economies are often referred to as the micro-foundations of agglomeration. Following Feldman (2000), urbanization economies refer to scale effects that depend on city size or density. This study focuses on localization economies. In recent years, there has been a revived interest in the determinants of industrial agglomeration, resulting in a number of theoretical and empirical papers.

We begin by briefly summarizing the evidence supporting our contention that the recent decline in U.S. manufacturing employment is largely due to the foreign outsourcing of manufacturing as a result of the ICT revolution and trade liberalization. Then we summarize the literature on the micro-determinants of agglomeration.

Several papers attribute the decline in U.S. manufacturing employment to the growth in the foreign outsourcing of manufactured goods. For example, Burke et al. (2004) link U.S. manufacturing job losses to the concurrent increase in foreign outsourcing. Using national input-output data, they examine the sources of inputs of 19 major manufacturing industries for the period between 1987 and 2002. They find that the share of foreign-sourced inputs in total manufactured inputs almost doubled between 1987 and 2002, from 12.4 percent to 22.1 percent. Similarly, Vogiatzoglou (2006) reports evidence that U.S. manufacturing was increasingly relocating to Mexico during the same period. Finally, Deitz (2004) and Deitz and Orr (2006) attribute the decline in U.S. manufacturing employment to labor productivity growth as a result of recent ICT

advances and the increase in global competition as a result of trade liberalization. In short, the combined effects of the ICT revolution and trade liberalization are contributing to the erosion of employment among U.S. manufacturing industries.[32] The resulting increase in global competitiveness forces less competitive U.S. manufacturers to cut back their operations, move their plants overseas, or close.

There is no consensus in the academic literature regarding effect of foreign outsourcing on industrial agglomeration in the U.S. O'Brien (1992) and Cairncross (1997) contend that increased globalization is eroding the importance of location for economic activity. In contrast, Ohmae (1995), Porter (1998), and Fujita et al. (2000) contend that globalization is in fact increasing the importance of location. These competing views warrant further empirical work with more recent data and innovative empirical approaches.

Having established that the decline in U.S. manufacturing employment is the result of the ICT revolution and trade liberalization, we now turn to a discussion of the literature on the micro-determinants of agglomeration. Duranton and Puga (2004) provide an excellent review of the theoretical literature on the determinants of agglomeration, and Rosenthal and Strange (2004) provide a comprehensive summary of the growing empirical literature on this topic. Finally, Audretsch and Feldman (2004) summarize contemporary theoretical and empirical literature on idea pooling as a micro-determinant

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[32] Henceforth, outsourcing as a result of trade liberalization and technological advancement will be referred to as globalization. However, these two mechanisms (i.e., trade liberalization and technological advancement) are likely to affect the micro-determinants of agglomeration differently.

of agglomeration. For the reader's convenience some frequently cited papers on the micro-determinants of agglomeration are summarized in Table 68.[33]

Diamond and Simon's (1990) empirical paper examines industrial specialization and the labor-market risk by studying the link between wages, unemployment, and industrial specialization in 43 U.S. cities. The study finds that labor-market risk is capitalized in the form of higher wages in more specialized agglomerations. Helsley and Strange (1990) develop a theoretical model with two kinds of positive externalities associated with a firm's moving into a city. The first positive externality issues from the traditional productivity externality; sources of the second positive externality are spatial competition and the heterogeneity of workers. The authors derive equilibrium for an agglomeration economy from a matching process between workers and firms, contending that such equilibrium-sized agglomeration has the characteristics of a local public good. Francis's (2009) theoretical paper uses simulation to derive spatial equilibrium. This paper finds that in-migration of labor as a result of agglomeration increases the quality of matching and labor productivity.

Analyzing plant-level manufacturing sector data of the United Kingdom, Overman and Puga (2009) find evidence in favor of labor-market pooling as a micro-determinant of agglomeration. The authors estimate and compare both plant-level and industry-level idiosyncratic fluctuations in employment and find that industries with plants displaying more of such fluctuations tend to be more agglomerated than other

[33] Due to space constraints, the table contains only a few frequently cited papers regarding micro-determinants of agglomeration. Understandably, there are other papers on this topic that are not listed in Table 2.

industries. The authors contend that establishments using workers with similar skills find it beneficial to locate in agglomerated areas where a supply of workers with comparable skills is relatively abundant.

Several papers examine the effectiveness of GP as a micro-determinant of agglomeration in both theoretical and empirical frameworks. Bartelsman, Ricardo, and Caballero (1994) analyze the effects of input supplies and linkages of intermediate goods on industrial productivity and find that long-run growth in industrial productivity is mostly related to intermediate goods linkages. Homes (1999) analyzes plant-level U.S. census data on manufacturing and finds that most agglomerated industries display a relationship that is consistent with input sharing. For example, Homes (1999) reports that the pantyhose industry is concentrated in North Carolina, with 62 percent of national employment. This industry in North Carolina displays a purchased input intensity of 53 percent, while the national average for purchased input intensity is only 40 percent. Homes and Stevens (2002) find that plant size is larger when an industry is concentrated indirectly, implying that agglomeration increases ease of access to intermediate inputs, which may facilitate plant-size expansion. Duranton and Puga (2004) develop a theoretical model of aggregate increasing returns due to input sharing, despite constant returns to scale in perfectly competitive final production. Ellison, Glaeser, and Karr (2007) analyze U.S. manufacturing industry data between 1972 and 1997 to examine the impact of three micro-determinants on industrial co-agglomeration. They report input-dependency to be the most important factor, followed by labor pooling.

Idea pooling is an important source of agglomeration that generates positive externalities of knowledge spillover and thus raises productivity. These knowledge

spillovers, named after the economists who initially theorized and explained them, are known as the Marshall-Arrow-Romer (MAR) spillover, the Porter spillover, and the Jacobs spillover. Marshall (1890), Arrow (1962), and Romer (1986) suggest that an agglomeration of similar firms facilitates the exchange of ideas among their workers, which in turn leads to innovation and growth. Porter (1990) refers to similar spillovers but emphasizes inter-firm competition more than cooperation, contending that positive externalities in the form of innovations and growth are maximized when firms compete fiercely for market share.

Jacobs (1969) contends that the co-agglomeration of diverse industries creates a fusion of knowledge and thus promotes innovation and growth. She refers to the transition of Detroit, Michigan, from a shipbuilding city to an automobile city and contends that the agglomeration of these diverse industries facilitated the innovation of gasoline engines for automobiles from the gasoline engines used for ships. Feldman and Audretsch (1999) analyze the location information of 3,969 new manufacturing product innovations for which the address of the innovating establishment can be identified. They find evidence that per-capita product innovation is generally higher for larger Metropolitan Statistical Areas and suggest that the propensity of knowledge spillovers is positively related to diversity in economic activities. Jaffe, Trajtenberg, and Henderson (1993) analyze patent citation data and find evidence of a strong localization of knowledge spillover that attenuates with geographical distance. Bas and Miribel (2005) analyze the employment concentration and productivity outcome for the information technology (IT) sector in U.S. states and counties for the year 1990 and find that industries with a rapid rate of knowledge obsolescence would benefit from locating near

sources of new knowledge. Greenstone, Hornebeck, and Moretti (2008) study productivity and agglomeration data for large manufacturing plants and find evidence that total factor productivity rises when a large manufacturing plant moves into an existing agglomeration. Autor, Levy, and Murnane (2003) examine the impact of computerization on changes in demand for various job skills and report that use of ICTs is associated with a decrease in demand for both routine manual and routine cognitive skills and with an increase in demand for both non-routine analytic and non-routine interactive skills. Combes, Duranton, Puga, and Roux (2009) dissect the productivity increase observed in agglomerations into two categories: an increase due to firm selection and that due to agglomeration externalities. They report evidence that productivity increases in French manufacturing industries are mostly explained by agglomeration externalities, which suggests that knowledge spillovers have a positive impact on total factor productivity.

Kim (1995) examines the patterns of regional specialization among U.S. manufacturing industries for the period 1860 to 1987. He finds that regional specialization increased between 1860 and the beginning of the twentieth century. Specialization reached a pinnacle during the interwar years and has fallen substantially since the 1930s.[34] In a seminal study of regional specialization, Ellison and Glaeser

[34] Kim (2003) employs Hoover's localization coefficient in measuring industrial localization trends for twenty manufacturing industries (at a two-digit SIC level) using employment data from the U.S. Census of Manufactures for the period 1860–1987. Kim finds that about half of these industries were less concentrated in 1987 than they had been in 1860.

(1997) construct a measure of industrial agglomeration that enables them to distinguish between spatial concentration resulting from industrial organization due to increasing returns to scale versus spatial concentration resulting from the micro-determinants of agglomeration. Using this measure along with manufacturing employment data from the Census of Manufactures, they analyze patterns of U.S. manufacturing agglomeration in 1987. They find that most of the manufacturing industries were only slightly concentrated relative to more highly agglomerated industries, such as ICT firms in Silicon Valley and the automobile industry in Michigan.

Rosenthal and Strange (2001) examine the micro-determinants of agglomeration using manufacturing employment data for the year 2000. They use the EGI as a measure of industrial agglomeration and regress it on proxies for GP, LP, and IP, along with control variables for transportation costs and natural cost advantages. They find a positive and statistically significant relationship between industrial agglomeration and the micro-determinants of agglomeration, but the magnitude of their influence varies across levels of geography. They point out that proxies for GP and transportation costs influence agglomeration positively at the state level analysis but display little impact on agglomeration at the county or zip-code level. On the other hand, the proxy for IP positively influences agglomeration only at the zip-code level, which perhaps is indicative of the rapid attenuation of knowledge spillovers across space. They found the influence of LP to be positive and statistically significant across jurisdiction levels.

Both Ellison and Glaeser (1997) and Rosenthal and Strange (2001) examine agglomeration at a point in time and hence do not explore trends in agglomeration in the

U.S. over time. Clearly, there is much to be learned about the effects of globalization on the patterns of agglomeration observed in the U.S. between 1988 and 2003.

Empirical Model, Variable Construction, and Data

In this section we describe the empirical model, variable construction, and the data used in this analysis. We estimate the impact of globalization on the micro-determinants of agglomeration using the following baseline equation:

$$EGI_{ist} = B_0 + B_1(LP)_{ist} + B_2(GP)_{ist} + B_3(IP)_{ist} + B_4(T95)_{ist} + B_5(LP \times T95)_{ist} + B_6(GP \times T95)_{ist} + B_7(IP \times T95)_{ist} + B_8 X_{ist} + B_9(X \times T95)_{ist} + \mu_s + \tau_t + \varepsilon_{ist}. \quad (1)$$

The i subscripts (= 1, 2, …, 76) indicate 76 manufacturing industries at the 3-digit Standard Industrial Classification (SIC) code level, s (= 1, 2, …, 48) indicates the 48 lower continental states, and t (= 1988, 1990, 1993, 1994, 1996, 1998, 2000, and 2003) indicates the year.[35] To avoid combining survey and census data, we pick years for which survey data are available. EGI_{ist} denotes the Ellison-Glaeser index of agglomeration, and EGG_{ist} denotes the Ellison-Glaeser Gini index, which is discussed in greater detail below. LP, GP, and IP are proxy variables for labor pooling, goods pooling, and idea pooling,

[35] The subscript i represents U.S. manufacturing industries that are bridgeable over the Standard Industrial Classification (SIC) codes and subsequent North American Industrial Classification System (NAICS) codes that have replaced SIC since 1997 (Retrieved from www.census.gov/eos/www/naics October 30, 2008. For more information on this transition from SIC to NAICS). Considering the idiosyncratic economic geography of island economies relative to those of the remaining 48 states, observations for the states of Alaska and Hawaii are excluded from the analysis.

respectively, whereas ADR stands for average import duty rate.[36] T95 is a vector of dummy variables set equal to 1.0 for the years in our sample after 1995 and equal to zero otherwise. D95 is the interaction between average duty rate and T95 (i.e., D95 = ADR × T95). X_{ist} is a vector of control variables for natural cost advantages, transportation costs, minimum wage, and corporate income tax rates; μ_s and τ_t are unobserved state and year fixed effects, respectively; and ε_{ist} is an identically and independently distributed idiosyncratic error term. We then estimate one variant equation in which three micro-determinants interact with D95. Next, we estimate two specifications using the Gini index (EGG) as the dependent variable and the Herfindahl index in the set of regressors. As with the previously mentioned equations, for these two models we have key regressors interact with T95 and D95. We also estimate a two-stage least square model.

As previously discussed, we contend that the decline in U.S. manufacturing employment has occurred as a result of the advent of the ITC revolution and trade liberalization in 1995. We hypothesize that the resulting increase in foreign outsourcing of manufactured goods led to a change in the effect of the micro-determinants of agglomeration. If globalization causes an attenuation of the effectiveness of the micro-determinants of agglomeration, then we would expect the estimated coefficients of these proxy variables interacting with T95 to be less than zero; i.e., we expect to observe $B_5 < 0, B_6 < 0,$ and $B_7 < 0$ in the regression results for equation 1. For the same reasons as argued above, we expect to observe similar patterns in the regression results for models

[36] The average import duty rate (ADR) for industry 'i' and year 't' is calculated for 3-digit SIC industries as follows: [ADR_{it} = (total import duty collected$_{it}$) / (total dutiable value of import$_{it}$)].

when we have the three micro-determinants interact with D95. Now we turn to a detailed explanation of the construction of these variables.

Following Ellison and Glaeser (1997), we use the EGI as a measure of industrial agglomeration because of its ability to isolate industrial agglomeration due to the micro-determinants from agglomeration that would result from a heavily skewed size distribution of plants due to increasing returns to scale.[37] EGI is a function of the Gini coefficient, which is also known as Ellison-Glaeser's index of raw geographic concentration (EGG_i) and the Herfindahl index (HI_i) of industry i.[38] To better appreciate the construction of EGI, we briefly describe Hoover's (1936) locational Gini quotient (LQ_{im}) and locational Gini coefficient (Gi) and Ellison and Glaeser's index of raw geographic concentration (EGG_{im}), where the subscripts i and m refer to industry i and region m, respectively.

To illustrate the construction of LQ_{im}, consider an economy with M regions (m = 1, …, M), where S_{im} represents industry i's share of total manufacturing employment in

[37] As noted by Ellison and Glaeser (1997), many industries consist of a few large firms producing the bulk of the output in a particular industry because of increasing returns to scale; examples of this include the vacuum cleaner industry (SIC 3635). About 75 percent of the workers in this industry are concentrated in only four states. But as Ellison and Glaeser explain, the observed concentration of the vacuum cleaner industry is not due to external economies of scale or the micro-determinants of agglomeration; rather, it is due to internal economies of scale resulting in a heavily skewed plant-size distribution.

[38] This Gini index is also known as Ellison-Glaeser's index of raw geographical concentration.

region m, and X_m represents total manufacturing employment in region m. We define industry i's location quotient in region m to be $LQ_{im} = S_{im}/X_m$. This measure can be further illustrated by a four-quadrant figure where each quadrant represents a region. As shown in Figure B6, total manufacturing employment is uniformly distributed across the four regions (e.g., $X_1 = X_2 = X_3 = X_4 = 0.25$), but employment in industry i is not (e.g., $S_{i1} = 0.10$, $S_{i2} = 0.20$, $S_{i3} = 0.30$, $S_{i4} = 0.40$). Using the formula given above, the location quotients are $LQ_{i1} = 0.4$, $LQ_{i2} = 0.80$, $LQ_{i3} = 1.20$, and $LQ_{i4} = 1.60$. From these quotients, it is evident that employment in industry i is more agglomerated in region 4 relative to region 1 because $LQ_{i4} > LQ_{i3} > LQ_{i2} > LQ_{i1}$.[39]

The spatial concentration also can be measured using a locational Gini coefficient. Figure B7 is a graphical representation of the locational Gini coefficient in which we plot the shares of total manufacturing employment (X_m) by region on the horizontal axis and industry i's employment shares on the vertical axis of a 1 x 1 square. The diagonal line AB bisects the square. The area of the lower triangle ABC is equal to 0.5. The bowed line represents the case when values of S_{im} and X_m are as given in Figure B6. The diagonal line represents the case when $S_{im} = X_m = 0.25$ as shown in Figure B6. In Figure B7, the area of the space between the diagonal and the bowed line is identified as θ_1; the remaining area of the lower triangle ABC is identified as θ_2. By construction, the total

[39] Gallagher (2007) has a similar four-quadrant exposition of the construction of locational quotient (LQ_{im}) and a brief discussion of other measures of agglomeration and co-agglomeration. In this paper we discuss the construction of the Locational Quotient (LQ_{im}) and Ellison-Glaeser Index of Raw Geographic Concentration (EGGi) in similar fashion but using different numbers.

area of the triangle ABC indicated by θ_1 and θ_2 is 0.5. Thus, the overall locational Gini coefficient in the region is = $\theta_1/ (\theta_1 + \theta_2) = \theta_1/0.5$.

If $S_{im} = X_m = 0.25$—i.e., if industry i's employment shares (to be measured on the vertical line) are equal to the shares of total manufacturing employment (measured horizontally on the AC line) across the 4 regions—then plots of these shares would result in the disappearance of the bowed line as this line would resemble the diagonal line AB, implying the value of θ_1 to be 0 and, thus, G_i to 0. When the shares of manufacturing employment across regions are equal, but industry i's employment shares vary across the four regions as in our previous example in Figure B6, the bowed line would emerge. Using the ratios shown in Figure B6, we can calculate $\theta_1 = 0.163$ and $G_i = 0.163/0.50 = 0.326$. Now, suppose that industry i's employment is solely concentrated in a single region in our hypothetical four-region economy. In this case, $\theta_2 = 0$, $\theta_1 = 0.5$; thus $G_i = 1.0$. So the locational Gini coefficient varies between 0 and 1.0, and agglomeration is increasing in G_i.

Ellison and Glaeser's Gini index (EGG_i) is another well-known measure of industrial agglomeration and is defined as $EGG_i \equiv \sum_{m=1}^{M} (X_m - S_{im})^2$ where, as before, X_m is region m's share of total manufacturing employment and S_{im} is industry i's share of total manufacturing employment in region m. EGG ranges between 0 and 1.0, and agglomeration is increasing in EGG. Returning to our previous example, $EGG_i = (0.25 - 0.10)^2 + (0.25 - 0.20)^2 + (0.25 - 0.30)^2 + (0.25 - 0.40)^2 = 0.05$. This index appeals to many researchers due to its ease of construction.

The problem with this approach of measuring agglomeration is that a value $EGG_i > 0$ does not necessarily mean that industry i is agglomerated as a result of external

economies of scale. For example, suppose an industry is made up of a small number of large plants and that this industrial structure is the result of increasing returns to scale. In this case, EGG_i will take on a large value, but the value is the result of economies of scale of this industry and not due to the micro-determinants of agglomeration.[40] To overcome this issue, Ellison and Glaeser (1997) propose the following measure:

$$EGI_{is} = \frac{EGG_{is} - (1 - \sum X_{is}^2)H_{is}}{(1 - \sum X_{is}^2)(1 - H_{is})}$$, where $H_{is} = \sum_{k=1}^{K} Z_{isk}^2$ is a Herfindahl index for the K plants of industry i in state s, and Z_{isk} represents the employment share of the *k*th plant of industry i in state s.[41] In the case of a perfectly competitive industry with a large number

[40] As an example, Ellison and Glaeser (1997) referred to the situation of the U.S. vacuum cleaner industry (SIC code 3635). Roughly 75 percent of the total employment in this sector is contained in one of the four largest plants, but this concentration is driven by the inherent organization of the industry and not necessarily the agglomeration forces. The EGI was developed "to facilitate comparisons across industries, across countries or over time. When plants' location decisions are made as in the model, differences in the size of the industry, the size and distribution of plants, or the fineness of the geographic data that are available should not affect the index." (Ellison & Glaeser, 1997, p. 890).

[41] Rosenthal and Strange (2001), Bertinelli and Decrop (2005), and many other researchers have used the Ellison-Glaeser Index (EGI) as a measure of agglomeration. The Herfindahl index is calculated for the plant size distribution of each industry in a particular year in a particular state using the county business pattern data.

of small plants, H_{is} approaches zero, and EGI_{is} approaches $EGG_{is}/(1-\sum X_{is}^2)$.[42] In this case, EGI measures spatial concentration and, unlike the Gini coefficient (EGG_{is}), is independent of industrial organization due to economies of scale.[43] According to this measure, EGI_{is} takes on a value of zero when industry i is not concentrated in some region(s) but is spread evenly, as could result from a random location process. EGI_{is} takes on a positive value when industry i is concentrated in some region(s). In short, we use EGI because this measure of industrial agglomeration controls for industry-specific agglomeration due to internal economies of scale and thus provides a measure of industrial agglomeration due to external economies of scale related to micro-determinants of agglomeration, natural advantage, transportation costs, and other external factors.[44]

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[42] We calculate the Herfindahl index using the median employment for different plant-size levels for each industry and the year covered in the study.

[43] Innovative use of the Herfindahl index in the construction of EGI controls for influence of skewed plant-size distribution on the measurement of relative density of agglomeration.

[44] One drawback of the Ellison-Glaeser index is the difficulty in interpreting the values. For example, an agglomeration index of 0.20 does not have an obvious meaning, except for comparison purposes. However, the advantages of this measure seem to outweigh its drawbacks, particularly in the current context. We also use Gini index as a measure of agglomeration as this traditional measure is simpler with its value ranging between 0 and 1. On the other hand, the EGI can be either positive or negative indicating agglomeration or deagglomeration respectively.

Now we will discuss the construction of the proxy variables for the micro-determinants of agglomeration and the set of control variables. We employ five proxy variables for labor pooling. Two out of five of these variables are based on educational profiles of the work force. These two variables (LP1 and LP2) are quite familiar in the empirical literature, as Rosenthal and Strange (2001) and others have used similar variables. Two out of the remaining three LP variables (LP3 and LP4) are also common in empirical literature. Using an additional proxy variable (LP5), although less common in the previous empirical literature, is intuitive.[45] Our first proxy for labor pooling (LP1) is as follows: $LP1_{ist} = \left[\frac{\text{Employees with bachelor's degree}}{\text{Total number of employees}} \right]_{ist}$. This proxy variable accounts for employees who have a four-year college degree. The reason for using educational-profile-based LP variables is that a worker's specialization often rises with the length of academic training he or she receives, and agglomeration enables firms to hire workers with industry-specific skills. Table A69 shows the ten industries with the highest value of LP1 in 1988 in our data sample. Industries with a higher ratio of

[45] Two variables, "per employee value-added net of cost of materials" (LP4) and "ratio of wages to shipment" (LP5), are created using the Annual Survey of Manufacturers (ASM) geographic area series data. These proxy variables mainly capture the economic dimension of labor used in the manufacturing production process. On the other hand, the first three labor-pooling proxies are constructed using Current Population Survey (CPS) data, and these variables mainly consider either educational profile (e.g., share of employees with a bachelor's degree) or managerial intensity (e.g., ratio of managerial employees to all employees) of the work force.

employees with bachelor's degrees include bakeries (SIC 205), electronic computers, storage devices, terminals (SIC 357), fertilizers, pesticides and agro-chemicals (SIC 287), medicinal chemicals (SIC 283), primary metal industries (SIC 332 and SIC333), etc. We will discuss the construction of additional LP variables in section 4. Now we proceed with discussing other micro-determinants and control variables used in the baseline model.

The goods-pooling (GP) variable is constructed using data from the Annual Survey of Manufacturers (various years). GP is the ratio of the cost of materials to the value of shipments: $GP_{ist} = \left[\frac{\text{Cost of materials}}{\text{value of shipments}} \right]_{ist}$. Since the cost of materials is positively correlated with the weight of the inputs, industries in which the cost of materials is high also employ materials that weigh a lot. Understandably, such industries have incentives to save on transportation costs by locating in close proximity to the sources of these heavy inputs. Table A70 shows the top ten industries with the highest values of GP among the industries in our 1988 sample. These industries tend to be weight-losing or input-heavy. For example, the main input of the meat-packing industry (SIC 201) is butchered cows, goats, hogs, and lambs. These live animals constitute the major source of input costs and also weigh a lot. Therefore, the meat-packing industry can conserve on transportation costs by locating in proximity to the source of livestock. A similar rationale accounts for the high rank of the rubber, plastic hose, and belting industry (SIC 305) and so on for the other industries listed in Table A70.

We use two proxies for idea pooling. We use IP1 in our baseline equation, which is the ratio of employees with post-graduate degrees to all employees:

$IP1_{ist} = \left[\frac{\text{Employees with post - graduate degree}}{\text{Total number of employees}} \right]_{ist}$. The reason for this measure of IP is that industries with higher shares of employees with more specialized training are more innovative and hence would be more sensitive to idea-pooling-driven agglomeration. This variable is constructed using the CPS data. Table A71 shows the ten industries with the highest values of IP1 among the 76 industries in our 1988 sample. We expect the signs of the coefficients of these micro-determinants to be positive, but we expect the signs of the interaction variables to be negative. We will discuss the IP2 along with the other four proxies of LP in the next section, as these variables are not part of our baseline equation. Now we will discuss other variables used in the baseline equation.

We construct the variable "average duty rate" (ADR) by 3-digit SIC codes as follows: $ADR_{st} = \left[\frac{\text{Duty collected}}{\text{Dutiable value of import}} \right]_{it}$. Data for this variable are collected from the U.S. International Trade Commission (USITC) database. We expect the sign of the coefficient of ADR to be positive. The rationale is that an increase in tariff barriers would make imports costlier to the home market and, as a result, import-substituting domestic manufacturing will thrive, causing an increase in agglomeration. Figure B8 displays trends of ADR from 1988 to 2003. We see ADR displayed modest increase in the early 1990s, but displayed steep decline since 1994 and then showed modest rise again in the late 1990s but the rate remains well below its pre-1994 level. This general decreasing trend in ADR can be attributed to increased trade liberalization since the early or mid-1990s.

Following Rosenthal and Strange (2001), we use the ratio of inventory-to-value of shipments as a proxy for transportation costs, the idea being that highly perishable goods

(such as dairy products, newspapers, and so on) have a lower inventory-to-shipment ratio. Therefore, industries producing perishable goods should locate in proximity to their consumers to reduce their transportation costs. Assuming that the consumers of such products are widely dispersed, industries with high transportation costs due to the perishability of their output will also be widely dispersed. This variable is constructed from the year-end-inventory data reported in the Annual Survey of Manufactures (geographic area series). These data are available up to 1997. For subsequent years in our sample, we impute year-end inventory data using the mean values of the previous years. We expect the sign of the estimated coefficient of this inverse proxy for transportation costs (i.e., inventory-to-shipment) to be positive. The explanation is that industries with relatively fewer perishable products would incur lower transportation costs and therefore would display more agglomeration. On the other hand, industries with highly perishable products would incur higher average transportation costs per unit of distance and therefore would locate close to consumer concentrations, resulting in less agglomeration.

We employ control variables for proximity to natural resources. More specifically, we use energy costs per dollar of shipment as proxy variables for the importance of proximity-to-natural-resource cost in firm location decisions. This variable is constructed using data from the Annual Survey of Manufactures (geographic area series). We expect the sign of the estimated coefficient of this variable to be negative as found in earlier empirical literature (e.g., Rosenthal and Strange, 2001; Linn, 2009). The rationale is that industries agglomerate where energy costs are relatively cheaper. We also use other control variables, such as minimum wage and corporate income tax. The minimum wage data are collected from the Bureau of Labor Statistics, and corporate

income tax rates are collected from the Book of the States published by the Council of State Governments.

We expect the signs of the estimated coefficients for minimum wage to be negative as found in most empirical literature that examined the effect of minimum wage on employment (e.g., Rohlin, 2007; Thompson, 2009). However, there are some empirical studies that have found otherwise (Card and Krueger, 2000). The prediction of negative impact of minimum wage is couched on the rationale that an increase in these rates would potentially decrease profitability for incumbent firms or industries and thus would discourage employment and industrial agglomeration. Theoretical predictions and empirical findings regarding corporate income tax are also mixed. For example, Baldwin and Krugman (2003) develop a theoretical model showing that tax rate hikes may not cause a decline in agglomeration if concentration creates "agglomeration rent," allowing fiscal authorities to charge higher tax rates without triggering a capital flight from the jurisdiction. Bartik (1985) uses plant location data across manufacturing industries for the years 1972 and 1978 and finds that a 10 percent increase in state-level corporate-income tax would cause a decline of about 3 percent in the number of new plants. Gius and Frese (2000) find the influence of CIT on industrial agglomeration to be statistically insignificant.

In constructing the panel data for the period 1988 to 2003, we have to bridge data across two industrial classification regimes. Since 1997, the U.S. has begun using a new industrial classification system known as the North American Industrial Classification System (NAICS), which replaced the earlier Standard Industrial Classification (SIC) system. The Bureau of Census provides a bridge table between 4-digit SIC industries and

6-digit NAICS industries. There is a legend that indicates the relative comparability of the SIC industries and the corresponding NAICS industries. The legends are: a complete bridge, a slightly open drawbridge, and an open drawbridge. A complete bridge indicates that the corresponding SIC and NAICS industries are perfectly bridgeable. For these industries, we are able to construct a complete time series. A slightly open drawbridge indicates that the corresponding SIC and NAICS industries do not deviate by more than 3 percent based on sales. An open drawbridge indicates that the corresponding data, if bridged, would contain a deviation of more than 3 percent based on sales across SIC and NAICS regimes. Due to this feature of our data, we use two samples. Our primary sample is constructed using those industries with a strong bridge between SIC and NAICS. We also construct a sample using the slightly open drawbridge as a test of the robustness of our results to the choice of samples.

At the 3-digit SIC code level, there are 139 industries. Due to the switching of industrial classification regimes from SIC to NAICS as described above, and due to constraints of data availability and missing values for some explanatory variables, we are limited to analyzing the agglomeration situation for a maximum of 76 3-digit SIC industries. In Table A72 we list all the 3-digit SIC codes and in Table A73 we list the 3-digit SIC codes for which such bridges are constructed for regression analysis.

As previously noted, we exclude Alaska and Hawaii from our sample. The resulting sample consists of 29,184 observations. Furthermore, we have to exclude 21,450 observations due to unavailability of data and in some cases due to reporting agencies' disclosure obligations. The final sample consists of 7,734 observations. In order to measure the impact of ICTs and trade liberalization on agglomeration, we need to

study the years before and after the mid-1990s to estimate differential effects of these dual forces of globalization on industrial agglomeration in the U.S. manufacturing industry. Table A74 reports the descriptive statistics for each of the variables used in this analysis for both the weak and strong bridges. The mean values of EGI using the strong bridge and weak bridge samples are 0.210 and 0.205, respectively. EGG (Gini index) has mean values of 0.496 and 0.481 for the strong bridge and weak bridge samples, respectively. The mean values for the Herfindahl index for strong bridge and weak bridge samples are 0.453 and 0.438, respectively. The mean values for LP1, GP, and IP1 are 0.113, 0.491, and 0.035 respectively. The mean value for the variable transportation costs (proxies by inventory-to-shipment) is 0.14. The variables for energy-cost-to-value-of-shipment ratio and maximum corporate-income tax rates have mean values of 0.025 and 6.727, respectively. The mean value for state minimum wage rates is 4.01.

We examine both robust standard errors and clustered standard errors. Robust standard errors are resistant to errors in the result, produced by deviations from classical assumptions such as normality of distribution (Huber, 2009). Clustered standard errors (by states) are relevant because observations within a cluster are thought to be correlated as a result of unobserved cluster effects (Woodridge, 2002). We report only clustered standard errors in this paper due to space constraints since the difference between these two kinds of standard deviations turned out to be statistically insignificant.

Estimation Results

We report the parametric results for four regression models in Tables A75 through A78. In Tables A75 and A76, we report estimation results for ordinary least squares (OLS) and fixed effect (FE) regressions of our main agglomeration measure-EGI, constructed using strong bridge and weak bridge manufacturing employment data across SIC and NAICS regimes. In Tables A77 and A78 we report estimation results for ordinary least squares (OLS) and fixed effect (FE) regressions of another agglomeration measure (Gini index). Each table contains four regression results presented in separate columns. The first two columns report estimation results of strong bridge data samples for OLS and FE specifications, respectively. The third and fourth columns report estimation results of weak bridge data samples for OLS and FE specifications, respectively. We incorporate a new variable average duty rate (ADR) in the variant models estimation, the results of which are reported in Tables A76 and A78. This variable measures the impact of trade liberalization. Also, the incorporation of an interaction term D95 (i.e., ADR × T95) allows us to decompose the total effect of globalization on micro-determinants of agglomeration into two separate forces: technological advancement and trade liberalization. More specifically, the difference in the magnitude of the coefficients of the two interacted variables (i.e., T95 and D95) would allow us to estimate the impact of technological advancement and trade liberalization separately on micro-determinants since the mid-1990s.[46]

[46] As T95 implies globalization due to technological advancement and trade liberalization, and ADR represents trade liberalization, the difference of the interaction-

Table A75, column 2, reports the estimated results for our baseline specification. Consistent with the previous literature, the signs of the coefficients for the proxies of LP, GP, and IP are positive and, in most cases, statistically significant at conventional levels. Also, estimated coefficients of variables of interest are generally negative and statistically significant in most cases, consistent with the hypothesis that the relative influence of the micro-determinants of agglomeration has attenuated since the mid-1990s due to globalization resulting from technological advancements and trade liberalization. Now we will discuss the estimated results of the baseline model (column 2) and other models in Table A75. Then we will briefly analyze the results of the variant models as presented in Tables A76 through A78. For convenience of comparisons, we express the magnitude and direction of influence of the key regressors and their interactions in terms of both estimated coefficients and their standard deviations.[47]

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variable pairs should give us the impact of technological progress on micro-determinants of agglomeration.

[47] In addition to reporting results using the estimated coefficients of variables of interest, we report results in terms of standard deviations of these key variables in order to provide a more accessible format or more tractable information regarding the impact of the micro-determinants on industrial agglomeration. For some of us, understanding the relative magnitude of a change may be easier if it is expressed in terms of standard deviation of that variable. To many, statements like "one standard deviation increase in the value of the micro-determinant X would cause an increase in the EGI by 0.5 standard deviation.…" may seem easier to visualize or grasp than statements like "a 1-unit

The estimated coefficients of LP1 in Table A75, column 2, are positive and statistically significant at conventional levels. The results in column 2 imply that a 1-unit increase in the value of LP1 would increase the magnitude of agglomeration by about 0.16 units. Alternatively, when the value of LP1 increases by 1 standard deviation, EGI rises by 0.06 standard deviation. The results are generally positive and statistically significant across the other three columns, indicating the OLS model for the strong bridge sample (column 1 of Table A75) and the OLS and FE models for the weak bridge sample (columns 3 and 4 of Table A75). This is consistent with the previous finding that labor pooling is one of the main reasons industries would agglomerate. The estimated coefficients for LP1× T95 are negative and statistically significant for both OLS and FE specifications for strong bridge agglomeration indices and negative but not significant for the FE model for the weak bridge sample. As per the estimated results in our baseline model, 1 unit increase in the value of the interaction variable would result in a decrease in agglomeration by about 0.32 units. In other words, an increase in the value of the interaction variable by 1 standard deviation causes agglomeration to decrease by 0.04 standard deviation. The negative sign of the estimated coefficients for the interaction variable LP × T95 lends support to our contention that globalization has attenuated the effect of LP on agglomeration. This result is plausible, as technological advancements and trade liberalization create possibilities for producing more output with fewer workers, outsourcing production processes, importing inputs from foreign countries, and allowing some industrial workers to work remotely via telecommuting using the internet and other

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increase in the value of the micro-determinant X would cause the EGI to increase by 0.5 units....” Considering this, we report the results in both ways.

web-based ICTs. All of these forces together contribute to the attenuation of the impact of LP on agglomeration.

The signs of estimated coefficients for GP are generally positive and statistically significant at conventional levels. As in our baseline model in column 2 of Table A75, 1 unit increase in the value of GP would cause the agglomeration value to rise by 0.33 units. In other words, 1 standard deviation increase in the value of GP would increase the value of EGI by 0.10 standard deviation. These results are consistent with the existing literature that contends that industries with higher costs of intermediate inputs relative to value of shipment, or "input-heavy industries," are more likely to agglomerate. The signs of the estimated coefficients for the interaction variables GP × T95 are also positive and statistically significant at conventional levels, implying that even in a new phase of globalization "input-heavy" firms have economic incentives to agglomerate near sources of intermediate inputs. As in Table A75, column 2, 1 unit increase in the value of the interaction variable of GP would result in an increase in the value of EGI by 0.44. Alternatively, an increase in the value of the interaction term of GP by 1 standard deviation would cause the agglomeration value to go up by 0.183 standard deviation.

The estimated coefficients for IP1 are positive and statistically significant at conventional levels across OLS and FE models for the strongly bridged agglomeration index, which reinforces the findings in earlier literature that industries sensitive to innovation would agglomerate for the ease of idea pooling. In our baseline model, 1 unit increase in IP would cause agglomeration to rise by about 0.20 units. In other words, an increase in IP of 1 standard deviation would cause agglomeration to rise by about 0.04 standard deviations. However, in the weak bridge sample, the coefficients have mixed

signs (positive for the FE model but negative for the OLS model) and are not statistically significant. The signs of the coefficients for interaction variable IP1 × T95 are negative for both OLS and FE models in the strong bridge sample but positive for both the OLS and FE models in the weak bridge sample. In our baseline model, 1 unit increase in IP interaction variable (IP×T95) would result in a decrease of EGI by 0.09 units. In other words, 1 standard deviation increase in the value of IP interaction variable would cause agglomeration to decrease by about 0.05 of a standard deviation. However, the signs of this interaction variable in the weakly bridged sample are positive and statistically significant at the conventional level. This mixed result may imply that, despite the recent advances in ICTs, knowledge spillovers may still depend a great deal on geographical proximity. In other words, idea pooling is still constrained by space, and the prospects of knowledge spillover may diminish with geographical distance. Firms' ability to generate and share knowledge seems to rise when they are agglomerated as opposed to when they are spatially dispersed. The change in the intercept due to globalization is indicated by the estimated coefficients of the time variable T95. This variable is negative and statistically significant at conventional levels across strong and weak bridge samples, which lends support to our central hypothesis that overall U.S. manufacturing agglomeration has attenuated since the mid-1990s due to globalization. For the strong bridge sample, globalization leads to a reduction in the EGI value by about 0.49 units in our baseline model. In other words, 1 standard deviation increase in the value of T95 causes the intercept to decrease by 0.40 standard deviation, implying a decrease in agglomeration in the post-1995 period. For the weak bridge sample, the results are quite similar. The magnitude of reduction in the intercept due to change in the slope coefficient

in the post-mid-1990s is about 0.59 units, according to the OLS model and 0.44 percentage points according to the FE model. Now we discuss the results for the estimated coefficients of a set of control variables that include state-level maximum corporate income tax, state minimum wage, state-level energy cost relative to value of shipment, and inventory-to-shipment ratio as an inverse proxy for transportation cost.

The coefficients for state minimum wage are negative and statistically significant at conventional levels for FE models across strong bridge and weak bridge samples. This result is consistent with the view common in economic literature that a binding wage floor would have a negative effect on employment and, therefore, on agglomeration, although empirical studies occasionally find either no effect or a positive effect of state minimum wage on employment (e.g., Card and Krueger, 2000). In our baseline model, 1 unit increase in state minimum wage would decrease the value of EGI by 0.08 units. Alternatively, 1 standard deviation increase in the state minimum wage would decrease the EGI by 0.13 units. The interaction variable "minimum wage × T95" turns out to be generally positive across OLS and FE models and data samples. But the estimated coefficient is statistically significant only for the baseline model where 1 unit increase in the interaction variable of minimum wage would increase the EGI by 0.08 units. Alternatively, 1 standard deviation increase in the interaction variable (minimum wage × T95) would increase EGI by 0.33 standard deviations. The positive sign of the estimated coefficients implies that the state minimum wage rose more in the post-1995 years than in the pre-1995 years.

The sign of the estimated coefficient of state maximum corporate income tax rates (CIT) is positive but statistically insignificant across OLS and FE models for both strong

bridge and weak bridge data sets, which is consistent with some recent empirical and theoretical studies (e.g., Gius & Frese, 2002; Baldwin & Krugman, 2004). This finding is plausible when one perceives CIT as the price that incumbent firms pay for the consumption of a "business environment." The business environment is composed of physical, socio-economic, financial, and legal infrastructures, including safety, security, enforcement of contracts, access to communication, transportation, energy, and other basic utilities and amenities. When most of the components of "business environment" are provided publicly, CIT rates tend to be higher than when some of these services are privately provided.[48] Also, agglomeration creates "agglomeration rent," which fiscal authorities take share of raising the rates of CIT[[the last part of the sentence is unclear]]. In our baseline model, 1 unit increase in CIT would increase the EGI by about 0.01 units. Alternatively, 1 standard deviation increase in CIT would result in an increase in EGI by 0.07 standard deviation. The signs of the estimated coefficient for the interaction variable (CIT×T95) are mixed (positive for OLS models and negative for FE models) and statistically insignificant. In our baseline model, 1 unit increase in the interaction variable

[48] For example, CIT rates could be low in some jurisdictions where access roads, power supply, and telecommunication services are inadequate or police patrol services are underprovided. In those jurisdictions incumbent firms would be forced to make side payments to build or rent privately provided power stations, access roads, communication networks, and security services. Under such scenarios, firms' total expenditures on "business environment" would not change with the changes in CIT rates, as "you get what you pay for." As a result, CIT rates may not be an important determinant in firms' location decisions.

(CIT × T95) would decrease the EGI by about 0.01 units. Alternatively, 1 standard deviation increase in the CIT interaction variable would reduce EGI by about one tenth of a standard deviation. The sign of the estimated coefficient for energy cost-to-value of shipment is negative and statistically very significant for OLS models across strong bridge and weak bridge samples. However, the sign of the estimated coefficient for the FE models are mixed (negative for strongly bridged agglomeration indices and positive for weakly bridged agglomeration indices). In our baseline model, 1 unit increase in the energy-cost-to-value-of-shipment ratio would decrease EGI by 0.25 units. Alternatively, 1 standard deviation increase in the ratio of energy-cost-to-value-of-shipment would decrease EGI by about one tenth of a standard deviation. This result is consistent with empirical literature (e.g., Rosenthal and Strange, 2001). The sign of the estimated coefficients for the interaction variable (energy cost × T95) is positive but not statistically significant.

The coefficient for the variable inventory-to-value-of-shipment is positive and statistically significant at conventional levels across both OLS and FE models for strong bridge samples, which is consistent with previous empirical studies. This variable is used in the previous literature (e.g., in Rosenthal & Strange, 2001) as a reverse proxy for transportation cost. The justification is that industries that produce fewer perishable products would have a higher inventory-to-shipment ratio as the cost of storage for nonperishable goods is relatively cheaper than that for perishable goods. These industries would incur a relatively lower transportation cost per unit of distance because, holding other things constant, transportation costs for perishable goods are on an average higher than those for relatively non-perishable goods. Therefore, industries with relatively less

perishable products (measured by higher inventory-to-shipment ratio in our data samples) would display more agglomeration than industries with relatively more perishable products. Thus, the inventory-to-shipment ratio serves as an inverse proxy of transportation cost. The desired sign of the estimated coefficients of this variable is negative as reported in some earlier studies (e.g., Rosenthal & Strange, 2001), which matches with our estimated coefficients for a weak bridge sample. But in the strong bridge sample we find the sign of the estimated coefficient to be positive, implying that as an industry's inventory-to-shipment ratio rises, the industry becomes more agglomerated.[49] The sign of estimated coefficients of the interaction variable for inventory-to-shipment ratio is generally positive and statistically significant at conventional levels, with the exception in the OLS model for the strong bridge sample where the sign of the estimated coefficient is negative (although statistically not significant). The R-squared value is low in both OLS and FE models, which is a measure of goodness of fit. The R-squared values for estimated models reported in Table A75 range from 1 percent to 2 percent for the OLS models. However, the R-squared value

[49] Rosenthal and Strange (2001) focus on the differential in cost of transportation per unit of distance regarding shipment of perishable products vs. non-perishable products. The haulage per unit of distance may be higher for perishable products as shipment of these goods would require special vehicles and other arrangements, such as refrigerator trucks, air-conditioned warehouses, etc. However, if industries produce perishable goods in significantly larger quantities relative to the output in the industries with relatively more perishable products, then it is possible that firms with less-perishable products may also tend to agglomerate to save on transportation costs.

increases in the FE models, with values ranging from 6 percent to 8 percent. The low R-squared ratio is consistent with the existing empirical literature (e.g., Rosenthal & Strange, 2001; Overman & Puga, 2009) common in agglomeration studies and may indicate that some omitted industry-level attributes could bias our estimates.

Table A76 reports the regression results when we include an average duty rate (ADR) to measure the impact of trade liberalization on agglomeration and to disaggregate the total effect of globalization into the effects of technological advances and trade liberalization. In order to accomplish these objectives, we have all regressors interact with a hybrid interaction variable D95, which was constructed by interacting the average duty rate (ADR) and time variable for globalization (T95). Thus, D95 is equal to ADR × T95. Now we will analyze the estimated coefficients of some variables of interest from the strong bridge sample as reported in column 2 of Table A76 and make general comments about the estimated coefficients presented in other columns of this table. In discussing the estimated coefficients in Tables A76 through A78, we will focus mainly on analyzing how we separate impact of technological advancement and trade liberalization.

Let us recall that estimated coefficients of variables that are interacted with T95 measure the influence of both technological advancement and trade liberalization. On the other hand, variables that are interacted with D95 measure the influence of trade liberalization. Therefore, the difference between these two interaction variables would capture the impact of technological advancement. The estimated coefficients of LP1 are all positive and statistically significant at conventional levels across both specifications and data samples and are consistent with the empirical literature. As shown in column 2

of Table A76, 1 unit (1 standard deviation) increase in LP1 would increase the EGI by 0.20 units (0.07 standard deviation). Now, let us take a look at the interaction variable LP1 × D95. As reported in column 2 of Table A76, 1 unit (1 standard deviation) increase in the value of LP1 would decrease the value of EGI by about 0.04 units (0.004 standard deviation). Now let us separate the impact of technological advancements and trade liberalization on agglomeration using differentials in the values of the estimated coefficients for the interaction variable of LP1 as in Table A75 (i.e., LP1 × T95) and Table A76 (i.e., LP × D95). As expected, the absolute value of the estimated coefficient for LP1 × T95 in column 2 of Table A75 (-0.32) is greater than that for LP1 × D95 (-0.04) as in column 2 of Table A76. Now we can take the difference of the values of these two estimated coefficients and contend that, out of an estimated total decline of 0.32 units in agglomeration due to attenuation of effectiveness of LP1, a decrease of 0.28 units can be attributed to the impact of technological advances, and the remaining 0.04 unit decrease can be attributed to trade liberalization.[50]

The coefficients for GP are all positive and statistically very significant. The value of the estimated coefficient for GP×D95 in column 2 of Table A76 is 0.013, which implies that 1 unit (1 standard deviation) increase in the interaction variable of GP would cause agglomeration to increase by 0.01 unit (0.06 standard deviation). This increase can

[50] The estimated coefficient of LP1 × T95 measures the impact of globalization, which includes the impact of technological advancement and trade liberalization, and the estimated coefficient of LP1 × D95 measures the impact of trade liberalization. Thus the difference between these two estimated coefficients indicates the impact of technological advancement.

be attributed to trade liberalization. The difference between the estimated coefficients for interaction variables GP × T95 and GP × D95 would account for the impact of technological advancement on EGI, which is 0.43 units (1.15 standard deviations).

The coefficients for IP1 are positive and statistically significant at conventional levels for the strong bridge sample but positive and statistically insignificant for the weak bridge sample. The estimated coefficient for the IP × D95 in column 2 of Table A76 indicates that 1 unit (1 standard deviation) increase in the interaction variable IP × D95 would decrease EGI by 0.01 (0.001 standard deviation). This decrease in agglomeration due to attenuation in the effectiveness of IP as a micro-determinant can be attributed to trade liberalization. The difference between the estimated coefficients IP × T95 and IP × D95 is 0.073. This decrease in the agglomeration index by 0.073 (0.20 standard deviation) may be attributed to the impact of technological progress.

The signs of coefficients with ADR, minimum wage, CIT, energy, and inventory-to-shipment ratio are all similar to those in 7475. The sign and magnitude of estimated coefficients of the interaction of these control variables may provide us with some significant insights. The coefficient for minimum wage × T95 is positive, but the estimated coefficient of the interaction variable (minimum wage × D95) is negative for OLS models, indicating that while technological advancement may have increased the minimum wage (possibly by increasing the productivity of manufacturing workers as shown in Figure 4), trade liberalization may have exposed U.S. workers to tougher foreign competition and may have put downward pressure on minimum-wage growth. As shown in Table A76, column 2, 1 unit (1 standard deviation) increase in the value of the variable “minimum wage × D95” would increase agglomeration by about 0.001 units

(0.002 standard deviations), which can be attributed to trade liberalization. The difference between the estimated coefficients of "minimum wage × T95" and "minimum wage × D95" is 0.079 units, which may imply that the minimum wage has increased by 0.079 units due to a technology-driven productivity improvement.

The estimated coefficients for the interaction variables CIT × D95, energy cost × D95, and inventory-to-shipment × D95 are -0.001, -0.078, and 0.098, respectively, in Table A76, column 2, indicating these variables' influence on EGI in a fraction of units that can be attributed to trade liberalization when the value of these regressors increases by 1 unit. The difference between the interaction variables of CIT is 0, which may imply that CIT is associated with trade liberalization and not with technological advancement. The value of the estimated coefficient of the interaction variable energy × T95 is 0.286 and that of the interaction variable energy × D95 is -0.078, which implies that technological advancement and trade liberalization may have opposite impacts on the influence of energy cost on industrial agglomeration. Due to technological advancement, EGI is positively influenced by energy price, and due to trade liberalization EGI is negatively influenced by the energy price. Trade liberalization exposes domestic producers to fierce foreign competition when the influence of energy cost as a determinant of agglomeration becomes more effective. The difference between the interaction variables of inventory-to-shipment ratio is 0.841 units, which can be attributed to the influence of technological advancement.

This disaggregation of impact of technological advancement and trade liberalization on key regressors relies on the assumption that the omitted variable bias, if any, goes into the error terms and is not correlated with the regressors. We test this

assumption by plugging in both kinds of interaction terms (T95 and D95) in the same regression. We find that the signs and values of the estimated coefficients of key variables are generally consistent with those reported in Tables A75 and A76 with few exceptions in the signs of the estimated coefficients of the interaction variable for IP, which turns out to be positive in the combined regression, differing from what we report in column 2 of Tables A75 and A76. The R-squared values are quite low for both OLS and FE models in Tables A75 and A76, with values ranging from 0.01 to 0.03 for OLS models and values ranging from 0.06 to 0.09 for FE models. As noted earlier, the relatively lower R-squared values reported in Tables A75 and A76 may imply that there are some omitted industry attributes, which could bias our estimates.

The results in Tables A77 and A78 are quite similar to those presented in Tables A75 and A76, with exceptions in the R-squared values. In Tables A77 and A78, the R-squared values for OLS models range from 0.37 to 0.42, and for FE models the values range from 0.44 to 0.48, which are higher than the R-squared values reported in Tables A75 and A76. This shows that incorporating the Gini index (EGG) instead of EGI as the regressand and including the Herfindahl index in the model as a regressor raise the goodness of fit, as is shown by the higher R-squared values reported in Tables A77 and A78. In addition, the increase in goodness of fit in these models may also imply that the use of EGG instead of EGI as a measure of agglomeration and inclusion of Herfindahl indices in the set of regressors may be a more effective approach in separating industrial-

organization-driven concentrations from industrial-concentration-driven agglomeration economies.[51]

The signs and statistical significance of the estimated coefficients of the interaction variables are consistent with our central hypothesis that a new phase of globalization beginning in 1995 is attenuating the forces of micro-determinants of agglomeration. Here we should mention that we also ran similar regressions using other proxies for LP (from LP2 to LP5) and using patent count as a proxy for idea pooling (IP2). Furthermore, we ran 2SLS models using time-lagged values as instruments for the micro-determinants. Finally, we estimated models with micro-determinants interacted with the globalization variable (T95) and trade liberalization variable (D95) and included these interaction variables in the same regression models. All of these variant models yielded results that are quite similar to those of the models reported in Tables A75 through A78.[52] Now we will briefly discuss the construction of these additional labor-

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[51] We gratefully acknowledge the advice of Stuart Rosenthal to include Herfindahl indices in the set of regressors and use EGG instead of EGI as the regressand. The regression results using Gini and Herfindahl indices are reported in Tables 9 and 10. The Gini measure of agglomeration is more traditional yet more intuitive, as its value ranges between 0 and 1. But EGI does not have such a closed range in the positive domain. Therefore, the Gini index can be more intuitive in understanding the changes in the magnitudes of agglomeration.

[52] We estimated 2SLS with a bootstrap variance error correction (1,000 and 5,000 replications).

pooling proxies (LP2 through LP5) and an alternative idea-pooling variable (IP2) with some brief comments regarding the estimation results when using these alternative variables.

The data for LP2 and LP3 are obtained from the Current Population Survey, and data for LP4 and LP5 are obtained from the County Business Pattern Survey conducted and published by the U.S. Bureau of Census. The second labor-pooling proxy (LP2) is the ratio of employees without a bachelor's degree to all employees: $LP2_{ist} = \left[\frac{\text{Employees without bachelor's degree}}{\text{Total number of employees}} \right]_{ist}$. This education-related labor proxy accounts for workers who do not have a four-year college degree. When we use this proxy for LP, all estimated coefficients of key variables bear expected signs, as in our baseline model, except for LP, which turns out to be negative. One explanation for this negative sign is that workers without a college degree are largely blue-collar workers who may not possess specialized skills and, as a result, may be more readily available across jurisdictions. Under such a scenario, industries may not need to agglomerate in a particular location to tap the benefits of labor pooling as the supply of blue-collar workers may be relatively abundant across locations.

Another proxy for labor pooling (LP3) is the ratio of managerial employees to total employees. More formally, $LP3_{ist} = \left[\frac{\text{Managerial employees}}{\text{Total number of employees}} \right]_{ist}$. This "brain vs. brawn" measure was used in Rosenthal and Strange (2001). The motivation is that if this ratio is very low for some industries, then the associated production process is perhaps more of a routine, and specialized skills are perhaps not very important for these industries.

We also use a couple of additional proxies for LP. We use per-employee net value added as a measure of the labor pooling, or:

$LP4_{ist} = \left[\frac{\text{Value of shipment} - \text{cost of material}}{\text{Total number of employees}} \right]_{ist}$. Industries with higher per-employee value added may indicate that employees in these industries possess more specialized skills than their counterparts in industries with relatively lower per-worker value added. Therefore, firms with a high value of LP4 would gain a cost advantage by locating in proximity to a source of highly skilled labor. This variable is constructed using data from the Annual Survey of Manufacturers, a geographic area data series. Another proxy for labor pooling (LP5) is the ratio of wages to value of shipment, or

$LP5_{ist} = \left[\frac{\text{Wages}}{\text{Value of shipment}} \right]_{ist}$. Industries with higher wages-to-value-of-shipment ratios are most likely to agglomerate due to labor pooling. All of these LP variables are widely used in the existing literature except LP5. The reason for use of these variables is that industries requiring specialized labor would be more inclined to employ workers with higher academic training and would agglomerate to tap the benefits of cost savings via skills matching. Also, industries with higher wages-to-value-of-shipment may also indicate workers with specialized skills, which may cause industries to agglomerate to tap the benefits of LP. Regressions using all of these proxy variables yield estimated coefficients that are generally consistent with our hypothesis and previous empirical studies in terms of their signs.

The second proxy for IP is the number of patents awarded to industry i in state s in year t, divided by 1,000: $IP2_{ist} = \left[\frac{\text{Total Patent count}}{1000} \right]_{ist}$. The explanation for this

measure is that industries with higher patent counts are intensive users of R&D. Therefore, these industries would agglomerate to tap the benefits of knowledge spillovers. This variable is constructed using data from the United States Patent and Trademark Office (USPTO). These data are available at the 2-digit SIC codes level by state and year. However, our current study is at the 3-digit SIC codes level. Following Chen and Yang (2005), we assign the patent counts at the 2-digit SIC code level to the corresponding 3-digit SIC industries.[53] We list the top ten industries that turn out to be the most innovative industries as per the IP2 variable in Table A79. These industries include industrial machinery (SIC 35), electronic and other electric equipment (SIC 36), instruments and related products (SIC 38), and chemical and allied products (SIC 28).

It seems that the decline in U.S. manufacturing employment and attenuation of influence of traditional micro-determinants are largely due to technological advancement and trade liberalization. However, the future availability of firm-level micro-data, along with firm-level data regarding use of ICTs, would enable us to examine the trends of agglomeration and changes in the relative forces of micro-determinants with more robustness and statistical significance.

Arguably, the use of micro-data and innovative research approaches would refine the process of isolation of firm-selection effects and industrial-organization effects from agglomeration economies. However, we have to be careful about the context dependence of agglomeration economies when generalizing the estimation results across jurisdictions nationally or internationally. Some recent meta-studies (e.g., Melo, Graham and Noland,

[53] Table 2 in the Appendix shows the ten industries with the highest values of IP2 among the 76 industries in our 1988 sample.

2009) contend that estimation results of agglomeration economies tend to display significant variations across time and space and, therefore, estimates for any particular empirical context may have limited relevance when we change the time dimension and/or jurisdiction boundaries or industrial sectors.

In this section we also report regression results depicting the differential impacts of globalization on micro-determinants of agglomeration across industries, depending on their information intensity.[54] The regression results suggest that in the internet era (i.e., after the mid-1990s), the influence of LP and GP for information-intensive manufacturing industries has diminished relative to industries that are not intensive users or information. The influence of IP seems to have increased in the internet era for industries that are relatively intensive users of information and, hence, perhaps of information technology. These regression results are presented in Tables A81 through A84 for interested readers.

[54] Porat (1977) classified U.S. industries into two broad categories: intensive users of information vs. non-intensive users of information. Recently, Bas and Miribel (2005) incorporated Porat's classifications in listing IT-industries vs. non-IT industries across all SIC industries. We use these lists in creating dummy variables for IT-intensive vs. non-IT intensive sectors. Table A80 presents the list of IT-intensive 3-digit SIC industries.

Conclusion

As shown in figures B1 through B5, declines in U.S. manufacturing employment and manufacturing output as shares of GDP and increases in U.S. manufacturing output and manufacturing labor productivity have gained momentum in recent years. Arguably, technological advancement and exposure to stiff foreign competition via trade liberalization are jointly instrumental in these phenomena. On one hand, increased productivity of the U.S. manufacturing workforce may increase agglomeration in the U.S. manufacturing industries, as more productive labor would provide more positive externalities via LP and IP. On the other hand, technological progress and trade liberalization, along with increased labor productivity of U.S. workers, may cause deagglomeration as these developments may allow U.S. manufacturers to produce target levels of output with fewer workers, import inputs at cheaper prices, and outsource production processes to other countries to tap the benefits of cheap labor. Because of these two opposing possibilities and their potential long-run impact on both the U.S. and world economies, the empirical examination of the impact of globalization on the three micro-determinants of agglomeration is of serious interest to both academic researchers and policy practitioners.

As is revealed in the regression results, the influence of micro-determinants of agglomeration has attenuated since 1995. This trend is apparent in the sign and magnitude of the estimated coefficients associated with interaction variables, as these coefficients in most cases are negative and statistically significant at conventional levels across model specifications, different variables for LP, and across strong bridge and weak bridge data samples. These findings are consistent with current theory, and our

hypotheses lend support in favor of our contention that there occurred a structural break in the U.S. economy in or around 1995, which was jointly caused by wide adoption of ICTs and recent liberalization of international trade. In the aftermath, the productivity of U.S. labor rose, U.S. manufacturing jobs were lost, and the micro-determinants of industrial agglomerations began losing effectiveness. Some are apprehensive that this erosion of manufacturing employment and the consequential weakening of influence of micro-determinants on industrial agglomeration may not only reduce incentives for new firms to agglomerate, but also may reduce existing firms' potential to harness the benefits of agglomeration economies. Future research efforts may include undertaking simulation studies in order to benchmark some critical mass of economic cost-saving opportunities offered by micro-determinants of agglomeration, below which the agglomeration would self-degenerate. Also, use of more innovative and sophisticated proxies for LP, GP, and IP could be used to enrich the estimation as more recent micro-data regarding U.S. manufacturing industries becomes available. Future availability of firm-level micro-data sets would enable us to examine the trends of agglomeration and their determinants with more robustness and statistical significance.

CHAPTER IV: CONCLUSION AND POLICY IMPLICATIONS

The rapid and significant decline in manufacturing employment is well documented. U.S. manufacturing employment is now in its lowest since 1950. The deagglomeration trends are predominant between 1988 and 2003. According to the EGI measure at the national level all of the twenty most agglomerated 3-digit SIC industries in 1988 displayed deagglomeration in 2003. Also, thirteen out of twenty least agglomerated industries in 1988 displayed deagglomeration in 2003. These trends are suggesting that most of the U.S. manufacturing industries initially agglomerated due to Jacob externalities that attenuate over time as industries attenuate. For these industries, increasing returns to scale comes in the form of knowledge spillover that facilitates product innovations. On the other hand, Marshall-Arrow-Romer externalities facilitate process innovation. As industries mature, agglomeration due to M-A-R externalities increase as matured industries gain more knowledge to share regarding efficient methods of production. One policy implication of this analysis is that in order to increase agglomeration, U.S. industrial and regional development policy planners can provide fiscal and other infrastructural and regulatory incentives to increase opportunities of M-A-R externalities by creating industrial parks where similar kinds of industries can collocate and exchange process innovation related knowledge.

As ensues from the Chapter 3 discussions and analysis , technological advancement is perhaps a stronger influence on mciro-determinants of agglomeration than trade liberalization. Therefore, policy planners should emphasize more on technological infrastructure to provide incentives for domestic firms to rely more on ‘insourcing’ as opposed to ‘outsourcing’. Also, goods pooling is a more robust kind of

micro-determinant of agglomeration than labor pooling and idea pooling. Despite technological advancement and trade liberalization, firms using expensive yet indivisible inputs would continue to have economic incentives to agglomerate in proximity to similar firms. Therefore, policy planners may want to adopt policies that would encourage 'physical input-heavy firms' to call U.S. home. These physical input-heavy firms are less susceptible to new phase of globalization due to internet and trade liberalization that is engulfing U.S. manufacturing landscape since the mid 1990s.

APPENDIX A-TABLES

TABLE A1 State Level Total Manufacturing Employment, 1988-2003

States*	1988	1993	1998	2003	Change between 1988 & 2003	States' rank by percent change in employment
Alabama	353,712	383,385	352,422	279,074	-21%	25th
Alaska	10,167	14,226	12,117	9,934	-2%	40th
Arizona	183,427	179,459	199,616	165,057	-10%	33rd
Arkansas	212,363	235,349	232,671	208,843	-2%	41st
California	2,140,959	1,878,709	1,827,350	1,510,049	-29%	13th
Colorado	184,893	189,415	173,403	138,642	-25%	19th
Connecticut	383,455	313,180	246,125	199,274	-48%	3rd
Delaware	67,621	64,506	43,511	37,807	-44%	6th
Florida	517,930	477,485	428,642	369,754	-29%	14th
Georgia	580,809	567,029	535,051	449,486	-23%	23rd
Hawaii	22,467	19,728	14,535	14,346	-36%	8th
Idaho	54,316	67,898	66,719	61,764	14%	45th [+]
Illinois	1,033,272	978,517	883,472	705,922	-32%	11th
Indiana	620,193	636,495	635,658	547,580	-12%	30th
Iowa	219,610	231,353	245,282	221,027	1%	43rd [+]
Kansas	192,883	189,145	196,519	175,387	-9%	34th
Kentucky	262,052	284,185	290,665	260,951	-0.01%	42nd
Louisiana	163,435	180,903	171,549	149,603	-8%	35th
Maine	105,734	88,469	80,640	65,475	-38%	7th
Maryland	231,375	194,598	163,123	147,326	-36%	9th
Massachusetts	600,730	475,516	409,938	318,766	-47%	4th
Michigan	948,943	906,672	828,751	679,638	-28%	17th
Minnesota	387,642	393,043	378,392	339,507	-12%	31st
Mississippi	224,900	242,787	230,175	172,618	-23%	24th
Missouri	432,073	411,157	382,003	308,755	-29%	15th
Montana	20,544	22,693	20,686	18,255	-11%	32nd
Nebraska	94,558	103,372	109,645	103,588	10%	44th [+]
Nevada	26,243	29,084	39,029	41,216	57%	50th [+]
New Hampshire	110,611	93,642	101,513	78,183	-29%	16th
New Jersey	684,408	546,873	405,275	338,414	-51%	1st
New Mexico	35,841	42,638	40,561	32,973	-8%	36th
New York	1,249,626	1,000,281	752,511	612,983	-51%	2nd
North Carolina	862,766	848,483	771,282	591,566	-31%	12th
North Dakota	16,269	19,224	23,209	22,575	39%	49th [+]
Ohio	1,119,170	1,046,039	994,788	838,725	-25%	20th
Oklahoma	154,804	161,668	168,140	142,725	-8%	37th
Oregon	208,623	210,957	211,636	180,084	-14%	29th
Pennsylvania	1,051,180	935,205	818,215	682,547	-35%	10th
Rhode Island	114,087	89,842	74,181	60,020	-47%	5th
South Carolina	374,828	369,891	343,295	283,244	-24%	21st
South Dakota	29,408	38,019	48,082	36,512	24%	47th[+]
Tennessee	496,633	513,568	482,811	393,832	-21%	26th
Texas	938,491	968,342	986,892	861,690	-8%	38th
Utah	94.934	110.748	124.504	108.774	15%	46th [+]
Vermont	46.838	44.537	44.836	39.310	-16%	28th
Virginia	429,930	404,065	368,397	308,571	-28%	18th
Washington	326,080	328,223	335,467	247,824	-24%	22nd
West Virginia	86,217	80,540	74,424	69,610	-19%	27th
Wisconsin	530,128	549,049	566,219	489,984	-8%	39th
Wyoming	8,320	9,370	8,916	10,368	25%	48th [+]
U.S. Total	19,253,371	18,174,011	16,936,918	14,121,652	-27%	

Note: * States with increase in manufacturing employment between 1988 & 2003 are indicated by plus [+].

TABLE A2 Ten States with Highest Attrition Rates of Manufacturing Employment between 1988 & 2003

States	Manufacturing employment in 1988	Manufacturing employment in 2003	Percent change in manufacturing employment
New Jersey	684,408	338,414	-51
New York	1,249,626	612,983	-51
Connecticut	383,455	199,274	-48
Massachusetts	600,730	318,766	-47
Rhode Island	114,087	60,020	-47
Delaware	67,621	37,807	-44
Maine	105,734	65,475	-38
Maryland	231,375	147,326	-36
Pennsylvania	1,051,180	682,547	-35
Illinois	1,033,272	705,922	-32

Note: Hawaii lost 36% manufacturing jobs relative to its 1988 employment and thus made a tie with Maryland in terms of percent attrition of manufacturing employment for this year. States are ranked in descending order by attrition rates in percent of manufacturing employment between 1988 & 2003.

TABLE A3 U.S. Census Divisions Ranked By Percent Change in Manufacturing Employment between 1988 And 2003

Census division	Manufacturing employment in 1988	Manufacturing employment in 2003	Percent change in manufacturing employment
Middle Atlantic	2,985,214	1,633,944	-45
New England	1,361,455	761,028	-44
South Atlantic	3,151,476	2,257,364	-28
Pacific	2,708,296	1,962,237	-28
East North Central	4,251,706	3,261,849	-23
East South Central	1,337,297	1,106,475	-17
West South Central	1,469,093	1,362,861	-7
Mountain	608,518	577,049	-5
West North Central	940,370	898,596	-4

Note: Nine U.S. census divisions are ranked in descending order by attrition rates in percent of manufacturing employment between 1988 & 2003.

TABLE A4 Top Twenty 3-Digit SIC Industries Ranked by Manufacturing Employment in 1988 and Their Employment Trends for Subsequent Years Through 2003

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
371	Motor vehicles	739,044	722,563	802,253	691,004	-7
308	Misc. plastic products	629,099	680,928	787,654	706,003	12
372	Aircraft and parts	614,338	507,425	438,867	308,750	-50
275	Commercial printing	569,216	576,879	604,451	522,516	-8
367	Electronic equip.	557,993	520,517	600,259	394,381	-29
271	Newspapers	441,254	415,131	401,373	384,716	-13
344	Fabric. Structural metal	409,960	389,786	464,611	430,221	5
381	Search, navigation equip.	359,401	233,036	188,186	148,741	-59
201	Meat products	349,919	405,136	239,391	256,834	-27
233	Women's, juniors' wear	342,417	295,224	241,053	116,829	-66
357	Computer, office equip.	338,369	234,894	268,067	190,168	-44
359	Industrial machinery	311,185	314,430	381,225	300,267	-4
382	Measuring, controlling	300,456	261,839	263,235	221,289	-26
251	Household furniture	289,490	261,953	267,432	227,625	-21
232	Men's and boys' wear	280,158	264,630	193,014	71,883	-74
354	Metalworking machinery	278,755	262,544	249,806	175,864	-37
349	Misc. fabricated metal	277,233	265,524	308,629	255,923	-8
331	Men's and boys' suits	266,435	234,796	217,993	180,792	-32
366	Communications equip.	258,986	229,317	272,634	165,638	-36
346	Metal forgings	258,592	238,274	273,337	218,156	-16

TABLE A5 Top Twenty 3-Digit SIC Industries Ranked in Descending Order by Rate of Decrease in Employment between 1988 And 2003

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
279	Printing trade services	69,489	61,019	12,569	7,556	-89
387	Watches, clocks	13,404	6,971	7,419	2,649	-80
314	Footwear	72,320	50,234	30,371	15,049	-79
234	Women's & kids wear	64,432	48,725	36,182	14,158	-78
302	Rubber and plastic ware	12,730	12,477	7,836	3,114	-76
278	Blankbooks & binding	71,386	65,033	28,857	18,161	-75
232	Men's and boys' wear	280,158	264,630	193,014	71,883	-74
348	Ordnance and ammun.	91,396	58,143	37,447	27,222	-70
315	Leather gloves, mittens	2,979	3,171	2,045	901	-70
376	Guided missiles	219,623	125,586	80,007	66,419	-70
317	Handbags, leather goods	16,384	11,722	8,500	5,263	-68
233	Women's, juniors' wear	342,417	295,224	241,053	116,829	-66
236	Girl's, children's wear	65,332	51,795	55,547	24,064	-63
221	Broadwoven fabric mills	71,691	55,710	44,350	26,471	-63
396	Costume jewelry	32,456	27,501	22,144	12,677	-61
225	Knitting mills	203,842	192,037	150,359	80,512	-61
223	Broadwoven fabric mills	14,286	14,211	9,618	5,753	-60
381	Search, navigation	359,401	233,036	188,186	148,741	-59
211	Cigarettes	34,034	24,928	20,943	15,269	-55
386	Photographic equip.	87,124	73,615	61,508	42,078	-52

TABLE A6 Top Twenty 3-Digit SIC Industries Ranked by Rate of Increase in Employment between 1988 & 2003

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
212	Cigars	2,441	2,129	6,626	6,520	167
213	Tobacco	3,226	3,275	11,693	8,561	165
351	Engines and turbines	87,840	83,198	252,453	209,827	139
379	Misc. transportation	50,373	47,007	113,812	107,701	114
253	Public building furniture	22,124	29,467	42,657	44,836	103
375	Motorcycles, bicycles	8,075	12,583	16,986	16,122	100
328	Cut stone and stone goods	12,421	12,123	15,159	23,314	88
207	Fats and oils	30,472	29,813	58,067	53,975	77
384	Ordnance and accessories	215,552	273,600	385,937	375,752	74
283	Drugs	174,440	199,700	217,111	251,855	44
254	Partitions and fixtures	75,080	72,894	103,735	105,910	41
399	Misc. manufacturing	166,351	156,477	235,942	234,561	41
352	Farm and garden equip.	91,419	90,782	155,953	123,527	35
272	Periodicals	116,488	111,836	131,942	155,812	34
229	Miscellaneous textile	57,410	55,497	90,796	72,093	26
243	Millwork, plywood	239,180	229,019	262,676	290,382	21
345	Screw machine products	97,594	91,421	138,476	116,631	20
286	Industrial org. chemicals	123,129	122,368	179,733	146,713	19
313	Footwear cut stock	5,755	4,176	10,535	6,608	15
323	Glass products	52,033	56,340	65,824	58,677	13

TABLE A7 Trends of Top Ten Manufacturing Industries in New England Division Ranked by Employment, 1988

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988
372	Aircraft and parts	70,001	49,797	12,101	11,217	-84
367	Electronic components	63,396	58,872	35,397	19,478	-69
357	Computer & office equip.	49,441	27,031	5,257	3,609	-93
308	Misc. plastic products	47,822	43,423	14,840	11,805	-75
382	Measuring equip.	45,148	37,615	20,331	13,424	-70
275	Commercial printing	38,940	33,345	31,042	23,518	-40
354	Metalworking machinery	24,770	19,443	8,892	4,955	-80
355	Special ind. machinery	24,228	19,668	10,916	5,750	-76
344	Fabricated structural metal	24,042	19,112	9,310	6,914	-71
384	Medical instruments	23,516	32,043	23,002	22,295	-5

TABLE A8 Trends of Bottom Ten Manufacturing Industries in New England Division Ranked by Employment, 1988

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
339	Misc. primary metal products	990	5,799	772	500	-49
281	Industrial inorganic chemicals	1,543	842	36	18	-99
234	Women's, children's wear	2,453	1,588	11	19	-99
206	Sugar and confectionery	2,676	1,620	335	340	-87
305	Hose, belting, gaskets	2,901	1,811	2,110	2,050	-29
336	Girls' & children's outerwear	3,029	2,356	470	435	-86
254	Partitions and fixtures	3,243	1,918	1,391	2,082	-36
201	Meat products	3,373	3,403	369	361	-89
373	Ship and boat building	4,569	11,004	1,179	680	-85
279	Printing trade services	4,669	3,593	379	176	-96

TABLE A9 Trends of Top Ten Manufacturing Industries in Middle Atlantic Division Ranked by Employment, 1988

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
233	Women's, juniors' wear	110,550	89,413	54,919	23,183	-79
275	Commercial printing	101,941	91,979	78,261	68,354	-33
367	Electronic components	100,660	73,209	20,518	14,272	-86
308	Misc. plastic products	95,348	89,864	44,387	35,583	-63
344	Fabricated structural metal	64,166	50,495	26,104	24,684	-62
283	Drugs	60,280	56,512	24,990	25,778	-57
331	Blast furnace and basic steel	60,248	47,291	7,390	12,781	-79
371	Motor vehicles and equip.	57,853	41,024	3,999	2,352	-96
382	Measuring equipment	54,151	38,385	16,972	12,347	-77
267	Misc. paper products	49,353	40,977	7,461	5,052	-90

TABLE A10 Trends of Bottom Ten Manufacturing Industries in Middle Atlantic Division Ranked by Employment, 1988

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
299	Misc. petroleum & coal	2,353	2,639	130	266	-89
324	Cement, hydraulic	2,520	2,219	758	597	-76
305	Hose, belting, gaskets	3,133	2,516	1,220	1,520	-51
228	Yarn and thread mills	3,212	2,274	2,734	910	-72
295	Asphalt paving and roofing	4,119	3,300	386	95	-98
379	Misc. transport. equip.	6,086	4,327	1,374	1,444	-76
317	Handbags & leather products	6,167	3,050	675	217	-96
396	Costume jewelry & notions	6,278	4,941	1,176	241	-96
226	Textile finishing	6,502	5,331	4,884	1,568	-76
365	Household audio & video	6,533	7,357	1,034	682	-90

TABLE A11 Trends of Top Ten Manufacturing Industries in East North Central Division Ranked by Employment, 1988

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
371	Motor vehicles & equip.	420,03	401,32	76,554	52,77	-87
308	Misc. plastic products	194,08	214,37	86,230	81,45	-58
346	Metal forgings & stampings	154,12	142,92	92,510	76,70	-50
354	Partitions and fixtures	141,15	138,09	80,055	53,93	-62
275	Commercial printing	130,55	139,00	99,010	87,12	-33
331	Blast furnace and basic steel	121,15	107,13	32,994	36,39	-70
359	Industrial machinery	88,777	95,143	72,179	55,81	-37
356	General industrial machinery	82,776	79,975	25,593	19,90	-76
344	Fabricated structural metal	82,237	80,531	34,115	29,41	-64
349	Misc. fabricated metal	80,831	76,881	28,861	24,63	-70

TABLE A12 Trends of Bottom Ten Manufacturing Industries in East North Central Division Ranked by Employment, 1988

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
396	Costume jewelry	787	1,242	397	69	-91
226	Textile finishing	1,680	1,590	102	34	-98
391	Jewelry, silverware	2,569	1,826	294	740	-71
299	Misc. petroleum products	3,646	4,072	678	879	-76
238	Misc. apparel	3,714	3,036	855	44	-99
295	Asphalt paving materials	4,032	3,110	680	578	-86
325	Structural clay products	5,061	5,015	141	515	-90
253	Public building furniture	6,090	10,848	5,932	3,890	-36
233	Women's, juniors' wear	6,797	5,310	861	543	-92
386	Photographic equip.	7,634	5,468	384	658	-91

TABLE A13 Trends of Top Ten Manufacturing Industries in West North Central Division Ranked by Employment, 1988

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
201	Meat products	75,099	86,015	7,480	5,779	-92
371	Motor vehicles	53,955	53,776	696	1,516	-97
275	Commercial printing	53,199	59,110	42,465	35,695	-33
372	Aircraft and parts	46,279	36,092	15,352	34,232	-26
308	Misc. plastic products	41,015	49,925	15,773	11,236	-73
357	Computer and office	32,109	21,135	313	313	-99
344	Fabr. structural metal	30,020	32,684	7,617	6,432	-79
359	Industrial machinery	26,226	29,519	13,559	11,358	-57
353	Construction machinery	25,316	21,915	2,039	977	-96
367	Electronic components	24,585	26,360	8,029	4,750	-81

TABLE A14 Trends of Bottom Ten Manufacturing Industries in West North Central Division Ranked by Employment, 1988

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
339	Misc. primary metal	851	866	374	167	-80
343	Plumbing and heating	1,087	419	196	112	-90
305	Hose, belting, gasket	1,776	921	781	312	-82
345	Screw machine products	2,859	5,483	4,096	3,629	27
306	Fabr. rubber products	2,912	5,754	330	231	-92
329	Misc. nonmetallic mineral	3,362	5,968	87	18	-99
373	Ship and boat building	4,264	281	1,268	1,294	-70
265	Paperboard containers	4,457	3,641	3,919	4,201	-6
254	Partitions and fixtures	4,927	7,613	4,093	2,700	-45
273	Books	5,112	14,650	1,911	1,452	-72

TABLE A15 Trends of Top Ten Manufacturing Industries in South Atlantic Division Ranked by Employment, 1988

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
225	Knitting mills	119,282	111,734	24,100	14,734	-88
251	Household furniture	112,139	99,496	47,343	37,694	-66
228	Yarn and thread mills	90,879	76,391	20,372	9,595	-89
275	Commercial printing	80,669	81,949	62,171	52,644	-35
232	Men's and boys' wear	78,911	73,949	2,604	353	-100
201	Meat products	77,872	90,182	1,421	1,864	-98
308	Misc. plastic products	76,714	87,873	25,939	22,986	-70
233	Women's, juniors' wear	69,454	51,069	8,600	1,882	-97
344	Fabricated structural metal	60,844	52,585	20,193	18,817	-69
371	Motor vehicle & parts	60,247	61,970	709	982	-98

TABLE A16 Trends of Bottom Ten Manufacturing Industries in South Atlantic Division Ranked by Employment, 1988

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
339	Misc. primary metal	622	855	27	176	-72
391	Jewelry, silverware	1,872	2,192	803	392	-79
365	Household audio & video	2,371	5,204	129	296	-87
395	Pens, pencils, office equip.	2,416	2,907	112	66	-97
396	Costume jewelry	2,644	3,029	45	14	-99
379	Misc. transportation	3,437	4,406	729	503	-85
295	Asphalt paving and roofing	4,141	3,575	32	76	-98
347	Metal services	6,354	7,211	1,904	1,950	-69
238	Misc. apparel, accessories	6,438	6,204	1,574	443	-93
279	Printing trade services	6,829	7,243	1,017	448	-93

TABLE A17 Trends of Top Ten Manufacturing Industries in East South Central Division Ranked by Employment, 1988

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
371	Motor vehicles, equip.	50,877	67,589	4,091	3,273	-94
251	Household furniture	46,365	51,224	9,725	5,437	-88
233	Women's, juniors' wear	36,046	31,308	429	34	-100
308	Misc. plastic products	35,897	44,703	5,911	10,372	-71
344	Fabricated structural metal	32,407	33,765	8,887	6,137	-81
242	Sawmills and planing mills	31,122	31,373	6,499	4,021	-87
275	Commercial printing	30,345	32,422	18,570	14,665	-52
225	Knitting mills	24,671	29,552	7,363	421	-98
349	Misc. fabricated metal	20,110	18,583	2,086	908	-95
282	Plastic & synth. materials	19,629	22,174	2,301	2,024	-90

TABLE A18 Trends of Bottom Ten Manufacturing Industries in East South Central Division Ranked by Employment, 1988

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
345	Screw machine products	2,455	2,996	399	310	-87
278	Blankbooks and bookbinding	2,541	2,835	183	82	-97
279	Printing trade services	2,560	2,533	272	99	-96
254	Partitions and fixtures	3,279	4,512	1,407	924	-72
284	Soaps, cleaners and toiletries	3,756	4,693	492	308	-92
329	Misc. nonmetallic mineral	4,469	4,163	503	268	-94
347	Metal services	4,697	5,249	1,422	1,052	-78
259	Misc. furniture and fixtures	4,893	3,624	168	231	-95
355	Special industry machinery	6,214	6,027	658	78	-99
229	Miscellaneous textile goods	6,473	7,268	0	113	-98

TABLE A19 Trends of Top Ten Manufacturing Industries in West South Central Division Ranked by Employment, 1988

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
372	Aircraft and parts	69,764	59,693	7,344	5,558	-92
201	Meat products	53,959	68,636	4,525	2,819	-95
344	Fabr. structural products	49,293	57,024	29,951	29,283	-41
367	Electronic components	42,913	54,827	45,215	31,510	-27
286	Industrial org. chemicals	40,023	46,653	13,817	8,826	-78
308	Misc. plastic products	39,344	50,765	28,121	17,824	-55
353	Construction & related	36,163	34,717	7,833	6,618	-82
275	Commercial printing	35,845	39,281	33,145	29,117	-19
232	Men's & boys' furnishing	34,768	39,730	1,864	444	-99
349	Misc. fabricated metal	31,806	34,754	12,236	10,973	-65

TABLE A20 Trends of Bottom Ten Manufacturing Industries in West South Central Division Ranked by Employment, 1988

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
395	Pens, pencils, off. supplies	793	1,167	67	249	-69
384	Medical instruments	841	14,572	6,132	5,715	580
339	Misc. primary metal	1,178	1,422	1,794	1,501	27
324	Cement, hydraulic	1,900	1,897	428	949	-50
259	Misc. furniture and fixtures	2,156	3,587	2,545	2,657	23
365	Household audio & video	2,170	1,047	94	48	-98
345	Screw machine products	2,182	2,873	2,755	2,274	4
238	Misc. apparel & accessories	2,514	2,586	2,100	262	-90
391	Jewelry, silverware	2,671	2,871	688	653	-76
343	Plumbing & heating equip.	2,802	2,664	422	33	-99

TABLE A21 Trends of Top Ten Manufacturing Industries in Mountain Division Ranked by Employment, 1988

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
367	Electronic components	45,352	50,344	29,628	19,362	-57
271	Newspapers	23,771	24,234	16,225	15,220	-36
275	Commercial printing	22,056	24,008	20,100	16,373	-26
344	Fabricated structural metal	14,009	16,127	9,563	7,903	-44
382	Measuring and controlling	13,127	15,555	4,771	1,255	-90
243	Millwork, plywood	13,038	15,501	7,278	8,212	-37
242	Sawmills and planing mills	12,835	7,924	1,876	2,753	-79
384	Medical instruments, supplies	12,412	19,311	7,254	6,934	-44
201	Meat products	11,057	13,351	995	385	-97
359	Industrial machinery	10,903	11,901	8,610	5,710	-48

TABLE A22 Trends of Bottom Ten Manufacturing Industries in Mountain Division Ranked by Employment, 1988

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
331	Blast furnace and basic steel	63	4,870	7	28	-55
322	Glass and glassware	84	403	33	10	-88
238	Misc. apparel accessories	143	141	89	60	-58
365	Household audio & video	271	903	4	18	-93
364	Electric lighting and wiring	383	1,259	554	193	-50
396	Costume jewelry and notions	436	704	335	207	-52
326	Pottery and related products	517	813	40	35	-93
206	Sugar and confectionery	550	2,620	21	182	-67
345	Screw machine products	788	1,253	1,467	127	-84
284	Soaps, cleaners, toiletries	892	4,013	253	69	-92

TABLE A23 Trends of Top Ten Manufacturing Industries in Pacific Division Ranked by Employment, 1988

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
367	Electronic components	155,48	141,95	143,35	82,422	-47
372	Aircraft and parts	126,59	97,563	30,413	34,327	-73
357	Computer and office	106,86	74,294	61,923	21,068	-80
308	Misc. plastic products	80,460	80,259	64,286	48,340	-40
233	Women's & juniors' wear	80,047	85,405	80,363	53,911	-33
275	Commercial printing	73,789	74,541	70,004	60,482	-18
382	Measuring equip.	73,657	59,438	50,034	38,834	-47
243	Millwork, plywood	61,773	45,983	23,034	27,691	-55
359	Industrial machinery	54,555	43,491	52,052	34,974	-36
344	Fabricated structural metal	52,773	47,162	45,668	38,984	-26

TABLE A24 Trends of Bottom Ten Manufacturing Industries in Pacific Division Ranked by Employment, 1988

3-digit SIC code	Industry description	1988 emp.	1993 emp.	1998 emp.	2003 emp.	Percent change between 1988 & 2003
317	Handbags, personal goods	1,157	712	316	907	-22
226	Textile finishing	2,109	2,345	2,805	3,579	70
396	Costume jewelry, notions	2,339	3,070	1,846	1,102	-53
324	Cement, hydraulic	2,569	1,912	1,299	1,296	-50
325	Structural clay products	2,652	2,107	216	364	-86
287	Agricultural chemicals	2,676	3,426	531	863	-68
281	Industrial inorg. chemicals	2,690	5,297	1,625	801	-70
282	Plastic & synth. materials	2,744	2,495	1,388	1,868	-32
339	Misc. primary metal	3,105	2,251	2,504	1,917	-38
305	Hose, belting, gaskets	3,189	3,779	3,239	3,204	1

TABLE A25 Trends of Twenty Most Agglomerated Industries Ranked by National Average Ellison-Glaeser Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
372	Aircraft and parts	1.229	0.091	0.556	0.301	-76
322	Glass and glassware	0.896	0.172	0.400	0.653	-27
325	Structural clay products	0.885	0.163	0.726	0.148	-83
286	Industrial organic chemicals	0.733	0.528	0.522	0.334	-55
259	Misc. furniture and fixtures	0.722	0.203	0.274	0.152	-79
373	Ship and boat building	0.683	0.501	-0.003	-0.141	-121
339	Misc. primary metal products	0.673	-0.027	0.171	-0.124	-118
332	Iron and steel foundries	0.670	0.488	0.538	0.491	-27
206	Sugar and confectionery	0.659	0.385	0.582	0.211	-68
341	Metal cans	0.648	0.547	0.498	0.404	-38
252	Office furniture	0.642	0.356	0.512	0.408	-37
226	Textile finishing	0.636	0.338	0.802	0.394	-38
299	Misc. petroleum and coal	0.635	0.556	0.955	0.600	-6
335	Nonferrous rolling and	0.628	-0.107	0.401	0.033	-95
314	Footwear	0.624	0.214	0.706	-0.015	-102
245	Wood buildings, mobile	0.623	0.645	0.282	0.053	-92
351	Engines and turbines	0.603	0.679	0.532	-0.880	-246
201	Meat products	0.601	0.346	0.529	0.349	-42
204	Grain mill products	0.589	0.102	0.669	0.311	-47
281	Industrial inorganic	0.586	0.356	0.543	0.388	-34

Note: Twenty agglomerated industries are ranked using Ellison-Glaeser Index (EGI) for the United Sates in 1988. The successive values of EGI for these industries are listed in a five year interval through 2003. The ranking is based on the EGI of weak bridge data sample consists of 139 three-digit SIC industries bridged across SIC and NAICS.

TABLE A26 Twenty Least Agglomerated Industries Ranked By National Average Ellison-Glaeser Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 &2003
333	Primary nonferrous metals	-0.134	0.109	0.802	0.494	468
324	Cement, hydraulic	-0.107	-0.106	0.521	0.386	459
308	Misc. plastic products	-0.051	-0.108	0.135	-0.052	-2
344	Fabricated structural metal	0.029	-0.078	0.087	0.003	-90
205	Bakery products	0.036	0.103	0.215	-0.043	-219
354	Metalworking machinery	0.074	-0.168	0.211	0.003	-95
265	Paperboard containers,	0.083	-0.118	0.053	-0.090	-208
359	Industrial machinery	0.091	0.022	0.022	0.003	-97
284	Soaps, cleaners, toilet goods	0.111	0.037	0.394	0.326	193
399	Misc. manufacturing	0.124	0.004	0.060	0.028	-78
347	Metal services	0.126	-0.062	0.161	-0.064	-151
243	Millwork, plywood	0.138	0.046	0.060	-0.059	-143
356	General industrial	0.148	-0.005	0.235	0.074	-50
349	Misc. fabricated metal	0.150	-0.035	0.316	-0.049	-133
355	Special industry machinery	0.153	0.088	0.209	0.175	15
345	Screw machine products	0.186	0.127	0.291	0.176	-5
279	Printing trade services	0.189	0.118	0.313	0.119	-37
395	Pens, pencils, office supplies	0.198	0.449	0.515	0.465	135
228	Yarn and thread mills	0.213	0.415	0.230	0.237	11
236	Girl's and children's	0.216	0.440	0.413	0.459	112

Note: Twenty agglomerated industries are ranked using Ellison-Glaeser Index (EGI) for 1988. The successive values of EGI for these industries are listed in a five year interval through 2003. The ranking is based on the EGI of weak bridge data sample consists of 139 3-digit SIC industries bridged across SIC and NAICS.

TABLE A27 Trends of Ten Most Agglomerated Industries in New England Division Ranked by Ellison-Glaeser Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
289	Misc. chemical products	1.616	0.296	0.785	-0.307	-119
278	Blankbooks and bookbinding	1.338	0.665	0.903	-0.069	-105
234	Women's & kids'	1.130	0.741	0.703	0.189	-83
339	Misc. primary metal products	1.079	-0.105	0.008	-0.131	-112
273	Books	1.072	0.216	0.655	0.219	-80
305	Hose, belting , gaskets	1.066	-0.074	-	-0.344	-132
372	Aircraft and parts	1.011	0.324	0.273	0.240	-76
335	Nonferrous rolling and	0.879	0.556	0.572	0.241	-73
275	Commercial printing	0.847	-0.144	-	-0.145	-117
396	Costume jewelry and notions	0.776	0.961	0.825	-0.060	-108

TABLE A28 Trends of Ten Least Agglomerated Industries in New England Division Ranked by Ellison-Glaeser Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
367	Electronic components	-0.178	-0.076	0.074	-0.027	85
356	General industrial	-0.160	0.275	0.290	-0.211	-31
347	Metal services	-0.146	-0.218	0.615	-0.141	3
329	Misc. nonmetallic mineral	-0.097	0.706	0.959	-0.024	75
384	Medical instruments	-0.090	0.029	0.580	-0.124	-38
265	Paperboard containers	-0.087	-0.139	-0.376	-0.890	-928
201	Meat products	-0.081	0.363	1.317	0.924	1,234
344	Fabricated structural metal	-0.059	-0.221	-0.002	-0.150	-155
349	Misc. fabricated metal	-0.044	0.216	0.443	-0.078	-79
354	Metalworking machinery	-0.036	-0.060	0.269	-0.182	-407

TABLE A29 Trends of Ten Most Agglomerated Industries in Middle Atlantic Division Ranked By Ellison-Glaeser Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
322	Glass and glassware	1.066	-0.047	1.095	0.815	-24
326	Pottery and related products	1.037	0.900	0.803	0.688	-34
343	Plumbing and heating, electric	1.021	0.535	0.639	0.229	-78
335	Nonferrous rolling and drawing	0.970	0.042	0.528	0.427	-56
299	Misc. petroleum and coal	0.879	0.721	0.933	0.542	-38
208	Beverages	0.870	0.313	-0.094	-0.094	-111
252	Office furniture	0.844	0.040	0.249	0.441	-48
372	Aircraft and parts	0.791	0.578	0.919	0.052	-93
245	Wood buildings and mobile	0.756	0.774	0.125	0.309	-59
295	Asphalt paving and roofing	0.751	0.537	0.563	0.258	-66

TABLE A30 Trends of Ten Least Agglomerated Industries In Middle Atlantic Division Ranked By Ellison-Glaeser Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 &2003
308	Misc. plastic products	-0.267	-0.232	-0.185	-0.211	21
265	Paperboard containers	-0.242	-0.578	-0.334	-0.499	-107
344	Fabricated structural metal	-0.159	-0.175	-0.169	-0.189	-18
349	Misc. fabricated metal	-0.137	-0.116	-0.084	-0.018	87
399	Misc. manufacturing	-0.129	-0.174	-0.141	-0.169	-31
324	Cement, hydraulic	-0.111	-0.109	0.010	0.859	874
354	Metalworking machinery	-0.098	-0.114	0.005	-0.070	29
347	Metal services	-0.095	-0.270	-0.173	-0.199	-109
289	Misc. chemical products	-0.085	-0.246	0.003	-0.019	77
359	Industrial machinery	-0.060	-0.170	-0.143	-0.201	-237

TABLE A31 Trends of Ten Most Agglomerated Industries in East North Central Division Ranked by Ellison-Glaeser Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
245	Wood buildings and mobile	1.102	0.779	0.606	0.703	-36
326	Pottery and related products	1.084	0.940	0.270	0.709	-35
373	Ship and boat building and	0.825	0.580	-0.017	-0.353	-143
273	Books	0.777	0.314	0.278	0.057	-93
372	Aircraft and parts	0.768	-0.139	0.756	0.610	-21
282	Plastic and synthetic materials	0.760	1.066	0.998	0.907	19
339	Misc. primary metal products	0.750	0.145	-0.145	-0.225	-130
305	Hose, belting , gaskets, packing	0.687	0.224	0.549	0.296	-57
259	Misc. furniture and fixtures	0.655	0.479	0.454	0.136	-79
379	Misc. transportation equipment	0.637	0.724	0.357	0.547	-14

TABLE A32 Trends of Ten Least Agglomerated Industries In East North Central Division Ranked By Ellison-Glaeser Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 &2003
359	Industrial machinery	-0.109	-0.177	-0.133	-0.160	-47
354	Metalworking machinery	-0.104	-0.140	-0.095	-0.109	-4
349	Misc. fabricated metal	-0.102	-0.193	0.048	-0.075	27
283	Drugs	-0.099	0.801	0.661	0.520	626
344	Fabricated structural metal	-0.096	-0.142	-0.070	-0.098	-2
347	Metal services	-0.085	-0.145	-0.127	-0.178	-111
346	Metal forgings and	-0.014	0.097	-0.033	-0.079	-462
356	General industrial machinery	-0.005	-0.040	0.063	-0.106	-1,930
399	Misc. manufacturing	-0.001	-0.048	-0.091	-0.097	-7,866
205	Bakery products	0.012	0.093	0.291	-0.010	182

TABLE A33 Trends of Ten Most Agglomerated Industries in West North Central Division Ranked by Ellison-Glaeser Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
373	Ship and boat building and	1.363	0.468	0.109	-0.122	-109
254	Partitions and fixtures	0.909	0.178	0.150	0.112	-88
201	Meat products	0.899	0.340	0.543	0.336	-63
336	Nonferrous foundries	0.853	0.536	0.953	-0.040	-105
251	Household furniture	0.819	0.660	0.054	0.074	-91
329	Misc. nonmetallic mineral	0.698	0.426	0.362	0.046	-93
339	Misc. primary metal products	0.658	0.469	0.712	-1.218	-285
283	Drugs	0.635	0.406	0.735	0.574	-10
382	Measuring and controlling devices	0.590	-0.497	0.396	0.016	-97
357	Computer and office equipment	0.588	0.134	0.523	-0.109	-119

TABLE A34 Trends of Ten Least Agglomerated Industries In West North Central Division Ranked By Ellison-Glaeser Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
347	Metal services	-0.145	0.035	0.039	-0.163	-12
289	Misc. chemical products	-0.089	0.008	0.566	0.119	234
345	Screw machine products,	-0.039	0.125	0.363	0.304	873
369	Misc. electrical equipment	-0.015	0.247	0.365	0.536	3,587
308	Misc. plastic products	0.036	0.073	0.063	0.447	1,144
399	Misc. manufacturing	0.095	0.304	0.003	0.082	-13
342	Cutlery, hand tools ,	0.097	-0.226	0.742	0.216	123
359	Industrial machinery	0.133	0.185	0.251	0.295	122
384	Medical instruments	0.133	0.149	0.542	-0.093	-170
346	Metal forgings and	0.156	0.076	0.815	0.030	-81

TABLE A35 Trends of Ten Most Agglomerated Industries in South Atlantic Division Ranked by Ellison-Glaeser Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
201	Meat products	1.216	0.440	0.875	0.784	-36
295	Asphalt paving and roofing	1.016	0.352	1.030	0.644	-37
306	Fabricated rubber products	0.996	0.156	0.832	0.274	-73
226	Sugar and confectionery	0.951	0.393	0.601	-0.056	-106
396	Costume jewelry and notions	0.935	0.325	0.914	0.587	-37
286	Industrial organic chemicals	0.921	0.845	0.705	0.305	-67
342	Sawmills and planing mills	0.899	0.387	0.528	0.337	-63
204	Grain mill products	0.872	0.882	0.800	0.601	-31
203	Preserved fruits and vegetables	0.865	0.509	1.137	0.964	12
252	Office furniture	0.839	0.326	0.722	0.174	-79

TABLE A36 Trends of Ten Least Agglomerated Industries In South Atlantic Division Ranked By Ellison-Glaeser Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 &2003
205	Bakery products	-0.143	0.690	0.269	0.174	222
359	Industrial machinery	-0.070	-0.169	-0.083	-0.088	-26
395	Pens, pencils, office supplies	-0.032	0.723	0.868	0.809	2,633
344	Fabricated structural metal	-0.021	-0.085	0.131	-0.003	86
308	Misc. plastic products,	-0.015	-0.133	0.034	-0.297	-1,824
355	Special industry machinery	0.007	0.143	0.305	0.344	5,140
279	Printing trade services	0.012	-0.085	0.157	0.040	246
228	Yarn and thread mills	0.017	0.264	0.125	0.276	1,504
242	Sawmills and planing mills	0.130	-0.078	0.110	-0.034	-126
239	Misc. fabricated textile	0.143	-0.080	0.037	-0.081	-157

TABLE A37 Trends of Ten Most Agglomerated Industries in East South Central Division Ranked by Ellison-Glaeser Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 &2003
233	Women's and juniors'	1.076	1.000	0.790	-0.397	-137
254	Partitions and fixtures	1.045	0.799	0.405	0.201	-81
259	Misc. furniture and fixtures	1.008	0.504	0.415	0.047	-95
353	Construction, related	0.984	0.567	0.257	0.523	-47
286	Industrial organic chemicals	0.974	1.078	1.018	0.761	-22
346	Metal forgings and	0.973	0.726	0.556	-0.019	-102
225	Knitting mills	0.944	0.429	0.673	1.000	6
204	Grain mill products	0.903	0.884	0.621	0.547	-40
373	Ship and boat building	0.887	0.312	0.325	0.336	-62
282	Plastic and synthetic	0.876	0.659	0.544	0.546	-38

TABLE A38 Trends of Ten Least Agglomerated Industries In East South Central Division Ranked By Ellison-Glaeser Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
242	Sawmills and planing mills	-0.020	-0.239	-0.058	-0.053	-168
359	Industrial machinery	0.027	-0.113	-0.067	-0.176	-764
354	Metal working machinery	0.071	0.000	0.125	0.237	232
245	Wood buildings, mobile	0.073	-0.078	0.138	1.045	1,324
308	Misc. plastic products	0.165	-0.316	0.187	-0.155	-193
344	Fabricated structural metal	0.184	0.098	0.345	0.033	-82
399	Misc. manufacturing	0.200	0.022	0.288	0.131	-35
384	Medical instruments	0.240	0.429	0.764	0.144	-40
251	Household furniture	0.271	-0.032	0.090	0.349	28
289	Misc. chemical products	0.292	0.404	0.901	0.324	11

TABLE A39 Trends of Ten Most Agglomerated Industries In West South Central Division Ranked By Ellison-Glaeser Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
232	Men's and boys' furnishings	1.122	0.871	0.831	0.162	-86
206	Sugar and confectionery	1.085	0.997	0.672	0.993	-8
339	Misc. primary metal products	0.907	0.609	0.637	0.295	-67
282	Plastic materials and	0.788	0.626	0.650	0.536	-32
273	Books	0.788	0.108	0.414	0.045	-94
331	Men's and boys' suits and	0.787	0.042	0.746	0.313	-60
201	Meat products	0.753	0.280	0.179	-0.063	-108
371	Motor vehicles and	0.732	0.278	0.439	0.130	-82
281	Industrial inorganic	0.724	0.110	0.757	0.440	-39
259	Misc. furniture and fixtures	0.707	-0.108	0.412	0.323	-54

TABLE A40 Trends of Ten Least Agglomerated Industries In West South Central Division Ranked By Ellison-Glaeser Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 &2003
283	Drugs	-0.302	-0.106	0.068	0.162	154
208	Beverages	-0.171	0.661	-0.103	-0.110	35
384	Medical instruments	-0.144	-0.139	0.372	0.296	306
324	Cement, hydraulic	-0.116	-0.114	1.319	-0.092	21
209	Misc. foods and kindred	-0.100	-0.006	0.093	-0.040	60
342	Sawmills and planing mills	-0.083	0.089	0.257	-0.052	38
359	Industrial machinery	-0.051	-0.153	-0.065	-0.137	-167
356	General industrial machinery	-0.016	-0.177	-0.020	0.193	1,297
369	Misc. electrical equipment	-0.008	-0.608	0.502	0.453	5,560
254	Partitions and fixtures	0.053	-0.017	0.066	0.172	226

TABLE A41 Trends of Ten Most Agglomerated Industries In Mountain Division Ranked By Ellison-Glaeser Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
242	Sawmills and planing mills	1.547	0.024	0.605	-0.064	-104
384	Medical instruments and	1.339	-0.112	0.874	-0.147	-111
254	Partitions and fixtures	1.302	0.059	0.333	-0.181	-114
233	Women's & juniors'	0.883	-0.416	1.061	1.296	47
353	Construction machinery	0.740	0.047	0.302	0.259	-65
391	Jewelry, silverware, plated	0.704	-0.136	0.126	0.076	-89
382	Measuring and controlling	0.681	0.221	0.187	0.148	-78
273	Books	0.589	0.350	0.296	-0.228	-139
204	Grain mill products	0.414	-1.563	0.665	0.301	-27
201	Meat products	0.394	0.665	0.712	0.709	80

TABLE A42 Trends of Ten Least Agglomerated Industries in Mountain Division Ranked By Ellison-Glaeser Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 &2003
284	Soaps, cleaners and toilet	-1.148	0.070	0.856	0.539	147
326	Pottery and related products	-0.933	0.681	-0.021	-0.105	89
345	Screw machine products,	-0.363	0.267	0.057	-0.040	89
373	Books	-0.205	1.565	-0.400	-0.396	-93
369	Misc. electrical equipment	-0.184	0.686	0.604	-0.014	93
308	Misc. plastic products	-0.150	-0.186	0.401	0.153	202
238	Misc. apparel and	-0.104	-0.088	1.122	1.150	1,200
245	Wood buildings, mobile	-0.086	0.545	0.422	-1.405	-1,537
209	Misc. foods and kindred	-0.062	-0.009	2.729	0.123	299
267	Misc. converted paper	-0.059	-1.894	-0.353	-0.377	-539

TABLE A43 Trends of Ten Most Agglomerated Industries in Pacific Division Ranked By Ellison-Glaeser Index Of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
245	Wood buildings and mobile	1.781	1.077	-0.152	0.306	-83
286	Industrial organic chemicals	1.627	0.089	-0.001	0.321	-80
281	Industrial inorganic chemicals	1.286	-0.003	0.132	0.116	-91
206	Sugar and confectionery	1.124	0.040	0.088	0.348	-69
259	Misc. furniture and fixtures	0.880	0.303	0.095	0.340	-61
341	Metal cans and shipping	0.856	0.417	-0.084	0.097	-89
325	Structural clay products	0.725	-0.425	0.401	0.322	-56
332	Iron and steel foundries	0.663	0.100	0.185	0.754	14
278	Blankbooks and bookbinding	0.608	-0.149	-0.045	0.051	-92
201	Meat products	0.537	-0.272	-0.045	0.053	-90

TABLE A44 Trends of Ten Least Agglomerated Industries in Pacific Division Ranked By Ellison-Glaeser Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 &2003
364	Electric lighting and wiring	-0.644	-0.119	-0.097	0.573	189
251	Household furniture	-0.467	-0.263	-0.009	0.765	264
308	Misc. plastic products	-0.308	-0.180	-0.045	-0.206	33
236	Girl's and children's outwear	-0.194	0.084	0.181	0.484	350
399	Misc. manufacturing	-0.124	-0.228	-0.150	-0.188	-52
295	Asphalt paving and roofing	-0.114	0.106	0.144	0.348	407
232	Men's and boys' furnishings	-0.113	-0.226	-0.148	-0.042	63
282	Plastic and synthetic	-0.110	-0.108	0.542	-0.065	41
344	Fabricated structural metal	-0.106	-0.231	0.007	0.011	110
243	Millwork, plywood	-0.103	-0.167	-0.104	0.054	152

TABLE A45 Twenty Most Agglomerated Industries Ranked By National Average Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 &2003
325	Structural clay products	0.816	0.545	0.738	0.591	-28
286	Industrial organic chemicals	0.727	0.628	0.584	0.572	-21
245	Wood buildings, mobile homes	0.725	0.717	0.479	0.561	-23
322	Glass and glassware	0.712	0.584	0.554	0.823	16
373	Books	0.709	0.567	0.264	0.241	-66
299	Misc. petroleum and coal	0.690	0.775	0.901	0.715	4
226	Textile finishing	0.678	0.531	0.656	0.473	-30
341	Metal cans and shipping	0.676	0.644	0.612	0.654	-3
259	Misc. furniture and fixtures	0.673	0.382	0.399	0.421	-37
339	Misc. primary metal products	0.670	0.464	0.395	0.371	-45
252	Office furniture	0.667	0.535	0.595	0.623	-7
314	Footwear	0.657	0.581	0.736	0.432	-34
372	Aircraft and parts	0.623	0.561	0.597	0.534	-14
335	Nonferrous rolling and	0.615	0.456	0.475	0.530	-14
351	Engines and turbines	0.611	0.703	0.584	0.484	-21
287	Agricultural chemicals	0.608	0.622	0.681	0.557	-8
273	Books	0.605	0.562	0.507	0.405	-33
204	Grain mill products	0.601	0.445	0.655	0.532	-12
331	Blast furnace and basic steel	0.592	0.576	0.690	0.547	-8
281	Industrial inorganic chemicals	0.592	0.578	0.583	0.588	-1

Note: Twenty agglomerated industries are ranked using Gini Indices for 1988. The values of Gini indices for these industries are listed in a five year interval through 2003. The ranking is based on the Gini indices of weak bridge data sample consists of 139 3-digit SIC industries bridged across SIC and NAICS.

TABLE A46 Twenty Least Agglomerated Industries Ranked By National Average Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
308	Misc. plastic products	0.167	0.189	0.279	0.220	32
359	Industrial machinery	0.211	0.199	0.157	0.175	-17
354	Metalworking machinery	0.220	0.183	0.320	0.280	28
344	Fabricated structural metal	0.226	0.181	0.243	0.226	0
399	Misc. manufacturing	0.267	0.247	0.213	0.215	-20
243	Millwork, plywood	0.291	0.261	0.221	0.202	-30
349	Misc. fabricated metal products	0.291	0.284	0.396	0.296	2
356	General industrial machinery	0.301	0.326	0.351	0.339	13
347	Metal services	0.303	0.245	0.296	0.219	-28
205	Bakery products	0.305	0.529	0.350	0.334	9
355	Special industry machinery	0.310	0.318	0.323	0.373	20
279	Printing trade services	0.328	0.321	0.388	0.374	14
384	Medical instruments	0.343	0.357	0.468	0.355	3
346	Metal forgings and stampings	0.347	0.383	0.375	0.369	6
367	Electronic components	0.349	0.363	0.393	0.381	9
345	Metal services	0.351	0.374	0.400	0.395	12
265	Paperboard containers	0.363	0.370	0.387	0.392	8
239	Misc. fabricated textile	0.363	0.315	0.265	0.220	-40
363	Household appliances	0.379	0.621	0.381	0.327	-14
382	Measuring, controlling devices	0.388	0.351	0.410	0.380	-2

Note: Twenty agglomerated industries are ranked using Gini Index for 1988. The values of Gini indices are listed in a five year interval from 1988 through 2003. The ranking is based on the Gini indices of weak bridge data sample consists of 139 three-digit SIC industries bridged across SIC and NAICS.

TABLE A47 Trends of Ten Most Agglomerated Industries in New England Division Ranked By Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
234	Women's and kids' underwear	0.898	0.784	0.630	0.330	-63
278	Blankbooks and bookbinding	0.898	0.611	0.773	0.475	-47
273	Books	0.825	0.426	0.578	0.400	-52
305	Hose, belting , gaskets	0.810	0.621	0.255	0.263	-68
339	Misc. primary metal products	0.805	0.286	0.282	0.279	-65
372	Aircraft and parts	0.803	0.512	0.330	0.387	-52
373	Ship and boat building	0.763	0.436	0.338	0.223	-71
289	Misc. chemical products	0.735	0.391	0.652	0.136	-81
335	Nonferrous rolling and drawing	0.732	0.567	0.550	0.407	-44
351	Engines and turbines	0.651	0.741	0.788	0.667	2

TABLE A48 Trends of Ten Least Agglomerated Industries In New England Division Ranked By Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 &2003
356	General industrial machinery	0.072	0.363	0.354	0.093	30
367	Electronic components accessories	0.078	0.106	0.229	0.192	147
354	Metalworking machinery	0.132	0.108	0.340	0.105	-21
347	Metal services	0.140	0.158	0.418	0.123	-12
384	Medical instruments	0.153	0.397	0.538	0.172	12
349	Misc. fabricated metal products	0.165	0.356	0.440	0.177	7
308	Misc. plastic products	0.176	0.316	0.524	0.225	28
306	Fabricated rubber products	0.179	0.445	0.447	0.545	205
382	Measuring and controlling devices	0.180	0.132	0.247	0.274	52
233	Women's & juniors' outerwear	0.233	0.257	0.561	0.295	27

TABLE A49 Trends of Ten Most Agglomerated Industries in Middle Atlantic Division Ranked By Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
322	Glass and glassware	0.969	0.696	0.986	0.924	-5
343	Plumbing and heating, electric	0.956	0.663	0.674	0.408	-57
326	Textile finishing, wool	0.949	0.916	0.817	0.768	-19
335	Nonferrous rolling and drawing	0.907	0.413	0.605	0.679	-25
299	Misc. petroleum and coal products	0.850	0.812	0.915	0.712	-16
208	Beverages	0.843	0.544	0.023	0.026	-97
252	Office furniture	0.830	0.359	0.390	0.702	-15
372	Aircraft and parts	0.787	0.654	0.878	0.577	-27
379	Misc. transportation equipment	0.785	0.623	0.584	0.288	-63
245	Wood buildings , mobile homes	0.781	0.810	0.395	0.615	-21

TABLE A50 Trends of Ten Least Agglomerated Industries in Middle Atlantic Division Ranked By Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
324	Cement, hydraulic	0.010	0.010	0.644	0.959	9,490
308	Misc. plastic products	0.033	0.037	0.075	0.087	160
344	Fabricated structural metal	0.047	0.044	0.043	0.036	-23
399	Misc. manufacturing	0.056	0.059	0.072	0.054	-3
349	Misc. fabricated metal products	0.063	0.088	0.088	0.173	173
354	Metalworking machinery	0.082	0.090	0.151	0.134	63
355	Special industry machinery	0.103	0.076	0.090	0.205	99
275	Commercial printing	0.108	0.130	0.025	0.025	-77
359	Industrial machinery	0.113	0.069	0.029	0.024	-79
346	Metal forgings and stampings	0.121	0.171	0.226	0.302	149

TABLE A51 Trends of Ten Most Agglomerated Industries in East North Central Division Ranked By Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
282	Plastic materials and synthetic	0.894	0.984	0.891	0.880	-2
373	Ship and boat building	0.801	0.656	0.217	0.043	-95
372	Aircraft and parts	0.771	0.615	0.774	0.720	-7
273	Books	0.738	0.505	0.451	0.292	-61
339	Misc. primary metal products	0.725	0.452	0.151	0.151	-79
379	Misc. transportation equipment	0.710	0.779	0.457	0.637	-10
305	Hose, belting , gaskets	0.699	0.567	0.643	0.505	-28
259	Misc. furniture and fixtures	0.683	0.551	0.521	0.383	-44
325	Structural clay products	0.678	0.569	0.911	0.583	-14
365	Household audio and video	0.650	0.833	0.329	0.325	-50

TABLE A52 Trends of Ten Least Agglomerated Industries in East North Central Division Ranked By Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
308	Misc. plastic products	0.058	0.030	0.083	0.080	38
359	Industrial machinery	0.061	0.055	0.037	0.039	-36
354	Metalworking machinery	0.066	0.065	0.084	0.097	46
344	Fabricated structural metal	0.095	0.067	0.117	0.117	23
349	Misc. fabricated metal products	0.105	0.091	0.203	0.135	28
347	Metal services	0.142	0.100	0.111	0.089	-37
346	Metal forgings and stampings	0.155	0.250	0.128	0.165	7
356	General industrial machinery	0.174	0.192	0.213	0.161	-7
399	Misc. manufacturing	0.176	0.172	0.124	0.105	-40
355	Special industry machinery	0.182	0.140	0.192	0.152	-16

TABLE A53 Trends of Ten Most Agglomerated Industries in West North Central Division Ranked By Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
201	Meat products	0.838	0.575	0.638	0.553	-34
254	Partitions and fixtures	0.778	0.434	0.309	0.348	-55
336	Nonferrous foundries	0.763	0.742	0.881	0.405	-47
251	Household furniture	0.746	0.749	0.234	0.350	-53
329	Misc. nonmetallic mineral	0.699	0.590	0.466	0.518	-26
339	Misc. primary metal products	0.692	0.640	0.711	0.554	-20
283	Drugs	0.643	0.634	0.757	0.723	12
273	Books	0.620	0.682	0.657	0.303	-51
208	Beverages	0.607	0.668	0.027	0.034	-94
382	Plastic materials and synthetic	0.591	0.427	0.478	0.347	-41

TABLE A54 Trends of Ten Least Agglomerated Industries in West North Central Division Ranked By Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
289	Misc. chemical products	0.129	0.420	0.581	0.430	234
347	Metal services	0.153	0.231	0.237	0.183	19
369	Misc. electrical equipment	0.205	0.494	0.461	0.533	160
308	Misc. plastic products	0.221	0.290	0.237	0.471	113
345	Screw machine products, bolts	0.236	0.601	0.450	0.461	95
359	Industrial machinery	0.258	0.350	0.313	0.348	35
399	Misc. manufacturing	0.261	0.430	0.188	0.301	15
384	Soaps, cleaners and toilet goods	0.279	0.479	0.553	0.218	-22
354	Metalworking machinery	0.287	0.415	0.331	0.519	81
346	Metal forgings and stampings	0.310	0.269	0.777	0.285	-8

TABLE A55 Trends of Ten Most Agglomerated Industries In South Atlantic Division Ranked By Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
306	Fabricated rubber products	0.960	0.464	0.827	0.596	-38
295	Asphalt paving and roofing	0.935	0.570	0.986	0.818	-13
226	Textile finishing, wool	0.912	0.689	0.649	0.305	-67
342	Cutlery, hand tools	0.892	0.625	0.613	0.589	-34
286	Industrial organic chemicals	0.887	0.862	0.727	0.631	-29
396	Costume jewelry and notions	0.884	0.524	0.900	0.751	-15
204	Grain mill products	0.862	0.656	0.805	0.822	-5
201	Meat products	0.849	0.721	0.784	0.838	-1
252	Office furniture	0.839	0.517	0.750	0.490	-42
278	Blankbooks and bookbinding	0.836	0.608	0.568	0.728	-13

TABLE A56 Trends of Ten Least Agglomerated Industries in South Atlantic Division Ranked By Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
359	Industrial machinery	0.135	0.067	0.089	0.108	-20
395	Pens, pencils, office supplies	0.151	0.700	0.904	0.885	485
344	Fabricated structural metal	0.171	0.196	0.295	0.256	49
308	Misc. plastic products	0.175	0.157	0.231	0.171	-2
279	Printing trade services	0.227	0.204	0.348	0.370	63
228	Yarn and thread mills	0.261	0.485	0.377	0.509	95
239	Misc. fabricated textile products	0.288	0.215	0.212	0.146	-49
372	Aircraft and parts	0.307	0.222	0.556	0.404	32
205	Bakery products	0.312	0.819	0.415	0.423	36
242	Sawmills and planing mills	0.312	0.214	0.281	0.240	-23

TABLE A57 Trends of Ten Most Agglomerated Industries in East South Central Division Ranked By Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
259	Misc. furniture and fixtures	0.970	0.623	0.516	0.624	-36
254	Partitions and fixtures	0.940	0.855	0.488	0.412	-56
353	Construction machinery	0.930	0.801	0.417	0.656	-29
225	Knitting mills	0.924	0.652	0.735	0.970	5
346	Metal forgings and stampings	0.919	0.871	0.666	0.626	-32
286	Industrial organic chemicals	0.913	0.980	0.965	0.874	-4
373	Ship and boat building	0.909	0.665	0.504	0.521	-43
204	Grain mill products	0.890	0.931	0.690	0.650	-27
282	Plastic materials and synthetic	0.888	0.819	0.646	0.656	-26
273	Books	0.840	0.772	0.771	0.816	-3

TABLE A58 Trends of Ten Least Agglomerated Industries in East South Central Division Ranked By Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
359	Industrial machinery	0.198	0.157	0.107	0.127	-36
242	Sawmills and planing mills	0.206	0.087	0.145	0.221	7
354	Metalworking machinery	0.249	0.305	0.269	0.429	72
308	Misc. plastic products	0.320	0.163	0.355	0.170	-47
344	Fabricated structural metal	0.344	0.344	0.461	0.315	-8
399	Misc. manufacturing	0.355	0.273	0.415	0.334	-6
251	Household furniture	0.440	0.326	0.247	0.576	31
289	Misc. chemical products	0.456	0.712	0.892	0.499	9
243	Millwork, plywood and structural	0.495	0.290	0.295	0.274	-45
275	Commercial printing	0.525	0.479	0.203	0.245	-53

TABLE A59 Trends of Ten Most Agglomerated Industries in West South Central Division Ranked By Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
339	Misc. primary metal products	0.848	0.665	0.669	0.502	-41
273	Books	0.761	0.433	0.520	0.402	-47
201	Meat products	0.759	0.582	0.352	0.277	-64
331	Blast furnace and basic steel	0.758	0.439	0.729	0.506	-33
282	Plastic materials and synthetic	0.757	0.700	0.670	0.598	-21
259	Misc. furniture and fixtures	0.749	0.238	0.512	0.525	-30
281	Industrial inorganic chemicals	0.738	0.406	0.727	0.568	-23
395	Pens, pencils, office supplies	0.687	0.261	0.739	0.504	-27
238	Misc. apparel and accessories	0.687	0.309	0.900	0.284	-59
365	Household audio and video	0.687	0.207	0.973	0.633	-8

TABLE A60 Trends of Ten Least Agglomerated Industries in West South Central Division Ranked By Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
384	Medical instruments and supplies	0.106	0.092	0.479	0.500	372
209	Misc. foods and kindred	0.109	0.262	0.271	0.264	142
208	Beverages	0.117	0.751	0.022	0.020	-83
359	Industrial machinery	0.144	0.097	0.107	0.096	-34
369	Misc. electrical equipment	0.152	0.176	0.570	0.646	324
342	Cutlery, hand tools and hardware	0.169	0.277	0.355	0.177	5
356	General industrial machinery	0.209	0.135	0.164	0.412	97
254	Partitions and fixtures	0.216	0.290	0.239	0.326	51
283	Drugs	0.232	0.359	0.220	0.511	120
278	Blankbooks and bookbinding	0.251	0.134	0.390	0.291	16

TABLE A61 Trends of Ten Most Agglomerated Industries in Mountain Division Ranked By Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
242	Sawmills and planing mills	0.817	0.498	0.529	0.366	-55
322	Glass and glassware	0.683	0.063	0.088	0.842	23
254	Partitions and fixtures	0.648	0.459	0.397	0.158	-76
384	Medical instruments	0.646	0.191	0.572	0.189	-71
233	Women's & juniors' outerwear	0.580	0.063	0.862	0.836	44
353	Construction and related	0.571	0.337	0.411	0.673	18
391	Jewelry, silverware and plated	0.556	0.166	0.275	0.317	-43
245	Wood buildings and mobile	0.550	0.712	0.518	0.261	-53
273	Books	0.505	0.495	0.392	0.205	-59
201	Meat products	0.484	0.699	0.722	0.858	77

TABLE A62 Trends of Ten Least Agglomerated Industries in Mountain Division Ranked By Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
346	Metal forgings and stampings	0.102	0.063	0.088	0.939	822
365	Household audio and video	0.102	0.063	0.692	0.272	167
308	Misc. plastic products	0.110	0.309	0.402	0.355	222
326	Pottery and related products	0.133	0.555	0.267	0.262	97
345	Screw machine products, bolts	0.145	0.452	0.250	0.407	180
379	Misc. transportation equipment	0.150	0.063	0.649	0.563	275
369	Misc. electrical equipment	0.165	0.710	0.540	0.310	88
396	Costume jewelry and notions	0.201	0.167	0.166	0.262	30
354	Metalworking machinery	0.203	0.167	0.604	0.398	97
238	Misc. apparel and accessories	0.209	0.249	0.892	0.797	282

TABLE A63 Trends of Ten Most Agglomerated Industries in Pacific Division Ranked By Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
341	Metal cans and shipping	0.719	0.532	0.274	0.432	-40
259	Misc. furniture and fixtures	0.708	0.334	0.245	0.411	-42
325	Structural clay products	0.638	0.215	0.466	0.432	-32
281	Industrial inorganic chemicals	0.610	0.253	0.235	0.316	-48
332	Iron and steel foundries	0.606	0.249	0.299	0.658	9
278	Blankbooks and bookbinding	0.598	0.313	0.268	0.410	-32
339	Misc. primary metal products	0.487	0.201	0.209	0.281	-42
201	Meat products	0.480	0.087	0.204	0.297	-38
357	Computer and office equipment	0.466	0.447	0.490	0.286	-39
369	Misc. electrical equipment	0.460	0.189	0.374	0.271	-41

TABLE A64 Trends of Ten Least Agglomerated Industries in Pacific Division Ranked By Gini Index of Agglomeration, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
324	Cement, hydraulic	0.052	0.062	0.478	0.623	1,104
243	Millwork, plywood	0.081	0.082	0.082	0.195	142
308	Misc. plastic products	0.086	0.058	0.176	0.066	-23
399	Misc. manufacturing	0.088	0.046	0.051	0.037	-58
359	Industrial machinery	0.097	0.266	0.053	0.044	-54
365	Household audio , video equip.	0.107	0.390	0.050	0.049	-54
282	Plastic materials and synthetic	0.111	0.133	0.582	0.131	17
355	Special industry machinery	0.116	0.175	0.172	0.197	70
232	Men's and boys' furnishings	0.126	0.187	0.147	0.399	218
349	Misc. fabricated metal products	0.133	0.075	0.123	0.121	-9

TABLE A65 Twenty Most Concentrated Industries Ranked By National Average Herfindahl Index, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
376	Guided missiles, space vehicles	0.744	0.589	0.854	0.362	-51
317	Handbags and personal leather	0.725	0.400	0.744	0.388	-46
333	Primary nonferrous metals	0.722	0.480	0.680	0.470	-35
351	Engines and turbines	0.701	0.497	0.452	0.480	-31
348	Ordnance and accessories	0.652	0.624	0.573	0.607	-7
322	Glass and glassware	0.644	0.585	0.623	0.737	14
299	Misc. petroleum and coal products	0.601	0.605	0.531	0.488	-19
228	Yarn and thread mills	0.600	0.440	0.637	0.512	-15
205	Bakery products	0.597	0.445	0.341	0.378	-37
363	Household appliances	0.596	0.597	0.384	0.331	-44
341	Metal cans and shipping containers	0.596	0.483	0.548	0.519	-13
236	Girl's and children's outerwear	0.582	0.412	0.316	0.359	-38
314	Footwear	0.582	0.570	0.671	0.519	-11
234	Women's and children's underwear	0.581	0.494	0.361	0.369	-36
396	Costume jewelry	0.575	0.449	0.574	0.404	-30
372	Aircraft and parts	0.561	0.504	0.493	0.399	-29
225	Knitting mills	0.555	0.262	0.508	0.402	-28
365	Household audio and video	0.549	0.484	0.508	0.485	-12
326	Pottery and related products	0.549	0.578	0.468	0.539	-2
238	Misc. apparel and accessories	0.545	0.339	0.294	0.370	-32

Note: Twenty agglomerated industries are ranked using Herfindahl Indices (HI) for 1988. The values of HI for these industries are listed in a five year interval through 2003. The ranking is based on the HI of weak bridge data sample consists of 139 3-digit SIC industries bridged across SIC and NAICS.

TABLE A66 Twenty Least Concentrated Industries Ranked By National Average Herfindahl Index, 1988

3-digit SIC code	Industry description	1988	1993	1998	2003	Percent change between 1988 & 2003
324	Cement, hydraulic	0.118	0.118	0.770	0.703	496
359	Industrial machinery	0.208	0.250	0.195	0.235	13
399	Misc. manufacturing	0.248	0.293	0.210	0.257	4
243	Millwork, plywood	0.255	0.306	0.234	0.278	9
275	Commercial printing	0.256	0.322	0.169	0.217	-15
344	Fabricated structural metal	0.257	0.276	0.237	0.271	5
239	Misc. fabricated textile	0.265	0.357	0.217	0.260	-2
308	Misc. plastic products	0.271	0.309	0.248	0.319	18
349	Misc. fabricated metal	0.281	0.353	0.241	0.316	13
354	Metalworking machinery	0.282	0.270	0.289	0.327	16
353	Construction machinery	0.285	0.357	0.301	0.447	57
242	Sawmills and planing mills	0.293	0.362	0.245	0.297	1
201	Meat products	0.305	0.426	0.330	0.416	37
279	Printing trade services	0.305	0.292	0.350	0.366	20
251	Household furniture	0.318	0.392	0.266	0.382	20
355	Special industry machinery	0.318	0.314	0.307	0.360	13
209	Misc. foods, kindred	0.324	0.401	0.265	0.381	18
204	Grain mill products	0.341	0.427	0.316	0.451	32
367	Electronic components,	0.342	0.340	0.274	0.304	-11
289	Misc. chemical products	0.356	0.364	0.325	0.332	-7

Note: Twenty agglomerated industries are ranked using Herfindahl indices (HI) for 1988. The values of HI for these industries are listed in a five year interval through 2003. The ranking is based on the HI of weak bridge data sample consists of 139 3-digit SIC industries bridged across SIC and NAICS.

TABLE A67 Top Ten Manufacturing Industries By Employment in The U.S.

		1988	2003	
3-digit SIC Code	**Industry Description**	**Employment in thousands**	**Employment in thousands**	**Percentage change**
308	Miscellaneous plastic products	616.6	684.9	11.1
372	Aircraft and parts	614.3	308.8	- 49.7
275	Commercial printing	436.4	415.0	- 4.9
367	Electronic components and accessories	380.9	248.7	- 34.7
382	Measuring and controlling devices	300.5	221.1	- 26.4
346	Metal forgings and stampings	258.4	218.2	-15.6
331	Blast furnace and basic steel products	236.2	159.5	- 32.5
354	Metalworking machinery	227.2	123.3	- 45.7
376	Guided missile and space vehicles	219.6	66.4	-69.8
357	Computer and office equipment	205.6	111.7	- 45.7
	Total manufacturing employment	2,932.9	2,812.6	- 4.10
	Total manufacturing employment in U.S.	19,261.7	14,132.0	- 26.6

Data source: County Business Pattern Data, 1988 & 2003, U.S. Bureau of Census.

Note: Industries are ranked in descending order according to employment count in 1988.

TABLE A68 Summary of Some Recently Published Papers on Agglomeration

Labor Market Pooling [Matching]		**Goods Pooling [Input Sharing]**		**Idea Pooling [Knowledge Spillovers]**	
Paper	**Key results**	**Paper**	**Key results**	**Paper**	**Key results**
Diamond and Simon (1990) [empirical paper]	Labor-market risk capitalized in wages	Bartlesman et al. (1994) [empirical paper]	long run growth in industrial productivity is mostly related to intermediate goods linkages	Audretsch and Feldman (1999) [empirical paper]	City size has a positive effect on per capita innovative activities
Helsley and Strange (1990) [theoretical paper]	Two kinds of positive externalities associated with a firm's moving into a city: i) the traditional productivity externality and ii) the spatial competition and heterogeneity of workers	Homes (1999) [empirical paper]	Firms use more purchased inputs in agglomeration	Jaffe, Trajtenberg and Henderson (1993) [empirical paper]	Strong localization of knowledge spillovers
Rosenthal and Strange (2001)	Labor pooling is relatively more prominent determinant of agglomeration	Homes and Stevens (2002) [empirical paper]	Aggregate increasing return due to input sharing	Bas and Miribel (2005) [empirical paper]	Industries with rapid rate of knowledge obsolescence would benefit more by locating near sources of new knowledge
Francis (2009) [theoretical paper]	The in-migration of labor as a result of agglomeration raises the quality of matching and labor productivity.	Duranton and Puga (2000) [empirical paper]	There is a positive correlation between agglomeration and firm size.	Greenstone, Hornbeck and Moretti (2008) [empirical paper]	Total factor productivity rises when a large manufacturing plant moves into an existing agglomeration
Overman and Puga (2009) [empirical paper]	Agglomerated firms display more fluctuations in employment indicating flexibility in hiring due to large labor pool	Ellison, Glaeser and Kerr (2007) [empirical paper]	Input-output dependencies are the most important factor, followed by labor pooling	Combes, Duranton, Puga, and Roux (2009) [empirical paper]	Agglomeration promotes interaction opportunities that increase productivity

TABLE A69 Industries Ranked By Labor Pooling Index (LP1), 1988

3-digit SIC	Industry	Ratio of employees with bachelors degree to all employees
205	Frozen Bakery	0.375
357	Computer and office equipment	0.302
287	Agricultural chemicals	0.300
283	Drugs	0.275
333	Primary non-ferrous metal	0.270
332	Iron and steel foundries	0.260
348	Ordnance and accessories	0.217
306	Fabricated rubber products	0.176
273	Books	0.164
265	Paperboard containers and boxes	0.156

Source: Current Population Survey, Annual Demographic Series, Bureau of Census (1988).* Mean $(LP1_{i,1988}) = 48^{-1}\Sigma_s[\text{employees with bachelor's degree /total number of employees}]_{is,1988.}$.

TABLE A70 Industries Ranked By Goods Pooling Index (GP), 1988

Ten highest ratios 1988		
SIC 3 digits	SIC description	Ratio of cost of materials-to-value of shipment
201	Meat packing	0.758
305	Rubber, plastic hose and belting	0.736
202	Cheese, dairy, milk	0.728
335	Rolling, drawing, extruding of copper, aluminum	0.697
365	Household audio and video equipment	0.657
371	Truck trailers, motor homes	0.657
265	Paperboard boxes, corrugated and solid fiber	0.651
331	Cold-rolled steel, strip, and bars, pipes and tubes	0.634
245	Mobile homes	0.630
299	Lubricating oils and greases	0.625

Source: Annual Survey of Manufactures, Geographic Area Series, 1988, Bureau of Census. *Note*: Goods pooling proxy is calculated as follows = $[\text{cost of materials / value of shipment}]_{ist.}$. In this table't' is year 1988.

TABLE A71 Industries Ranked By Idea Pooling Index (IP1), 1988

Ten highest ratios 1988		
SIC 3 digits	**SIC description**	**Ratio of post-graduate employees to all employees**
283	Drugs	0.167
365	Household audio and video equipment	0.147
317	Handbag and personal leather goods	0.143
348	Ordnance and accessories	0.139
357	Computer and office equipment	0.109
229	Miscellaneous textile goods	0.100
204	Grain mill products	0.085
284	Soaps, cleaners and toilet goods	0.077
346	Metal forgings and stampings,	0.069
373	Ship and boat building and repairing	0.067

Source: Current Population Survey, Annual Demographic Series, Bureau of Census (1988). * Mean $(LP1_{i,1988}) = 46^{-1}\Sigma_s[\text{employees with post-graduate degree /total number of employees}]_{is,1988}$.

TABLE A72 List of All Industries Bridged Across SIC and NAICS Codes

3-digit SIC code	3-digit SIC Industry	2-Digit SIC Industry
201	Meat products	Food and kindred products
202	Dairy products	Food and kindred products
203	Preserved fruits and vegetables	Food and kindred products
204	Grain mill products	Food and kindred products
205	Bakery products	Food and kindred products
206	Sugar and confectionery products	Food and kindred products
207	Fats and oils	Food and kindred products
208	Beverages	Food and kindred products
209	Misc. foods and kindred products	Food and kindred products
211	Cigarettes	Tobacco products
212	Cigars	Tobacco products
213	Chewing and smoking tobacco	Tobacco products
214	Tobacco stemming and redrying	Tobacco products
221	Broadwoven fabric mills, cotton	Textile mill products
222	Broadwoven fabric mills, manmade	Textile mill products
223	Broadwoven fabric mills, wool	Textile mill products
224	Narrow fabric mills	Textile mill products
225	Knitting mills	Textile mill products
226	Textile finishing, exc wool	Textile mill products
227	Carpets and rugs	Textile mill products
228	Yarn and thread mills	Textile mill products
229	Miscellaneous textile goods	Textile mill products
231	Men's and boys' suits and coats	Apparel and other textile mill
232	Men's and boys' furnishings	Apparel and other textile mill
233	Women's, and juniors' outerwear	Apparel and other textile mill
234	Women's and children's	Apparel and other textile mill
235	Hats, caps and millinery	Apparel and other textile mill
236	Girl's and children's outerwear	Apparel and other textile mill
238	Misc. apparel and accessories	Apparel and other textile mill
239	Misc. fabricated textile products	Apparel and other textile mill
241	Logging	Lumber and wood products
242	Sawmills and planing mills	Lumber and wood products
243	Millwork, plywood, structural	Lumber and wood products
244	Wooden containers	Lumber and wood products
245	Wood buildings and mobile homes	Lumber and wood products
249	Misc. wood products	Lumber and wood products
251	Household furniture	Furniture and fixtures
252	Office furniture	Furniture and fixtures

3-digit	3-digit SIC Industry	2-Digit SIC Industry
253	Public building & related furniture	Furniture and fixtures
254	Partitions and fixtures	Furniture and fixtures
259	Misc. furniture and fixtures	Furniture and fixtures
261	Pulp mills	Paper and allied products
262	Mills, exc building paper	Paper and allied products
263	Paperboard mills	Paper and allied products
265	Paperboard containers and boxes	Paper and allied products
267	Misc. converted paper products	Paper and allied products
271	Newspapers	Printing and publishing
272	Periodicals	Printing and publishing
273	Books	Printing and publishing
274	Miscellaneous publishing	Printing and publishing
275	Commercial printing	Printing and publishing
276	Manifold business forms	Printing and publishing
277	Greeting cards	Printing and publishing
278	Blankbooks and bookbinding	Printing and publishing
279	Printing trade services	Printing and publishing
281	Industrial inorganic chemicals	Chemicals and allied products
282	Plastic and synthetic materials	Chemicals and allied products
283	Drugs	Chemicals and allied products
284	Soaps, cleaners and toilet goods	Chemicals and allied products
285	Paints and allied products	Chemicals and allied products
286	Industrial organic chemicals	Chemicals and allied products
287	Agricultural chemicals	Chemicals and allied products
289	Misc. chemical products	Chemicals and allied products
291	Petroleum refining	Petroleum and coal products
295	Asphalt paving and roofing materials	Petroleum and coal products
299	Misc. petroleum and coal products	Petroleum and coal products
301	Tires and inner tubes	Rubber and miscellaneous plastic
302	Rubber and plastic footwear	Rubber and miscellaneous plastic
305	Hose, belting, gaskets and packing	Rubber and miscellaneous plastic
306	Fabricated rubber products, nec	Rubber and miscellaneous plastic
308	Misc. plastic products, nec	Rubber and miscellaneous plastic
311	Leather tanning and finishing	Leather and leather products
313	Footwear cut stock	Leather and leather products
314	Footwear, exc rubber	Leather and leather products
315	Leather gloves and mittens	Leather and leather products
316	Luggage	Leather and leather products
317	Handbags and personal leather goods	Leather and leather products
319	Leather goods, nec	Leather and leather products
321	Flat glass	Stone, clay, and glass products

3-digit	3-digit SIC Industry	2-Digit SIC Industry
322	Glass and glassware	Stone, clay, and glass products
323	Products of purchased glass	Stone, clay, and glass products
324	Cement, hydraulic	Stone, clay, and glass products
325	Structural clay products	Stone, clay, and glass products
326	Pottery and related products	Stone, clay, and glass products
327	Concrete, gypsum and plaster	Stone, clay, and glass products
328	Cut stone and stone products	Stone, clay, and glass products
329	Misc. nonmetallic mineral products	Stone, clay, and glass products
331	Blast furnace and basic steel products	Primary metal industries
332	Iron and steel foundries	Primary metal industries
333	Primary nonferrous metals	Primary metal industries
334	Secondary nonferrous metals	Primary metal industries
335	Nonferrous rolling and drawing	Primary metal industries
336	Nonferrous foundries (castings)	Primary metal industries
339	Misc. primary metal products	Primary metal industries
341	Metal cans and shipping containers	Fabricated metal products
342	Cutlery, hand tools and hardware	Fabricated metal products
343	Plumbing and heating, exc electric	Fabricated metal products
344	Fabricated structural metal products	Fabricated metal products
345	Screw machine products, bolts, etc.	Fabricated metal products
346	Metal forgings and stampings	Fabricated metal products
347	Metal services, nec	Fabricated metal products
348	Ordnance and accessories, nec	Fabricated metal products
349	Misc. fabricated metal products	Fabricated metal products
351	Engines and turbines	Industrial machinery and equipment
352	Farm and garden machinery	Industrial machinery and equipment
353	Construction and related machinery	Industrial machinery and equipment
354	Metalworking machinery	Industrial machinery and equipment
355	Special industry machinery	Industrial machinery and equipment
356	General industrial machinery	Industrial machinery and equipment
357	Computer and office equipment	Industrial machinery and equipment
358	Refrigeration and service machinery	Industrial machinery and equipment
359	Industrial machinery, nec	Industrial machinery and equipment
361	Electric distribution equipment	Electronic and other electric
362	Electrical industrial apparatus	Electronic and other electric
363	Household appliances	Electronic and other electric
364	Electric lighting and wiring	Electronic and other electric
365	Household audio & video equipment	Electronic and other electric
366	Communications equipment	Electronic and other electric
367	Electronic components accessories	Electronic and other electric
369	Misc. electrical equipment	Electronic and other electric
371	Motor vehicles and equipment	Transportation equipment

3-digit	3-digit SIC Industry	2-Digit SIC Industry
372	Aircraft and parts	Transportation equipment
373	Ship and boat building and repairing	Transportation equipment
374	Railroad equipment	Transportation equipment
375	Motorcycles, bicycles and parts	Transportation equipment
376	Guided missiles, space vehicles, parts	Transportation equipment
379	Misc. transportation equipment	Transportation equipment
381	Search and navigation equipment	Instruments and related products
382	Measuring and controlling devices	Instruments and related products
384	Medical instruments and supplies	Instruments and related products
385	Ophthalmic goods	Instruments and related products
386	Photographic equipment and supplies	Instruments and related products
387	Watches, clocks, watchcases and parts	Instruments and related products
391	Jewelry, silverware and plated ware	Miscellaneous manufacturing
393	Musical instruments	Miscellaneous manufacturing
394	Toys and sporting goods	Miscellaneous manufacturing
395	Pens, pencils, office, and art supplies	Miscellaneous manufacturing
396	Costume jewelry and notions	Miscellaneous manufacturing
399	Misc. manufacturing	Miscellaneous manufacturing

Note: The acronyms ‘nec’ and ‘exc’ stand for ‘not elsewhere classified’ and ‘excluding’ respectively.

TABLE A73 List of Selected 3-Digit Industries Bridged Across SIC and NAICS Codes for the Regression Analysis

3-digit SIC	**3-digit SIC Industry**	**2-Digit SIC Industry**
201	Meat products	Food and kindred products
202	Dairy products	Food and kindred products
203	Preserved Fruits and Vegetables	Food and kindred products
204	Grain mill products	Food and kindred products
205	Bakery products	Food and kindred products
206	Sugar and confectionery products	Food and kindred products
208	Beverages	Food and kindred products
209	Misc. foods and kindred products	Food and kindred products
211	Cigarettes	Tobacco products
227	Carpets and rugs	Textile mill products
229	Miscellaneous textile goods	Textile mill products
232	Men's and boys' furnishings	Apparel and other textile mill products
239	Misc. fabricated textile products	Apparel and other textile mill products
243	Millwork, plywood and structural	Lumber and wood products
245	Wood buildings and mobile Homes	Lumber and wood products
249	Misc. wood products	Lumber and wood products
251	Household furniture	Furniture and fixtures

3-digit	3-digit SIC Industry	2-Digit SIC Industry
252	Office furniture	Furniture and fixtures
259	Misc. furniture and fixtures	Furniture and fixtures
265	Paperboard containers and boxes	Paper and allied products
267	Misc. converted paper products	Paper and allied products
271	Newspapers	Printing and publishing
273	Books	Printing and publishing
274	Miscellaneous publishing	Printing and publishing
275	Commercial printing	Printing and publishing
278	Blankbooks and bookbinding	Printing and publishing
281	Industrial inorganic chemicals	Chemicals and allied products
282	Plastics materials and synthetic	Chemicals and allied products
283	Drugs	Chemicals and allied products
284	Soaps, cleaners and toilet Goods	Chemicals and allied products
286	Industrial organic chemicals	Chemicals and allied products
287	Agricultural chemicals	Chemicals and allied products
289	Misc. chemical products	Chemicals and allied products
291	Petroleum refining	Petroleum and coal products
295	Asphalt paving and Roofing	Petroleum and coal products
299	Misc. Petroleum and Coal Products	Petroleum and coal products
305	Hose & belting & gaskets & packing	Rubber and miscellaneous plastic
306	Fabricated rubber products, nec	Rubber and miscellaneous plastic
308	Misc. Plastics products, nec	Rubber and miscellaneous plastic
314	Footwear, exc rubber	Leather and leather products
316	Luggage	Leather and leather products
317	Handbags and personal leather	Leather and leather products
321	Flat glass	Stone, clay, and glass products
325	Structural clay products	Stone, clay, and glass products
326	Pottery and related products	Stone, clay, and glass products
327	Concrete, gypsum and plaster	Stone, clay, and glass products
329	Misc. nonmetallic mineral products	Stone, clay, and glass products
331	Blast furnace and basic steel	Primary metal industries
332	Iron and steel foundries	Primary metal industries
333	Primary nonferrous metals	Primary metal industries
335	Nonferrous rolling and drawing	Primary metal industries
336	Nonferrous foundries (castings)	Primary metal industries
339	Misc. primary metal products	Primary metal industries
341	Metal cans and shipping containers	Fabricated metal products
342	Cutlery, hand tools and hardware	Fabricated metal products
343	Plumbing and heating, exc electric	Fabricated metal products
344	Fabricated structural metal products	Fabricated metal products
345	Screw machine products, bolts, etc.	Fabricated metal products
346	Metal forgings and stampings	Fabricated metal products
347	Metal services, nec	Fabricated metal products

3-digit	3-digit SIC Industry	2-Digit SIC Industry
346	Metal forgings and stampings	Fabricated metal products
347	Metal services, nec	Fabricated metal products
348	Ordnance and accessories, nec	Fabricated metal products
349	Misc. fabricated metal products	Fabricated metal products
353	Construction and related machinery	Industrial machinery and equipment
354	Metalworking machinery	Industrial machinery and equipment
356	General industrial machinery	Industrial machinery and equipment
357	Computer and office equipment	Industrial machinery and equipment
358	Refrigeration and service machinery	Industrial machinery and equipment
359	Industrial machinery, nec	Industrial machinery and equipment
361	Electric distribution equipment	Electronic and other electric equipment
362	Electrical industrial apparatus	Electronic and other electric equipment
363	Household appliances	Electronic and other electric equipment
364	Electric lighting and wiring	Electronic and other electric equipment
365	Household audio & video equipment	Electronic and other electric equipment
366	Communications equipment	Electronic and other electric equipment
367	Electronic components accessories	Electronic and other electric equipment
369	Misc. electrical equipment	Electronic and other electric equipment
371	Motor vehicles and equipment	Transportation equipment
372	Aircraft and parts	Transportation equipment
373	Ship and boat building and repairing	Transportation equipment
376	Guided missiles, space vehicles,	Transportation equipment
382	Measuring and controlling devices	Instruments and related products
384	Medical instruments & supplies	Instruments and related products
387	Watches, clocks, watchcases & parts	Instruments and related products
391	Jewelry, silverware and plated ware	Miscellaneous manufacturing industries
393	Musical instruments	Miscellaneous manufacturing industries
394	Toys and sporting goods	Miscellaneous manufacturing industries
395	Pens, pencils, office, & art Supplies	Miscellaneous manufacturing industries
396	Costume jewelry and notions	Miscellaneous manufacturing industries
399	Misc. manufacturing	Miscellaneous manufacturing industries

Note: The acronyms ‘nec’ and ‘exc’ stand for ‘not elsewhere classified’ and ‘excluding’ respectively. * This list of three-digit SIC industries is created using selected four-digit SIC industries for which the deviation in terms of sales do not exceed 3 percent when they are bridged across SIC and NAICS regimes.

TABLE A74 Descriptive Statistics

Variable name	Variable description	Mean [standard deviation]
EGl (strong bridge)	Ellison-Glaeser Index of agglomeration constructed from strong bridge sample	0.210 [0.373]
EGI (weak bridge)	Ellison-Glaeser Index of agglomeration constructed from weak bridge sample	0.205 [0.377]
Gini (strong bridge)	Gini index of agglomeration constructed from strong bridge sample	0.496 [0.189]
Gini (weak bridge)	Gini index of agglomeration constructed from weak bridge sample	0.482 [0.202]
Herfindahl Index (strong bridge)	Herfindahl index of industrial organization constructed from weak bridge sample	0.454 [0.121]
Herfindahl Index (weak bridge)	Herfindahl index of industrial organization constructed from strong bridge sample	0.438 [0.126]
LP1	Share of employees with bachelor degree	0.113 [0.131]
LP2	Share of employees with less than bachelor degree	0.853 [0.154]
LP3	Ratio of managerial workers to total workers	0.168 [0.161]
LP4	Per worker value added net of cost of materials (in million US $)	0.082 [0.060]
LP5	Wages per dollar of value of shipment	0.123 [0.167]
GP	Ratio of cost materials to value of shipment	0.491 [0.116]
IP1	Share of employees with post graduate degree	0.035 [0.074]
IP2	patent count	102.652 [237.194]
ADR	Average Duty Rate = [duty/dutiable value]	5.654 [3.604]
Minimum Wage	State level minimum wage rates	4.001 [0.587]
CIT	State level maximum corporate income tax rates	6.727 [2.021]
INV2SHIP	Ratio of value of inventory to value of shipment	0.140 [0.066]
ENERGY	Cost of energy per dollar of shipment	0.025 [0.017]
Observations	Number of observations	7,734

TABLE A75 OLS and Fixed Effect Regressions of Ellison-Glaeser Agglomeration Index

	STRONG BRIDGE		WEAK BRIDGE	
	OLS [clustered standard errors]	**FIXED EFFECTS [clustered standard errors]**	**OLS [clustered standard errors]**	**FIXED EFFECTS [clustered standard errors]**
Constant	0.022	0.173**	0.222***	0.312***
	[0.096]	[0.122]	[0.088]	[0.114]
LP1	0.132***	0.156***	0.043	0.068*
	[0.043]	[0.041]	[0.041]	[0.039]
LP1 × T95	-0.324***	-0.323***	0.040	-0.092
	[0.074]	[0.069]	[0.076]	[0.081]
GP	0.367***	0.332***	0.118**	0.068
	[0.053]	[0.054]	[0.049]	[0.052]
GP × T95	0.481***	0.444***	0.507***	0.500***
	[0.175]	[0.165]	[0.169]	[0.167]
IP1	0.168***	0.197***	-0.004	0.012
	[0.058]	[0.053]	[0.056]	[0.054]
IP1 × T95	-0.162	-0.085	0.248*	0.259*
	[0.152]	[0.118]	[0.142]	[0.137]
T95	-0.227	-0.489***	-0.588***	-0.443***
	[0.159]	[0.152]	[0.135]	[0.134]
State Minimum Wage [MW]	-0.017	-0.080***	-0.016	-0.051***
	[0.018]	[0.036]	[0.017]	[0.032]
MW × T95	0.012	0.080***	0.028	0.043
	[0.021]	[0.031]	[0.017]	[0.024]
State Maximum Corporate Income Tax [CIT]	0.002	0.010	0.002	0.003
	[0.007]	[0.006]	[0.006]	[0.005]
CIT × T95	0.003	-0.001	0.002	-0.002
	[0.005]	[0.005]	[0.006]	[0.007]
Energy Cost –to-Value of Shipment [Energy]	-1.289***	-0.252	-0.778***	0.116
	[0.340]	[0.360]	[0.400]	[0.526]
Energy × T95	0.182	0.286	2.399**	0.452
	[1.218]	[0.694]	[1.106]	[1.014]
Inventory-to-Value-of-Shipment [Inventory]	0.411***	0.445***	-0.185**	-0.194**
	[0.143]	[0.158]	[0.072]	[0.084]
Inventory × T95	-0.100	0.939*	0.721	1.322**
	[0.599]	[0.520]	[0.457]	[0.454]
Observations	7,734	7,734	7,734	7,734
R-squared	0.019	0.079	0.007	0.061

Notes: Robust and clustered [by states] standard errors are given in parenthesis and square brackets respectively. The fixed effects model controls for states and years. We report statistical significance of the estimated coefficients at the conventional 10 percent (*), 5 percent (**), and 1 percent (***) levels. LP is ratio of employees with bachelor's degree to total employees. GP is ratio of cost of materials to value of shipment. IP1 is ratio of employees with post-graduate degree to all employees. The time dummy variable for globalization (T×95) takes on value of one (1) if year $\geq$ 1995, and value of zero (0) if otherwise.

TABLE A76 OLS and Fixed Effect Regressions of Ellison-Glaeser Agglomeration Index

	STRONG BRIDGE		WEAK BRIDGE	
	OLS [clustered standard errors]	**FIXED EFFECTS [clustered standard errors]**	**OLS [clustered standard errors]**	**FIXED EFFECTS [clustered standard errors]**
Constant	-0.087 [0.093]	0.059 [0.110]	0.094* [0.084]	0.193*** [0.108]
LP1	0.176*** [0.043]	0.200*** [0.041]	0.109*** [0.042]	0.131*** [0.040]
LP1 × D95	-0.031*** [0.009]	-0.035*** [0.009]	0.007 [0.011]	-0.006 [0.008]
GP	0.417*** [0.054]	0.374*** [0.055]	0.180*** [0.051]	0.127** [0.053]
GP × D95	0.021 [0.018]	0.013 [0.016]	0.024 [0.016]	0.019 [0.016]
IP1	0.185*** [0.059]	0.210*** [0.053]	0.014 [0.056]	0.028 [0.053]
IP1 × D95	-0.027 [0.020]	-0.012 [0.017]	0.025 [0.020]	0.030 [0.020]
Average Duty Rate (ADR)	0.013*** [0.001]	0.013*** [0.001]	0.019*** [0.001]	0.018*** [0.001]
D95 (= ADR × T95)	0.011 [0.015]	-0.016 [0.013]	-0.024 [0.012]	-0.027* [0.012]
State Minimum Wage (MW)	-0.014 [0.018]	-0.068*** [0.032]	-0.017* [0.016]	-0.048*** [0.030]
MW × D95	-0.003* [0.002]	0.001 [0.002]	-0.001 [0.002]	0.001 [0.002]
State Maximum Corporate Income tax Income Tax (CIT)	0.001 [0.007]	0.002 [0.006]	0.001 [0.006]	-0.001 [0.005]
CIT × D95	-0.001 [0.001]	-0.001 [0.001]	0.001 [0.001]	-0.001 [0.001]
Energy Cost-to-Value of Shipment (Energy)	-1.299*** [0.341]	-0.379 [0.314]	-0.852*** [0.383]	-0.107 [0.441]
Energy × D95	-0.114 [0.142]	-0.078 [0.085]	0.116 [0.072]	-0.027 [0.071]
Inventory-to-Value of Shipment (Inventory)	0.412*** [0.141]	0.443*** [0.154]	-0.178** [0.073]	-0.192** [0.084]
Inventory × D95	-0.008 [0.054]	0.098* [0.058]	0.056 [0.052]	0.114** [0.055]
Observations	7,734	7,734	7,734	7,734
R-squared	0.031	0.090	0.030	0.083

*Notes: C*lustered [by states] standard errors are given in parenthesis and in square brackets respectively. The fixed effects model controls for states and years. We report statistical significance of the estimated coefficients at the conventional 10 percent (*), 5 percent (**), and 1 percent (***) levels. Labor pooling proxy (LP) is ratio of employees with bachelor's degree to total employees. GP is ratio of cost of materials to value of shipment. IP1 is ratio of employees with post-graduate degree to all employees. The time dummy variable for globalization (T×95) takes on

value of one (1) if year ≥ 1995, and value of zero (0) if otherwise. ADR is calculated as ratio of total import duty to total dutiable value of U.S. imports. D95 = T95 × ADR.

TABLE A77 OLS and Fixed Effect Regressions of Gini Index

	STRONG BRIDGE		WEAK BRIDGE	
	OLS [clustered standard errors]	**FIXED EFFECTS [clustered standard errors]**	**OLS [clustered standard errors]**	**FIXED EFFECTS [clustered standard errors]**
Constant	0.009 [0.051]	0.118*** [0.050]	0.067*** [0.044]	0.139*** [0.047]
LP1	0.035** [0.012]	0.044*** [0.011]	0.009 [0.011]	0.020 [0.010]
LP1 × T95	-0.121*** [0.043]	-0.133*** [0.041]	-0.015 [0.042]	-0.067 [0.042]
GP	0.050*** [0.017]	0.047*** [0.017]	-0.036** [0.018]	-0.045*** [0.018]
GP × T95	0.576*** [0.114]	0.586*** [0.109]	0.491*** [0.089]	0.516*** [0.086]
IP1	0.071*** [0.024]	0.102*** [0.022]	0.003 [0.023]	0.025 [0.020]
IP1 × T95	-0.004 [0.086]	0.009 [0.073]	0.097 [0.072]	0.092 [0.071]
Herfindahl Index	0.934*** [0.037]	0.858*** [0.027]	1.015*** [0.033]	0.946*** [0.028]
HI × T95	-0.184*** [0.039]	-0.183*** [0.045]	-0.232*** [0.042]	-0.233*** [0.048]
State Minimum Wage	0.010** [0.010]	-0.016** [0.012]	0.002 [0.009]	-0.010 [0.011]
MW × T95	-0.021* [0.012]	0.017 [0.016]	-0.012 [0.011]	0.003 [0.015]
State Maximum Corporate Income Tax	-0.003** [0.004]	-0.003** [0.003]	-0.002** [0.004]	-0.004** [0.003]
CIT × T95	0.005 [0.003]	0.002 [0.002]	0.006** [0.003]	0.004 [0.003]
Energy Cost-to-Value of Shipment	-0.369*** [0.169]	0.189 [0.244]	-0.286** [0.205]	0.246 [0.294]
Energy × T95	0.429 [0.642]	0.177 [0.507]	0.890* [0.494]	0.207 [0.496]
Inventory-to-Value of Shipment	0.136** [0.053]	0.169** [0.065]	-0.040 [0.026]	-0.020 [0.029]
Inventory × T95	-0.032 [0.334]	0.420 [0.312]	0.137 [0.262]	0.481* [0.261]
Observations	7,734	7,734	7,734	7,734
R-squared	0.374	0.438	0.410	0.463

Notes: Robust and clustered [by states] standard errors are given in parenthesis and square brackets respectively. The fixed effects model controls for states and years. We report statistical significance of the estimated coefficients at the conventional 10 percent (*), 5 percent (**), and 1 percent (***) levels. Labor pooling proxy (LP) is ratio of employees with bachelor's degree to total employees. GP is ratio of cost of materials to value of shipment. IP1 is ratio of

employees with post-graduate degree to all employees. The time dummy variable for globalization (T×95) takes on value of one (1) if year ≥ 1995, and value of zero (0) if otherwise.

TABLE A78 OLS and Fixed Effect Regressions of Gini Index

	STRONG BRIDGE		WEAK BRIDGE	
	OLS [clustered standard errors]	**FIXED EFFECTS [clustered standard errors]**	**OLS [clustered standard errors]**	**FIXED EFFECTS [clustered standard errors]**
Constant	-0.027	0.074**	0.024	0.096***
	[0.050]	[0.046]	[0.044]	[0.043]
LP1	0.050***	0.059***	0.032**	0.042***
	[0.013]	[0.012]	[0.013]	[0.012]
LP1 × D95	-0.010*	-0.013**	0.001	-0.005
	[0.006]	[0.006]	[0.004]	[0.003]
GP	0.074***	0.068***	-0.009	-0.020
	[0.017]	[0.017]	[0.019]	[0.018]
GP × D95	0.044***	0.044***	0.032***	0.033***
	[0.012]	[0.011]	[0.007]	[0.007]
IP1	0.081***	0.110***	0.012	0.034
	[0.025]	[0.022]	[0.023]	[0.020]
IP1 × D95	-0.008	-0.005	0.006	0.008
	[0.011]	[0.010]	[0.010]	[0.011]
Average Duty Rate (ADR)	0.005***	0.005***	0.006***	0.006***
	[0.000]	[0.000]	[0.001]	[0.001]
D95 (=ADR × T95)	0.008	-0.006	0.009	0.005
	[0.009]	[0.008]	[0.007]	[0.007]
Herfindahl Index	0.921***	0.848***	0.998***	0.929***
	[0.038]	[0.028]	[0.033]	[0.026]
HI × D95	-0.017***	-0.021***	-0.028***	-0.032***
	[0.004]	[0.004]	[0.004]	[0.005]
State Minimum Wage (MW)	0.011**	-0.011	0.003	-0.006
	[0.010]	[0.010]	[0.009]	[0.010]
MW × D95	-0.004***	-0.002	-0.004***	-0.003*
	[0.001]	[0.001]	[0.001]	[0.001]
State Maximum Corporate	-0.003***	-0.004***	-0.003**	-0.005***
Income Tax (CIT)	[0.004]	[0.003]	[0.004]	[0.003]
CIT × D95	0.001	-0.001	0.001	0.001
	[0.001]	[0.001]	[0.001]	[0.001]
Energy Cost to Value of	-0.363***	0.158	-0.291**	0.186
Shipment	[0.171]	[0.226]	[0.200]	[0.262]
Energy × D95	-0.014	-0.032	0.035	-0.005
	[0.070]	[0.054]	[0.038]	[0.035]
Inventory-to-Value of	0.134**	0.166**	-0.039	-0.021
Shipment	[0.052]	[0.063]	[0.026]	[0.028]
Inventory × D95	0.002	0.067**	0.025	0.081***
	[0.029]	[0.033]	[0.024]	[0.027]
Observations	7,734	7,734	7,734	7,734
R-squared	0.379	0.443	0.422	0.476

Notes: Clustered [by states] standard errors are reported in brackets. The fixed effects model controls for states and years. We report statistical significance of the estimated coefficients at the conventional 10 percent (*), 5 percent (**), and 1 percent (***) levels. Labor pooling proxy (LP) is ratio of employees with bachelor's degree to total employees. GP is cost of materials to value of shipment. IP1 is ratio of employees with post-graduate degree to all employees. The time dummy variable for globalization (T×95) takes on value of one (1) if year ≥ 1995, and value of zero (0) if otherwise. ADR is calculated as ratio of total import duty to total dutiable value of U.S. imports. D95 = T95 × ADR.

TABLE A79 Industries Ranked by Idea Pooling Index (IP2), 1988

Total national patent count by 2-digit SIC industries in 1988

SIC 2 digits	SIC description	Patent counts
35	Industrial machinery and equipment (except electrical)	8,540
36	Electronic and other electric equipment (plus instruments to measure electricity-SIC 3825)	8,148
38	Instruments and related products (except industries coded as SIC 3825)	5,217
28	Chemicals and allied products	5,214
34	Fabricated metal products (except industries coded as SIC 3462, SIC 3463, and SIC 348)	3,527
37	Transportation equipment (plus industries coded as SIC 348)	1,825
30	Rubber and miscellaneous plastic products	1,746
32	Stone, clay, and glass products	724
29	Petroleum and coal products (plus a part of mineral industries-SIC 13)	490
33	Primary metal industries (plus industries coded as SIC 3462 and 3463)	417

Source: Patent data, U.S. Patent and Trademark Office data for year 1988

TABLE A80 List of Information and Communication Technology (ICT) Intensive Industries Bridged Across SIC and NAICS Codes

3-digit SIC Code	Industry	2- digit SIC industry
271	Newspaper	Printing and publishing
273	Book printing	Printing and publishing
275	Commercial printing, gravure	Printing and publishing
278	Bookbinding and related work	Printing and publishing
281	Alkalies, inorganic pigment	Chemicals and allied
282	Plastic materials, synthetic and resins, etc	Chemicals and allied
283	Medicinal chemicals	Chemicals and allied
284	Specialty cleaning, polishing, sanitation agents,	Chemicals and allied
286	Gum and wood chemicals	Chemicals and allied
287	Nitrogenous and phosphatic fertilizers, pesticides	Chemicals and allied
289	Adhesives and sealants	Chemicals and allied
353	Mining machinery and equipment, oil & gas field	Industrial machinery and
354	Machine tools, metal forming type, industrial	Industrial machinery and
356	Pumps and pumping equipments, ball and roller	Industrial machinery and
357	Electronic computers, storage devices, terminals	Industrial machinery and
358	Automatic vending machines, commercial	Industrial machinery and
359	Carburetors, pistons, piston rings, and valves, etc	Industrial machinery and
361	Power distribution and transformers	Electronic and other
362	Carbon and graphite products	Electronic and other
363	Refrigerator, household cooking equipment	Electronic and other
364	Electric lamp bulbs, tubes, wiring devices	Electronic and other
365	Household audio and video equipment	Electronic and other
366	Communication equipment	Electronic and other
367	Electronic tubes, printed circuit boards	Electronic and other
369	Storage batteries, dry and wet batteries	Electronic and other
371	Truck trailers, motor homes	Transportation equipment
372	Aircraft engine and parts	Transportation equipment
373	Ship and boat building and repairing	Transportation equipment
376	Guided missile and space vehicles	Transportation equipment
382	Lab apparatus and furniture	Instruments and related
384	Dental equipment and supplies	Instruments and related
387	Watches, clocks, watchcases and parts	Instruments and related

Note: Information and communication intensive industries are identified using the list of such industries mentioned in Bas and Miribel (2005).

TABLE A81 OLS and Fixed Effect Regressions of Ellison-Glaeser Agglomeration Index with ICT Interactions

	STRONG BRIDGE		WEAK BRIDGE	
	OLS [clustered standard errors]	**FIXED EFFECTS [clustered standard errors]**	**OLS [clustered standard errors]**	**FIXED EFFECTS [clustered standard errors]**
Constant	0.010	0.151	0.210**	0.309***
	[0.101]	[0.110]	[0.089]	[0.109]
LP1	0.013	0.037	0.008	0.022
	[0.057]	[0.056]	[0.059]	[0.057]
LP1×ICT	0.185***	0.193***	0.012	0.039
	[0.064]	[0.069]	[0.071]	[0.075]
LP1×ICT×T95	-0.273***	-0.242**	-0.113	-0.175
	[0.091]	[0.095]	[0.117]	[0.128]
GP	0.384***	0.357***	0.036	-0.007
	[0.068]	[0.067]	[0.060]	[0.062]
GP×ICT	0.057	0.011	0.396***	0.354***
	[0.068]	[0.065]	[0.073]	[0.073]
GP×ICT×T95	-0.139	-0.218	-0.287	-0.248
	[0.334]	[0.328]	[0.326]	[0.334]
IP	0.053	0.156*	0.043	0.127*
	[0.093]	[0.079]	[0.082]	[0.076]
IP×ICT	-0.014	-0.127	-0.143	-0.260**
	[0.122]	[0.113]	[0.104]	[0.102]
IP×ICT×T95	0.297	0.446	0.333	0.537
	[0.338]	[0.325]	[0.326]	[0.349]
T95	0.112***	0.548***	0.009	0.076
	[0.024]	[0.061]	[0.025]	[0.058]
ICT×T95	-0.495	-1.140***	-0.728***	-0.937***
	[0.315]	[0.371]	[0.241]	[0.298]
State Minimum Wage (MW)	-0.034*	-0.096***	-0.013	-0.051*
	[0.018]	[0.032]	[0.017]	[0.030]
MW×ICT	0.058***	0.063***	-0.009	-0.005
	[0.014]	[0.014]	[0.013]	[0.014]
MW×ICT×T95	-0.016	0.060	0.040	0.073*
	[0.043]	[0.052]	[0.032]	[0.038]
State Corporate Income Ta x	0.005	0.007	0.004	0.005
	[0.006]	[0.006]	[0.007]	[0.005]
CIT × ICT	-0.011*	-0.011*	-0.0 05	-0.005
	[0.006]	[0.006]	[0.006]	[0.006]
CIT × ICT × T95	0.008	-0.003	0.007	0.001
	[0.011]	[0.012]	[0.010]	[0.012]
Energy cost-to-value of	-1.585***	-0.562	-0.591	0.204

	[0.435]	[0.420]	[0.489]	[0.619]
Energy × ICT	0.739*	0.879**	-0.269	-0.030
	[0.430]	[0.356]	[0.525]	[0.425]
Energy × ICT × T95	4.579**	3.016	6.805**	4.126
	[2.089]	[2.147]	[3.173]	[3.286]
Inventory-to-value of	0.841***	0.912***	-0.060	-0.050
	[0.127]	[0.128]	[0.127]	[0.138]
Inventory × ICT	-1.087***	-1.142***	-0.393*	-0.419*
	[0.149]	[0.138]	[0.206]	[0.211]
Inventory × ICT×T95	1.355	4.029***	1.925***	2.901***
	[0.900]	[0.665]	[0.552]	[0.589]
Observations	7,734	7,734	7,734	7,734
R-squared	0.033	0.095	0.015	0.068

Notes: Clustered [by states] standard errors are given in square brackets. The fixed effects model controls for states and years. We report statistical significance of the estimated coefficients at the conventional 10 percent (*), 5 percent (**), and 1 percent (***) levels. LP is ratio of employees with bachelor's degree to total employees. GP is ratio of cost of materials to value of shipment. IP1 is ratio of employees with post-graduate degree to all employees. The dummy variable for information and communication technology (ICT) takes on a value of 1 for ICT-intensive industries indicated by SIC codes as listed in Appendix Table A80 and value of zero (0) if otherwise. The time dummy variable for globalization (T×95) takes on value of one (1) if year $\geq$ 1995, and value of zero (0) if otherwise.

TABLE A82 OLS and Fixed Effect Regressions of Ellison-Glaeser Agglomeration Index with ICT Interactions

	STRONG BRIDGE		WEAK BRIDGE	
	OLS [clustered standard errors]	**FIXED EFFECTS [clustered standard errors]**	**OLS [clustered standard errors]**	**FIXED EFFECTS [clustered standard errors]**
Constant	-0.015	0.152	0.212**	0.310***
	[0.102]	[0.111]	[0.089]	[0.109]
LP1	0.009	0.037	0.008	0.021
	[0.057]	[0.056]	[0.059]	[0.057]
LP1×ICT	0.189***	0.194***	0.012	0.039
	[0.064]	[0.069]	[0.072]	[0.075]
LP1×ICT×D95	-0.069***	-0.063**	-0.030	-0.045
	[0.024]	[0.025]	[0.031]	[0.034]
GP	0.384***	0.353***	0.037	-0.007
	[0.067]	[0.066]	[0.060]	[0.061]
GP×ICT	0.064	0.020	0.396***	0.353***
	[0.067]	[0.064]	[0.072]	[0.072]
GP×ICT×D95	-0.049	-0.069	-0.082	-0.071
	[0.087]	[0.086]	[0.087]	[0.088]
IP	0.065	0.150*	0.044	0.127
	[0.092]	[0.080]	[0.082]	[0.077]
IP×ICT	-0.025	-0.119	-0.143	-0.260**
	[0.122]	[0.114]	[0.104]	[0.103]
IP×ICT×D95	0.073	0.111	0.081	0.136
	[0.087]	[0.086]	[0.085]	[0.092]
D95	0.008***	-0.005	0.001	0.000
	[0.002]	[0.004]	[0.002]	[0.004]
ICT×D95	-0.106	-0.309***	-0.193***	-0.250***
	[0.081]	[0.097]	[0.062]	[0.079]
State Minimum Wage (MW)	-0.026	-0.095***	-0.013	-0.051*
	[0.018]	[0.032]	[0.017]	[0.030]
MW×ICT	0.055***	0.061***	-0.009	-0.005
	[0.013]	[0.014]	[0.013]	[0.014]
MW×ICT×D95	-0.004	0.017	0.012	0.020*
	[0.011]	[0.013]	[0.008]	[0.010]
State Corporate Income Ta x	0.005	0.008	0.004	0.005
	[0.006]	[0.006]	[0.007]	[0.005]
CIT × ICT	-0.010*	-0.010*	-0.005	-0.006
	[0.005]	[0.006]	[0.006]	[0.006]
CIT × ICT × D95	0.002	-0.001	0.002	0.000
	[0.003]	[0.003]	[0.003]	[0.003]
Energy cost-to-value of	-1.519***	-0.561	-0.599	0.202

	[0.433]	[0.420]	[0.489]	[0.618]
Energy × ICT	0.742*	0.878**	-0.267	-0.029
	[0.428]	[0.356]	[0.526]	[0.425]
Energy × ICT × D95	1.173**	0.777	1.800**	1.104
	[0.548]	[0.557]	[0.846]	[0.870]
Inventory-to-value of shipment	0.839***	0.910***	-0.060	-0.050
	[0.128]	[0.128]	[0.127]	[0.138]
Inventory × ICT	-1.080***	-1.137***	-0.393*	-0.421*
	[0.149]	[0.137]	[0.206]	[0.212]
Inventory × ICT×D95	0.370	1.062***	0.509***	0.772***
	[0.235]	[0.175]	[0.146]	[0.157]
Observations	7,734	7,734	7,734	7,734
R-squared	0.032	0.095	0.015	0.068

*Notes: C*lustered [by states] standard errors are given in square brackets. The fixed effects model controls for states and years. We report statistical significance of the estimated coefficients at the conventional 10 percent (*), 5 percent (**), and 1 percent (***) levels. Labor pooling proxy (LP) is ratio of employees with bachelor's degree to total employees. GP is ratio of cost of materials to value of shipment. IP1 is ratio of employees with post-graduate degree to all employees. The dummy variable for information and communication technology (ICT) takes on a value of 1 for ICT-intensive industries indicated by SIC codes as listed in Table A80 and value of zero (0) if otherwise. The time dummy variable for globalization (T×95) takes on value of one (1) if year $\geq$ 1995, and value of zero (0) if otherwise. ADR is calculated as ratio of total import duty to total dutiable value of U.S. imports. D95 = T95 × ADR.

TABLE A83 OLS and Fixed Effect Regressions of Gini Index with ICT Interactions

	STRONG BRIDGE		WEAK BRIDGE	
	OLS [clustered standard errors]	**FIXED EFFECTS [clustered standard errors]**	**OLS [clustered standard errors]**	**FIXED EFFECTS [clustered standard errors]**
Constant	0.028	0.130***	0.100**	0.174***
Herfindahl Index [HI]	0.860***	0.787***	0.981***	0.915***
	[0.040]	[0.027]	[0.034]	[0.027]
HI × ICT	0.179***	0.166***	-0.045	-0.054
	[0.043]	[0.047]	[0.046]	[0.044]
HI × ICT × T95	0.001	0.028	0.017	0.033
	[0.167]	[0.177]	[0.232]	[0.217]
LP1	-0.026	-0.017	-0.038**	-0.030**
	[0.016]	[0.015]	[0.017]	[0.015]
LP1×ICT	0.062**	0.075***	0.055*	0.070**
	[0.026]	[0.024]	[0.028]	[0.027]
LP1×ICT×T95	-0.044	-0.041	-0.026	-0.062
	[0.060]	[0.061]	[0.076]	[0.080]
GP	0.033	0.031	-0.101***	-0.110***
	[0.022]	[0.020]	[0.020]	[0.019]
GP×ICT	0.177***	0.157***	0.351***	0.333***
	[0.028]	[0.027]	[0.034]	[0.031]
GP×ICT×T95	0.039	-0.032	-0.098	-0.129
	[0.215]	[0.217]	[0.191]	[0.191]
IP	-0.008	0.038	-0.043	-0.001
	[0.042]	[0.035]	[0.036]	[0.032]
IP×ICT	0.056	0.037	0.052	0.024
	[0.050]	[0.043]	[0.043]	[0.037]
IP×ICT×T95	0.304	0.253	0.251	0.237
	[0.202]	[0.168]	[0.194]	[0.184]
T95	0.013	0.171***	0.005	0.058**
	[0.016]	[0.023]	[0.012]	[0.023]
ICT×T95	-0.348**	-0.634***	-0.401**	-0.537**
	[0.169]	[0.200]	[0.167]	[0.201]
State Minimum Wage [MW]	0.005	-0.021*	-0.001	-0.015
	[0.011]	[0.011]	[0.009]	[0.012]
MW × ICT	-0.009	-0.007	-0.013*	-0.012*
	[0.005]	[0.005]	[0.007]	[0.007]
MW × ICT × T95	0.010	0.057**	0.025	0.053**
	[0.021]	[0.026]	[0.018]	[0.023]
State Corporate Income Ta x [CIT]	-0.001	-0.002	-0.001	-0.003
	[0.003]	[0.003]	[0.003]	[0.003]
CIT × ICT	-0.003*	-0.002	-0.002	-0.001

	[0.002]	[0.002]	[0.002]	[0.002]
CIT × ICT × T95	0.005	-0.000	0.003	0.000
	[0.006]	[0.006]	[0.006]	[0.006]
Energy cost-to-value of	-0.427**	0.208	-0.227	0.323
	[0.211]	[0.282]	[0.245]	[0.331]
Energy × ICT	0.101	0.111	-0.060	-0.005
	[0.194]	[0.149]	[0.247]	[0.196]
Energy × ICT × T95	1.071	0.480	1.477	0.718
	[1.416]	[1.517]	[1.564]	[1.510]
Inventory-to-value of	0.383***	0.435***	0.087*	0.124**
	[0.046]	[0.049]	[0.044]	[0.047]
Inventory × ICT	-0.607***	-0.629***	-0.375***	-0.400***
	[0.088]	[0.073]	[0.109]	[0.103]
Inventory × ICT×T95	0.946*	1.669***	1.176***	1.432***
	[0.474]	[0.385]	[0.417]	[0.395]
Observations	7,734	7,734	7,734	7,734
R-squared	0.394	0.460	0.425	0.479

Notes: Clustered [by states] standard errors are given in the brackets. The fixed effects model controls for states and years effects. We report statistical significance of the estimated coefficients at the conventional 10 percent (*), 5 percent (**), and 1 percent (***) levels. Labor pooling proxy (LP) is ratio of employees with bachelor's degree to total employees. GP is ratio of cost of materials to value of shipment. IP is ratio of post-graduate employees to all employees. The dummy variable for information and communication technology (ICT) takes on a value of 1 for ICT-intensive industries as listed in Appendix Table 2 and value of zero (0) if otherwise. The time dummy variable for globalization (T×95) takes on value of one (1) if year $\geq$ 1995, and value of zero (0) if otherwise.

TABLE A84 OLS And Fixed Effect Regressions of Gini Index With ICT Interactions

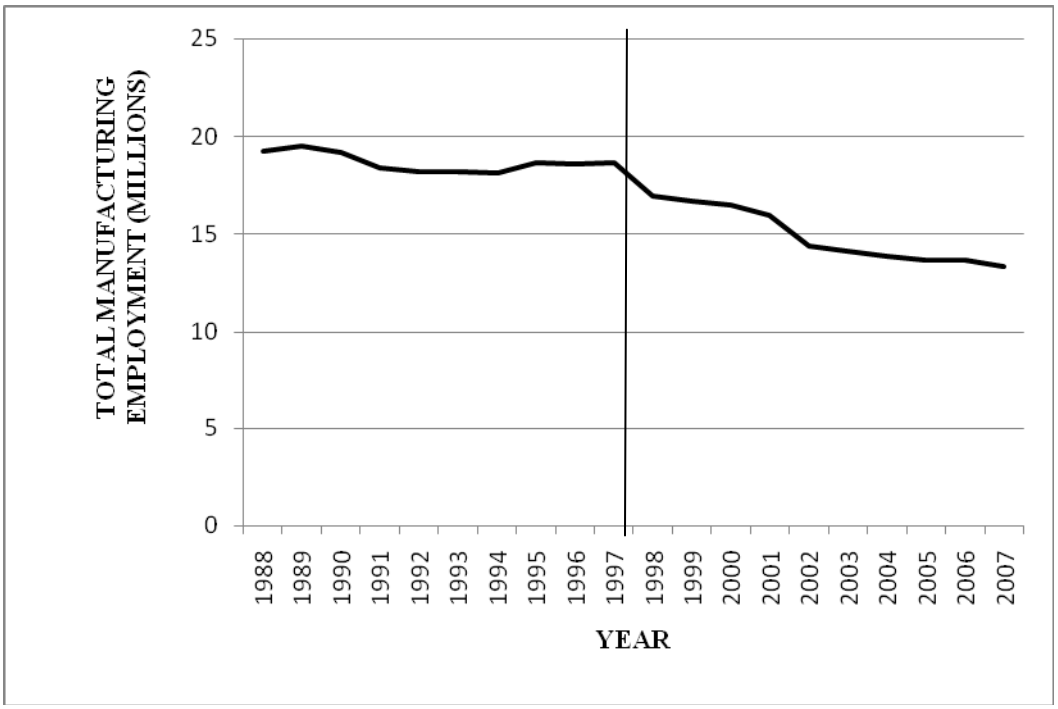
	STRONG BRIDGE		WEAK BRIDGE	
	OLS [clustered standard errors]	**FIXED EFFECTS [clustered standard errors]**	**OLS [clustered standard errors]**	**FIXED EFFECTS [clustered standard errors]**
Herfindahl Index [HI]	0.855***	0.784***	0.980***	0.916***
	[0.041]	[0.028]	[0.034]	[0.027]
HI × ICT	0.188***	0.169***	-0.043	-0.054
	[0.044]	[0.047]	[0.046]	[0.044]
HI × ICT × D95	0.004	0.012	0.003	0.007
	[0.045]	[0.048]	[0.062]	[0.058]
LP	-0.028*	-0.017	-0.039**	-0.029*
	[0.016]	[0.015]	[0.017]	[0.015]
LP×ICT	0.064**	0.074***	0.056*	0.070**
	[0.026]	[0.025]	[0.028]	[0.027]
LP1×ICT×D95	-0.011	-0.014	-0.007	-0.018
	[0.015]	[0.016]	[0.020]	[0.021]
GP	0.028	0.024	-0.103***	-0.113***
	[0.021]	[0.019]	[0.020]	[0.019]
GP×ICT	0.187***	0.167***	0.355***	0.336***
	[0.027]	[0.026]	[0.033]	[0.030]
GP×ICT×D95	0.002	-0.012	-0.030	-0.036
	[0.056]	[0.055]	[0.051]	[0.050]
IP	-0.006	0.026	-0.042	-0.005
	[0.041]	[0.036]	[0.036]	[0.033]
IP×ICT	0.054	0.051	0.052	0.029
	[0.049]	[0.044]	[0.043]	[0.038]
IP×ICT×D95	0.078	0.064	0.062	0.059
	[0.052]	[0.045]	[0.051]	[0.049]
D95	-0.001	-0.012***	-0.000	-0.004*
	[0.001]	[0.003]	[0.001]	[0.003]
ICT×D95	-0.084*	-0.186***	-0.103**	-0.148***
	[0.043]	[0.051]	[0.044]	[0.054]
State Minimum Wage [MW]	0.012	-0.019*	0.001	-0.015
	[0.012]	[0.011]	[0.009]	[0.012]
MW × ICT	-0.013**	-0.009	-0.015**	-0.012*
	[0.005]	[0.005]	[0.007]	[0.007]
MW × ICT × D95	0.002	0.015**	0.007	0.014**
	[0.005]	[0.007]	[0.005]	[0.006]
State Corporate Income Ta x [CIT]	-0.001	-0.002	-0.001	-0.003
	[0.004]	[0.003]	[0.003]	[0.003]
CIT × ICT	-0.003	-0.002	-0.002	-0.001

	[0.002]	[0.002]	[0.002]	[0.002]
CIT × ICT × D95	0.001	-0.000	0.001	-0.000
	[0.002]	[0.002]	[0.002]	[0.002]
Energy cost-to-value of shipment [Energy]	-0.363*	0.210	-0.206	0.322
	[0.212]	[0.282]	[0.246]	[0.330]
Energy × ICT	0.081	0.098	-0.065	-0.006
	[0.192]	[0.150]	[0.246]	[0.196]
Energy × ICT × D95	0.258	0.095	0.388	0.189
	[0.371]	[0.392]	[0.416]	[0.400]
Inventory-to-value of shipment[Inventory]	0.378***	0.432***	0.085*	0.123**
	[0.046]	[0.048]	[0.044]	[0.047]
Inventory × ICT	-0.597***	-0.625***	-0.372***	-0.399***
	[0.086]	[0.072]	[0.108]	[0.103]
Inventory × ICT×D95	0.253**	0.454***	0.310***	0.384***
	[0.121]	[0.099]	[0.111]	[0.105]
Observations	7,734	7,734	7,734	7,734
R-squared	0.394	0.462	0.425	0.479

*Notes: C*lustered [by states] standard errors are given in brackets. The fixed effects model controls for state and year effects. We report statistical significance of the estimated coefficients at the conventional 10 percent (*), 5 percent (**), and 1 percent (***) levels. Labor pooling proxy (LP) is ratio of employees with bachelor's degree to total employees. GP is cost of materials to value of shipment. IP1 is ratio of employees with post-graduate degree to all employees. The dummy variable for information and communication technology (ICT) takes on a value of 1 for ICT-intensive industries as listed in Appendix Table 2 and value of zero (0) if otherwise. The time dummy variable for globalization (T×95) takes on value of one (1) if year $\geq$ 1995, and value of zero (0) if otherwise. ADR is calculated as ratio of total import duty to total dutiable value of U.S. imports. D95 = T95 × ADR.

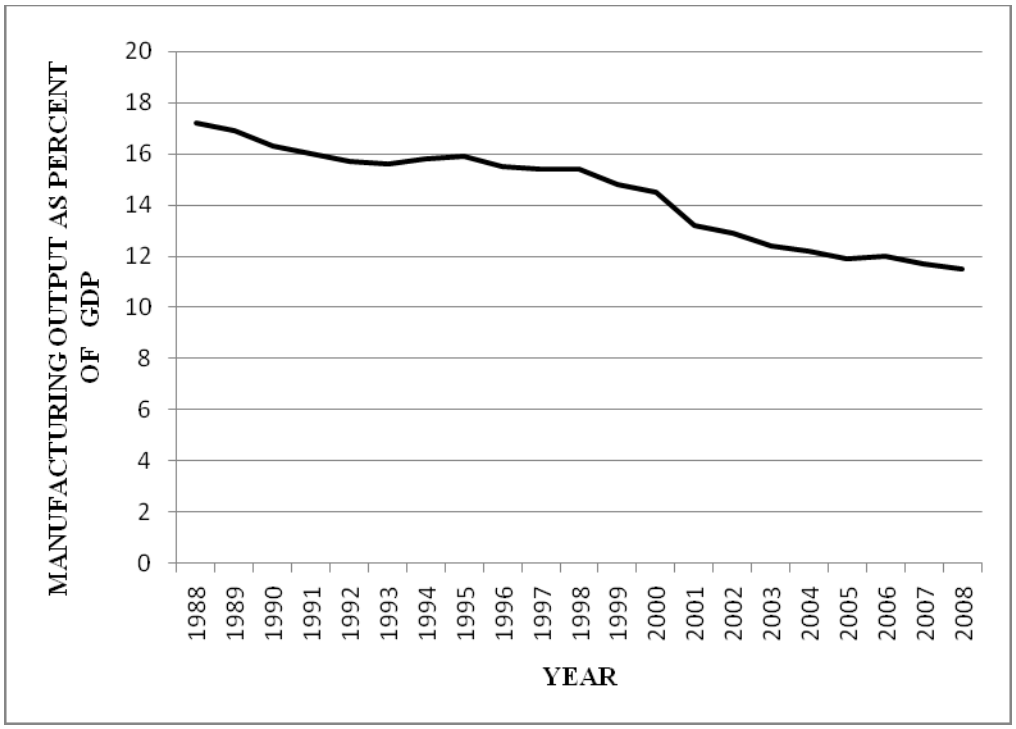
APPENDIX B GRAPHS AND MAPS

FIGURE B1. Total manufacturing employment in the United States, 1988–2007



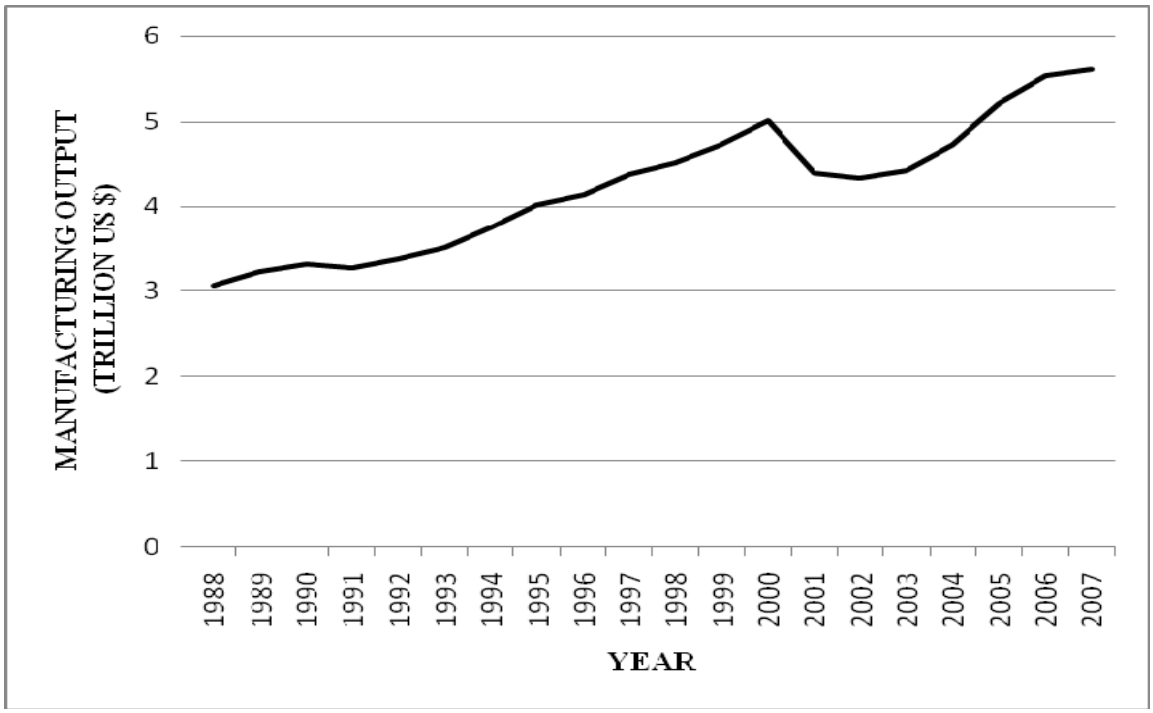
Note: Bureau of Census. Author has produced this graph above Using County Business Pattern Data.

FIGURE B2. Manufacturing output as percent of GDP in the United States, 1988–2008. Data



Source: Bureau of Economic Analysis, U.S. Bureau of Census. Author produced this graph above.

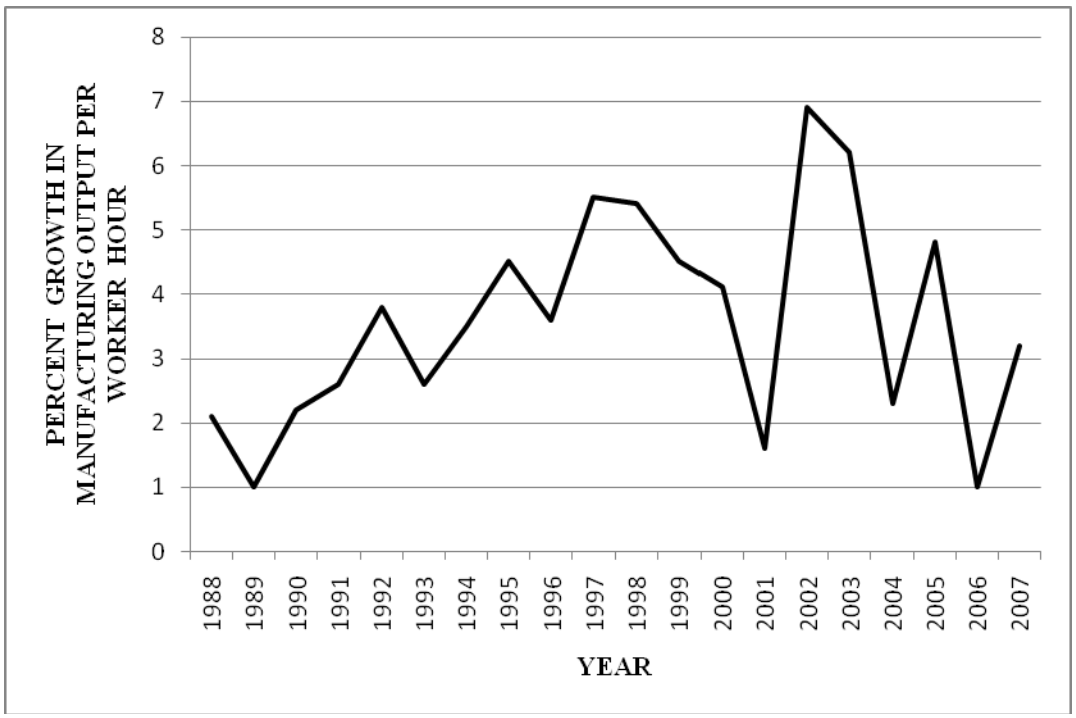
FIGURE B3. Historical Manufacturing Output In The United States, 1988–2007



Source: Annual Survey of Manufacturers, U.S. Bureau of Census.

Note: Total output of manufacturing industries is calculated by adding end-of-year inventory of previous year with the value of shipment in the current year. For example, manufacturing output for the year 1988 is calculated by adding the value of year-end-inventory for year 1987 with value of shipment for year 1988. Author produced this graph above.

FIGURE B4. Growth in Manufacturing Output per Worker Hour in the United States, 1988-2007

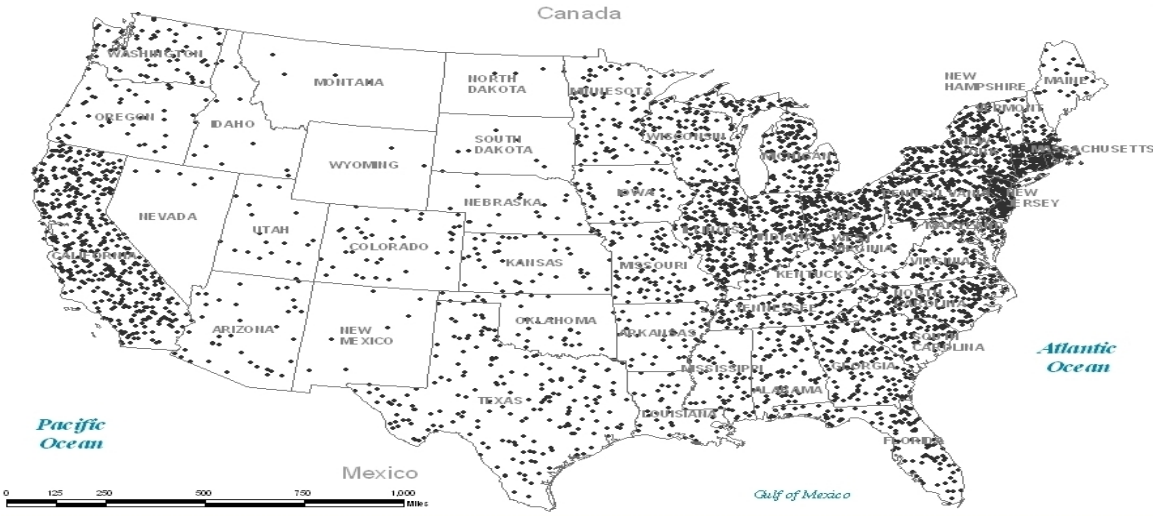


Data Source. Bureau of Labor Statistics, U.S. Bureau of Census

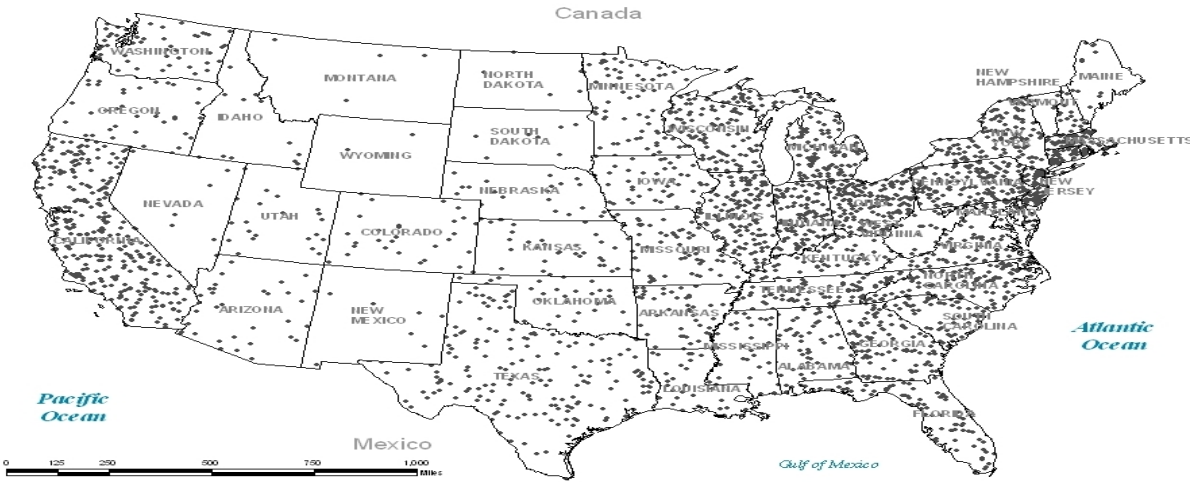
Output growth rate is measured in percent. Author produced the graph above. Author produced this graph above.

FIGURE B5. Total Manufacturing Employment in the United States in 1988 & 2003

A. Total Manufacturing Employment in 1988 (19.25 million)



B. Total Manufacturing Employment in 2003 (14.13 million)



Note: State level total manufacturing employment is mapped using dot density. Each dot represents manufacturing employment of 5,000 workers. Alaska and Hawaii are not shown in the map due to space constraints. As seen on the maps, the manufacturing

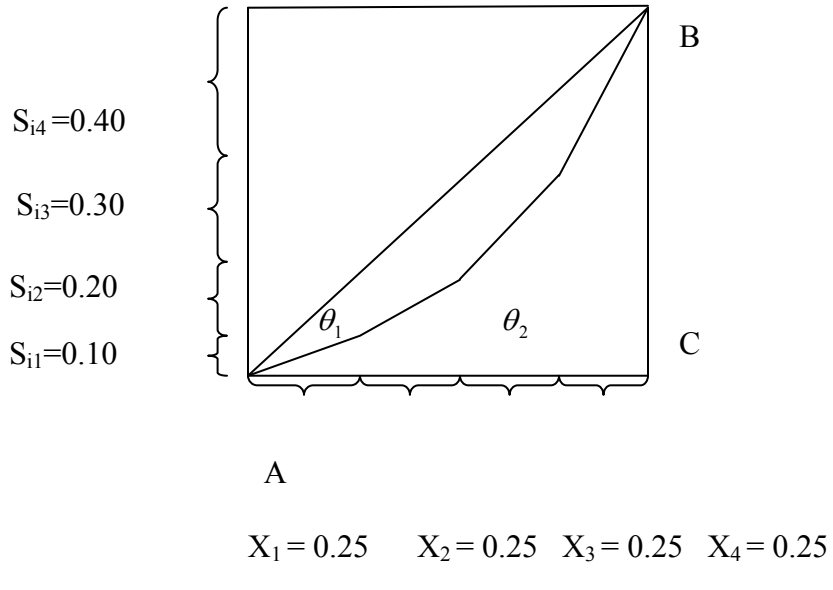
employment density in 2003 is less dense relative to that in 1988 depicting the attrition in the manufacturing jobs in U.S. in recent years.

FIGURE B6. Hypothetical Employment Shares of Manufacturing Industries in a Four Region Economy

Region 1 $S_{i1} = 0.10$ $X_1 = 0.25$	Region 2 $S_{i2} = 0.20$ $X_2 = 0.25$
Region 3 $S_{i3} = 0.30$ $X_3 = 0.25$	Region 4 $S_{i4} = 0.40$ $X_4 = 0.25$

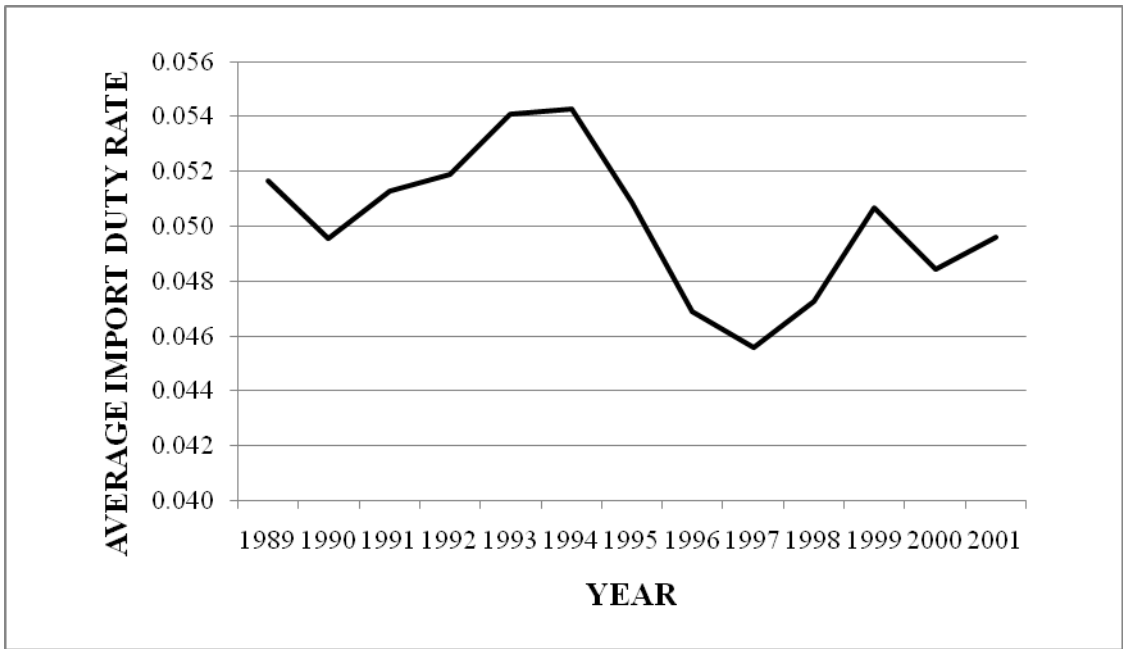
Note: Using the information above and the definition of location quotient $LQ_{im} = S_{im}/X_{m,}$ we can calculate $LQ_{i1} = [0.10/0.25] = 0.4$, $LQ_{i2} = [0.20/0.25] = 0.80$, $LQ_{i3} = [0.30/0.25] = 1.20$, and $LQ_{i4} = [0.40/0.25] = 1.60$. Here industry i's employment is more concentrated in region 3 and region 4 relative to that in other two regions.

FIGURE B7. Gini Index for Employment Concentration



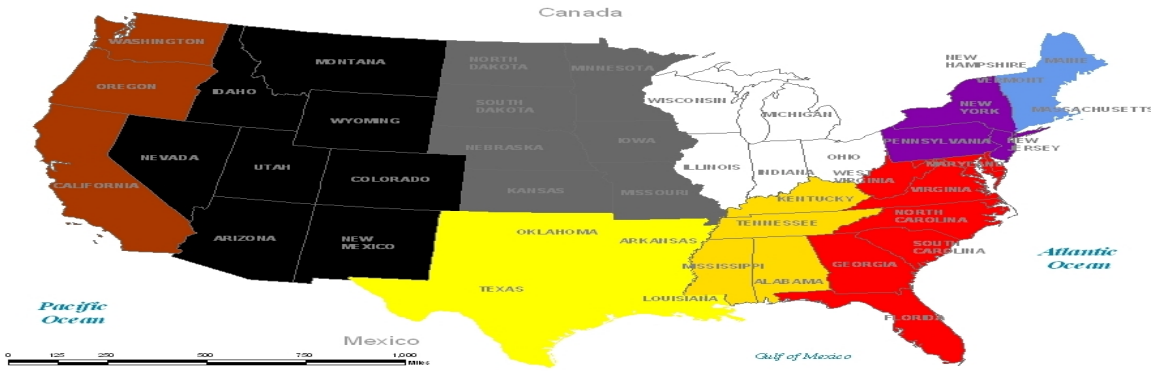
Note: In this example, manufacturing employment is distributed evenly across regions (i.e., $X_i = 0.25$ for i = 1, 2, .., 4). But the employment in industry i is distributed as follows: $S_{i1} = 0.10$, $S_{i2} = 0.20$, $S_{i3} = 0.30$, and $S_{i4} = 0.40$. The locational Gini quotient is calculated as follows: $[\theta_1 /(\theta_1 + \theta_2)]$, where $\theta_1 = (0.5 - \theta_2)$ and θ_2 equal to the aggregate area corresponding to the pairs of employment shares indicated by pairs (x_1, s_{i1}), (x_2 and s_{i2}), (x_3 , s_{i3}), and (x_4 and s_{i4}). Using this formula, the locational Gini quotient in this example is 0.326.

FIGURE B8. Average Import Duty Rate in the United States from 1989 to 2001



Note: Average Import Duty Rate (ADR) is calculated as follows: [(total collected duties)/ (total dutiable value of import of all commodities)]. Historical trade data is obtained from the online database of U.S. International Trade Commission (USITC).

FIGURE B9. List of Nine Census Divisions and Sates Therein



Region 1: Northeast	**Region 2: Midwest**	**Region 3: South**	**Region 4: West**
Division 1: New England	Division 3: East North Central	Division 5: South Atlantic	Division 8: Mountain
Connecticut Maine Massachusetts New Hampshire Rhodes Island Vermont	Indiana Illinois Michigan Ohio Wisconsin	Delaware Florida Georgia Maryland North Carolina South Carolina Virginia West Virginia	Arizona Colorado Idaho New Mexico Montana Utah Nevada Wyoming
Division 2: Middle Atlantic	Division 4: West North Central	Division 6: East South	Division 9: Pacific
New Jersey New York Pennsylvania	Iowa Kansas Minnesota Missouri Nebraska North Dakota South Dakota	Alabama Kentucky Mississippi Tennessee	Alaska* California Hawaii* Oregon Washington
		Division 7: West South	
		Arkansas Louisiana Oklahoma Texas	

Note: Map is produced by author using regional classification of the U.S. Bureau of Census. *Alaska and Hawaii are not shown on the map due to space constraint.

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