CAGE

From the Manufacturing Belt to the Rust Belt. Spatial Inequalities in the United States: An Interdisciplinary Literature Review

Alexander Klein

WARWICK
THE UNIVERSITY OF WARWICK

UKRI

Economic
and Social
Research Council

From the Manufacturing Belt to the Rust Belt.
Spatial Inequalities in the United States:
An Interdisciplinary Literature Review[1]

Alexander Klein
School of Economics, University of Kent
Canterbury, UK
(a.klein-474@kent.ac.uk)

Abstract

This paper reviews research on spatial inequalities in the United States focusing on the Manufacturing Belt and Rust Belt. It offers a taxonomy of scholarship in this area and assesses its contribution to our understanding of the evolution of U.S. spatial inequalities since the middle of the nineteenth century. This scholarship has shown that the initial location of the Manufacturing Belt was influenced by natural resources, location of initial European settlements and early development of canals. The dominant position of the belt was the result of its large market potential which allowed firms to take advantage of agglomeration economies, supply-chain linkages and low-cost access to the consumers. Its decline and subsequent emergence of the Rust Belt was the result of rising labor costs and diminished location advantage.

Keywords: manufacturing belt, rust belt, economic geography, spatial inequality

JEL codes: B20, R12, N61, N62, N91, N92

I: Introduction

The spatial distribution of American manufacturing activities has changed considerably over time. What had emerged as a natural concentration of manufacturing production on the north-east coast of the Atlantic Ocean in the late seventeenth and early eighteenth century, and later spread to the Midwest, evolved into a major region of the U.S. manufacturing sector after the Civil War, earning a name – the Manufacturing Belt. Table 1 shows the distribution of manufacturing employment, and population across U.S. regions between 1880 and 2007 respectively. We see that in 1880 more than 84 percent of manufacturing employment was concentrated in the Manufacturing Belt which contained less than 60 percent of the U.S. population. Its position as the dominant location of manufacturing activities gradually declined and by 2007 its share on the U.S. manufacturing employment halved and dropped to 40.5 percent. We can say that the U.S. manufacturing in the late nineteenth century exhibited a core-periphery structure with 84.3 percent located inside and the remaining 15.7 percent outside the Manufacturing Belt. This had eroded over the course of the twentieth century and by the beginning of the millennia, fewer manufacturing jobs resided inside than outside the belt: 42.4 percent vs. 57.6 percent.

<INSERT TABLE 1>

The rise and decline of the Manufacturing Belt have attracted a considerable scholarly attention. Having been linked to the success of the U.S. industries at the turn of the twentieth century, scholars tried to understand the sources of the belt's long-lasting dominance in North American industrial production. Its demise has drawn even more attention, especially as the region suffered a massive dislocation of manufacturing activities, and industries such as iron and steel and car manufacturing – once staple sectors of the industrial heartland – had become the posterchild of this industrial decline. To deepen the belt's demise, the industries of ICT revolution relocated away for the belt to the South and West with the states such as Texas, California, and Washington becoming the new centers of high-skilled, research and innovation intensive sectors such as computer, software, or electronics industries. All of this was reflected in the name-change: a region once proudly called the *Manufacturing Belt* gave way to a new term: the *Rust Belt*.

As we have noted earlier, the share of manufacturing employment located in the belt halved over 130 years. What about the actual number of employees: how many manufacturing jobs did the Manufacturing Belt lost? And was there any other period in the U.S. history with a

2

comparable manufacturing employment decline? Table 2 presents the number of employees between 1880 and 2007 in the United States, the Manufacturing Belt, and the rest of the country. Focusing on the belt, we see that the employment levels peaked in 1967 (column (10) in Table 2). Since then, it witnessed a steady decline and by 2007 it lost about 5.6 million manufacturing jobs, which is about thirty percent of the initial (in our case year 1967) total U.S. manufacturing employment. Looking at the manufacturing employment in the United States as a whole, post 1967 years can be split into two sub periods: 1967-1997, and 1997-2007. In the former, the decline of the manufacturing employment was almost solely confined to the Manufacturing Belt (except for 1987-1997 when the manufacturing employment declined slightly outside the belt as well). However, in the period from 1997 to 2007, manufacturing employment dropped in the entire country and the losses were split between the Manufacturing Belt and the rest of the U.S. more or less equally: around 1.7 million in the former and 1.8 million in the latter case. It is interesting to compare the magnitude of the manufacturing employment losses between the Manufacturing Belt in 1967-1997 and the United States 1997-2007: 3.99 million vs 3.499; or, in percentage terms relative to the U.S. total manufacturing employment 21.3 percent vs 20.9 percent.

<INSERT TABLE 2>

Naturally, these figures reflect only one dimension of the industrial decline: unemployment rates, or real per capita income would provide further evidence. But the figures in Table 2 clearly point to the enormity of both spatial and sectoral labor reallocation: away from the Manufacturing Belt, and from the industrial sector. There is only one period in recent U.S. history that saw such a profound decline of the manufacturing employment: the first decade of the new millennia. Indeed, as discussed in the previous paragraph, the Manufacturing Belt shed as many manufacturing jobs from the late 1960s until late 1990s as the United States in the early 2000s. Clearly, the belt's decline wasn't as fast and lasted for three decades. Nevertheless, the sheer magnitude of its decline is comparable only to that of the whole United States at the beginning of the millennia.

This paper reviews and assesses research on the Manufacturing Belt/Rust Belt and puts it into a wider intellectual context. This literature crosses several discipline including economics, geography, and history, and whilst they are united by a common interest, they use different empirical tools and theoretical concepts. This presents two main challenges. First, there are studies which are directly relevant to the evolution and inner working of the belt, yet they are

confined either to a specific city, industry, or their combination. To make the review manageable, I focus on the work which is about the Manufacturing Belt/Rust Belt as a whole region.[2] The second challenge is a methodological diversity of the work reviewed which arises naturally from its interdisciplinary nature. I have addressed it by organizing the review into several parts. First, I split the literature into two broad categories: (1) the emergence and dominance of the Manufacturing Belt, (2) its decline and the emergence of the Rust Belt. Within each category, I then create sub-categories. In the first category, I split the literature into four sub-categories chronologically. This allows us me to respect their different methodological approaches. In the second category, I split the literature by specific topics. This is possible because unlike the literature on the emergence of the belt, there is more research about its decline and each topic is well represented by a considerable body of work. Table 3 presents these categories and summarizes the main findings and methodological approach of the works reviewed in this article.

<INSERT TABLE 3>

We can summarize the main findings as follows:

1. initial location and the emergence of the Manufacturing Belt was influenced by the initial location of population, natural resources, and early developments of the canal system

2. position of the Manufacturing Belt as the dominant industrial region was 'locked-in' by its large market potential which occurred in the last two decades of the nineteenth century. This allowed firms to take advantage of agglomeration economies, supply-chain linkages and low-cost access to the consumers, which then enabled the Manufacturing Belt to remain the leading industrial region until the 1960s.

3. dissolution of the Manufacturing Belt and the emergence of the Rust Belt began in the late 1960s and was a result of numerous factors among which high labor costs in the belt and the diminished importance of the belt's location advantage are seen as the most important.

Economic geography of the United States is complex, and this review focuses on one aspect of it. There are other important surveys which examine its other features: a review of a long-

---

[2] Single-industry studies relevant to the development of the Manufacturing Belt include Warren (1987) on steel industry, Rubenstein (2002) on automobile industry, Buenstorf and Klepper (2009, 2010) on rubber and tire industry. Studies on individual cities relevant to the development of the Manufacturing Belt include Lindstrom (1978) about Philadelphia, and Cronon (1991) about Chicago.

run development of U.S economic geography is offered by Margo and Kim (2004), urbanization and historical development of cities is reviewed in Boustan, Bunten, and Hearey (2018), post-World War II spatial distribution of economic activities in the U.S. is carefully discussed in Holmes and Stevens (2004), and Fort et al (2018) discuss the causes of manufacturing decline from the late 1970s. I see this survey article as complementary to them.

The rest of the paper is structured as follows. Section 2 discusses the origins of the Manufacturing Belt as a geographical concept, and how it metamorphosed into the concept of the Rust Belt. Section 3 reviews the studies about the emergence and dominance of the Manufacturing Belt, Section 4 studies about its decline and transformation into the Rust Belt, and Section 5 then concludes.

II: The Manufacturing/Rust Belt as geographical concepts: an intellectual history.

The Manufacturing Belt

The locus of manufacturing activities has been drawing attention since the emergence of the United States as a sovereign country, even more so as the country industrialized and expanded its territory to the Pacific coast. U.S. Census of Manufacturers has often published summaries and analytical reports about the location of manufacturing activities in states, cities and counties.[3] Scholarship about the geographical distribution of U.S. manufacturing has a long history and there is no lack of diversity of empirical approaches, concepts, ideas, and debates (see Margo and Kim 2004). Rather than mutually exclusive, they are often complementary to each other and together offer a plastic picture of the changes that the location of U.S. manufacturing has been undergoing over the past centuries. The Manufacturing Belt as a geographical concept has provided both descriptive and analytical framework to examine the scope and extend of the economic geography of U.S. industrial activities. Its intellectual history is rich and spans almost a century with scientific contributions that advanced not only our understanding of this region, but also push forward the frontier of theoretical and empirical research on geography, economics, and history in general.

---

[3] For example, Census of Manufacturers 1860, Introduction; Remarks on the Statistics of Manufacturers 1880, pp. xii-xvi, xxii-xxiii; 1900 Census of Manufacturers, Part 1, Chapter II, Sections xxxiii-xxxv; Location of Manufacturers 1899-1929, Bureau of the Census (1933).

Systematic studies about the Manufacturing Belt emerged in the late 1920s. The 'founding father' of the Manufacturing Belt as a geographical concept is considered the Swedish geographer Sten De Geer, who, in his work 'The American Manufacturing Belt', published in *Geografiska Annaler* in 1927, carefully outlined a dominant concentration of manufacturing in the north-eastern part of the United States and Canada's southern Ontario, and coined it with a term '*the Manufacturing Belt*'.

He wasn't the first who observed a dense concentration of the manufacturing activities in this area though. A report in 1900 Census of Manufacturers shows a map with the value of gross products per square mile in each county and notices a strong concentration of manufacturers in an area north of the Potomac and Ohio river and east of the Mississippi river (Census of Manufacturers 1900, Part, 1, Chapter 2, page clxx). In an extensive monograph *Industrial and Commercial Geography* published in 1913, J. Russell Smith defined a parallelogram of manufacturing cities Boston – Baltimore – St. Louis – Chicago – Boston as a region of high concentration of manufacturing activities. Ray Hughes Whitbeck in his textbook *High School Geography IV* from 1922 observed that even though manufacturing is present in all U.S states, its center is in the north-eastern states north of the Ohio and Potomac rivers and east of the Mississippi River. In addition, using a term 'factory belt', he described a strip of dense manufacturing activities extending from Massachusetts to Baltimore (Whitbeck 1922, pp. 406-407). Whitbeck further refined it in his 1924 book *Industrial Geography* where he outlines the chief manufacturing region by a parallelogram Milwaukee – St. Louis – Baltimore – Portland, Maine – Milwaukee, similar to the one drawn by J. Russel Smith (Whitbeck 1924, page 232, Figure 141).

De Geer's work is a scientific break from these studies because it leaves behind – though undoubtedly well-informed – the eyeballing the Census of Manufacturers data for a well-defined criterion which identifies manufacturing clusters. By today's standards, it is not a conventional academic article, but rather a semi monograph consisting of 126 pages and about 60,000 words.[4] De Geer's main geographical unit is a city with more than 10,000 inhabitants, manufacturing activities are measured with the number of wage earners, and he defines a cluster of manufacturing activities as a group of cities which distance between them ranges

---

[4] A detailed discussion of this paper is in Alvstam (2018).

from 35 to 53 miles (De Geer 1927, pp. 248-250). Using this definition, he finds several manufacturing clusters and called the main one the Manufacturing Belt.[5]

Other manufacturing clusters exist, but he notices that they do not constitute a large continuum of closely located cities as does the Manufacturing Belt. In the south, he identifies several manufacturing cities. However, he observes that they are rather dispersed and that the distances between them are larger than in the north which, using his criterion, leads him to conclude that there is no continuous manufacturing region similar to the Manufacturing Belt in the south. Other scattered manufacturing groups are on the Pacific coast including Los Angeles with Pasadena, Long Beach and San Bernardino, a group around San Francisco that includes Oakland, Alameda, Berkeley, Richmond, and San Jose, and Pacific north with Portland, Oregon, and Seattle, Tacoma, and Everett.

De Geer's work opened a debate about the criterion and delineation of the Manufacturing Belt borders. As a result, refinements of the belt's location as well as the overall spatial distribution of manufacturing activities in the U.S. followed. Various fine tunings were proposed and whilst the norther border was largely uncontested, researchers were debating the western and southern border (Hartshorne 1936, Strong 1937, Jones 1938, Wright 1938). This comes as no surprise since the northern border is outlined by the national border with Canada and even though geographers were including the Ontario peninsula as part of the Manufacturing Belt, later research has mostly treated the Canadian border as a natural northern borderline. Western and southern frontier, on the other hand, had been refined as the manufacturing activities continued to spread west- and south-wards.

Hartshorne (1936) was among the first who started refining De Geer's criteria. He noted that not all cities can be characterized as places of manufacturing. To eliminate those which were dominated by mining or commercial activities, he subtracted 10 percent from the city's population employed as wage earners, arguing that this is an expected proportion of wage earners being employed in non-industrial activities. His map of the Manufacturing Belt leaves the major contours of De Geer's Manufacturing Belt unchanged, but the manufacturing activities outside the belt changed considerably: places such as Birmingham, Alabama, St. Paul-Minneapolis, or most of Pacific coast cities were eliminated. Strong (1937) argued that

---

[5] De Geer outlines the Manufacturing Belt with the U.S state borders as follows (De Geer 1927, page 250): Massachusetts, Connecticut, Rhode Island, small parts of New Hampshire and Maine, New York, New Jersey, Pennsylvania, northern parts of Delaware and Maryland, Ohio, Indiana, Illinois, parts of Michigan, Wisconsin, and Iowa, St. Louis in Missouri, and the Province of Ontario, Canada.

horsepower is better suited to portray the full extent of the manufacturing sector. Since such data were available by counties only, she used a county, not a city as the main geographical unit. The result, in general, confirms the spatial distribution of manufacturing activities by De Geer (1927), though the boundaries are less strictly outlined. Wright (1938) proceeded further on the measurement of manufacturing activities and argued for the value added as the most appropriate one. He chose, similarly to De Geer and Hartshorne, cities over 10,000 population and confirmed the dominant position of the Manufacturing Belt as the main manufacturing region. As for other regions, value added measure showed less pronounced industrial clusters in the south but retained important industrial centers on the Pacific coast. Jones (1938) reflected upon all these studies and whilst agreed with Wright (1938) that value added is the most satisfactory measure, he combined wage earners used by De Geer (1927) and Hartshorne (1936), horsepower used by Strong (1937) and valued added used by Wright (1938), using counties and main geographical unites and the minimum thresholds of 4,000 horsepower, 4,000 wage earners, and $4,000,000 value added. His map confirms that the Manufacturing Belt as the main manufacturing region in the United States though highlights its regional structure with the New England and Middle Atlantic being the most industrialized regions. It also highlights industrial clusters in the south and scattered industrial clusters on the Pacific coast.

Research how to measure manufacturing activities and their spatial distribution have continued as the manufacturing activities spread to the south and the Pacific west, especially in the post-World War II decades (e.g. Hoover (1936), Thompson (1955), Morrison, Scripter, Smith (1968), Zelinsky (1958), Pred (1964), Krugman (1991c)), Ellison and Glaeser (1997), Guimaraes, Figueiredo, and Woodward (2011), Eriksson, Russ, Shambaugh, and Xu (2020), Crafts and Klein (2021)). However, by 1950s, the Manufacturing Belt was accepted as one of the main conceptual frameworks to describe, analyse, and ultimately understand the nature and dynamism of the U.S. manufacturing sector, at least until it began to dissolve in the late 1970s (e.g. Harris (1954), Perloff et al. (1960), Guiness and Bradshaw (1985), Mitchell and Groves ed. (1987), Boal and Royle eds. (1999)). Indeed, Harris 's (1954) seminal work on the market potential as a factor explaining the location of industry in the United States begins as follows:

"Manufacturing in the United States is highly localized as a result of a complex many factors. In the Manufacturing Belt in the North-eastern United States, which occupies only a twelfth of the country, is concentrated half of the entire national market, seventy percent of the industrial labor force, and the sources of supply of most materials and parts directly used in manufacturing" (Harris, 1954, page 315).

In a sweeping, more than 700-page long research monograph *Regions, Resources, and Economic Growth* by Perloff, Dunn, Lampard, and Muth (1960), the authors stated:

"The record of relative regional growth lends itself to a choice of emphasis – either upon the West's remarkable growth or upon East's equally remarkable maintenance of national dominance, especially that of the Manufacturing Belt.… [C]learly, this area is still the very heart of the national economy and the very center of the national market for goods and services." (Perfloff et al 1960, pp. 50-51).

The Manufacturing Belt was also an empirical example used by Krugman (1991b, 1991c) to motivate his seminal models of new economic geography which cast the U.S. regional development as a core-periphery dynamics and view the Manufacturing Belt through the concepts of path dependence and persistence. Once beginning to dissolve, the concept of the Manufacturing Belt and the corresponding terminology was refined to reflect this process and terms such as the *Sun Belt* (e.g. Hulten and Schwab (1984), Ullmann (1988), Teaford (1993), Glaeser and Tobio (2008)) and the *Rust Belt* (e.g. Crandall (1993), Teaford (1993), High (2003), Kahn (1999, 2019), Feyrer et al (2007), Safford (2009), Glaeser (2011), Moretti (2012), Yoon (2017), Adler et al (2021)) emerged. We will review seminal work on the Rust Belt and the Sun Belt later in this chapter, but we will first pause briefly to discuss the origins of the name 'Rust Belt' and put it into a wider socio-economic and cultural context.

The Rust Belt

The term 'The Rust Belt', unlike 'the Manufacturing Belt', exists beyond the realm of economics, geography, history, or political science. It is part of everyday vocabulary and is widely used in popular media including literature, films or television, (e.g. Manning 2016). Also, unlike the 'Manufacturing Belt', the term emerged outside academia and was shaped by the popular media when it tried to reflect and understand the economic events of the 1970s and early 1980s. The term began to form the 1970s when then manufacturing industries started declining. The industrial decline was often linked to the images of towns and metropolitan areas rather than rural areas and juxtaposed to the Sun Belt, a term denoting a region stretching from Florida to southern California (High, 2003, page 23).[6] The economic ascendancy of the southern states in the post-World War II decades had cast a long shadow over the declining

---

[6] Etymological dictionaries suggest that it was coined by the American writer Kevin Phillips in 1969, patterned after the Bible Belt and Corn Belt (High 2003, pp. 22-23).

industrial heartland, offering thus a contrast crucial for highlighting the new realities of the old industrialized region.

Recession years at the turn of the 1980s resulted in masses of unemployed workers, plant shutdowns, and urban decay, mostly related to the industries of iron and steel, rubber, and auto-making. Detroit and auto industry, especially with a near bankruptcy of the Chrysler Corporation in 1979, became a poster child of this economic downturn. Searching for a symbol that would counterpose the Sun Belt, terms such as the Frost belt or Snowbelt appeared first (High 1993, page 27). The ambiguity of these terms led to their brief refinements such as industrial Frostbelt, Smokestack America, or the Foundry, all projecting an image of heavy industries, gritty cities, and environmental degradation. Though short-lived, they found their way into academic studies as a conceptual framework which juxtaposes the declining American Heartland with the prosperous Sunbelt (e.g. Casetti (1984), Sawers and Tabb (1984), Hulten and Schwab (1984), Bartik (1985), Wheat (1986), Casetti and Paul Jones III (1987), Stough (1991), Moomaw and Williams (1991), Rigby (1992), Haynes and Dinc (1997)).

Recession years of early 1980s evoked the memories of the Great Depression, symbolized especially by the Dust Bowl. Ascribed to the fears of a new Great Depression, media began to refer to the region around the Great Lakes as the Rust Bowl rather than the Foundry or the Frostbelt, mainly due to their association with rusting machinery, abandoned factories, closed old steel mills, and padlocked factory gates (High 1993, pp. 29-30). The final step that coined the term the Rust Belt came around 1983-4 when the upturn of the American economy made a comparison to the Great Depression era a bit of a stretch, and the term Rust Belt – as an economic and geographical opposite to the Sun Belt – was considered a better representation of an economic region running from Chicago and Milwaukee on the west and Buffalo and Pittsburgh on the east. The Oxford Dictionary of New Words (1991, pp. 255-256) credited U.S. Democratic Party presidential candidate Walter Mondale with it, but we can suspect that the term was in people's vernacular even before[7].

It is interesting to note that English dictionaries offer various, though similar, definition of the Rust Belt: Meridian-Webster defines it as industrialized part of the northeaster and midwestern states of the U.S., Collins as the north-eastern U.S., Macmillan as the Midwest,

---

[7] The Dictionary entry on pages 255-256 says: "The coinage of the term is often attributed to US Democratic politician Walter Mondale, who opposed Ronald Reagan in the presidential election of 1984. Attacking Mr Reagan's economic policies, Mr Mondale said: His … policies are turning our great Midwest and the industrial base of this … country … into a rust bowl. This was picked up in the media and repeated as *Rust Belt*."

Oxford Learner's as the northern part of the U.S., and Cambridge Learner's only as 'an area where there was previously a lot of industry but where most factories are now closed'.[8] However, the associating of the term Rust Belt is the strongest with the steel and auto-producing area of the Great Lakes, and we will see later in this chapter that its regional boundaries, whilst vary across scholarly work, coincides mostly with the U.S. states around the Great Lakes. The Rust Belt is thus seen as a *subset* of the Manufacturing Belt, something I will discuss in Section IV.

III: The emergence and persistence of the Manufacturing Belt.

Studies on the emergence and persistence of the Manufacturing Belt are eclectic. They often provide similar explanations, but they reach them differently. There are those which rely almost exclusively on the vastness of quantitative evidence provided by the U.S. censuses, those using the methods of historical research, bringing in qualitative evidence alongside quantitative data, and then there are studies which are rooted in econometrics and economic modelling. Such an eclectic range is a challenge for a review, but it also creates an opportunity to trace more than half a century of progress that scholars made when examining the rise and persistence of spatial inequalities in the United States. I will categorize this literature into (1) early studies on the Manufacturing Belt, (2) historical studies, (3) explanations emerging from the new economic geography models, and (4) other explanations.

<u>Early studies on the Manufacturing Belt</u>

I will begin with Harris (1954) seminal study *The Market as a Factor in the Localization of Industry in the United States*. This study has a crucial place in the early literature on the Manufacturing Belt because it is first to conceptualize economic mechanisms that make the Manufacturing Belt an attractive location for the firms and provides an economic rationale for a long-lasting success of this region. Harris does that by conceptualizing the interactions between the market size and transportation costs and by deriving a measure which captures the importance of market size as a function of the distance between the producers and consumers.

Harris, in the context of the Manufacturing Belt, develops a concept of market potential. He argues that markets play a crucial role in the location of manufacturing industries in that region since its emergence in the middle of the nineteenth century. Their importance stems

---

from the fact that they enable a low-cost access to the final goods consumer as well as the suppliers of the intermediate goods. The latter one is particularly stressed by Harris who singles out the importance of industrial linkages as more and more manufacturing goods are produced by assembling various parts rather than from raw materials. He goes as far as making a case that the extraction of raw materials and the location of mining industries is determined more by the proximity to the manufacturers market than by the location of mineral resources themselves. He does that by pointing out that many sources of raw materials are not being explored because they are far away from the manufacturing demand and that mining activities are located closer to the Manufacturing Belt because of the linkages they have to the industries in the belt.

A two-volume study *Population Redistribution and Economic Growth, United States 1870-1950* published in 1957 and 1960 respectively by the collective of authors which consists of Everett Lee, Ann Ratner Miller, Carol P. Brainerd, and Richard Easterlin working under the direction of Simon Kuznets and Dorothy Swaine Thomas is a seminal and magisterial work in the U.S. economic history, comparable in scope and quality only to Kendrick's (1961) *Productivity Trends in the United States*. The team of authors develops and then uses their methodologies to build extensive decadal data sets for the period 1870-1950 consisting of population, sectoral labor force, migration, manufacturing value added, wages and salaries, employment, capital stock, and personal income at state and regional level, many of them broken down into industrial subcategories. The analytical part of this work discusses, among other topics, geographical location of manufacturing and its changes between 1870 and 1950. They document a core-periphery structure of manufacturers with a dominant share located in the Northeast and East North Central states. These two regions are the authors own grouping of the states, and consists of New England, Middle Atlantic, Delaware, Maryland, and D.C. in the former, and Indiana, Illinois, and Ohio in the latter case. This means that even though they don't use the term Manufacturing Belt, they locate the dominant portion of manufacturing activities in the regions which are, effectively, the Manufacturing Belt. They notice a high level of manufacturing labor productivity in these two regions and offer a conjecture that the location of manufacturing is not strongly linked to the population but rather to the external economies of scale. This acts as important agglomeration force which counterbalances the dispersion forces of the westward and southward population movement.

The monograph by Perloff, Dunn, Lampard, and Muth (1960) *Regions, Resources, and Economic Growth* is an in-depth account of a long-run regional development in the United

States. Examining the sources of regional growth from 1870 to 1954, the monograph is based on an extensive collection and analysis of U.S. Census data as well as on the data provided by *Population Redistribution and Economic Growth, United States 1870-1950* (1957, 1960) which the authors brake down into SIC-1 digit category in 1870-1954 and SIC-2 in 1939-1954. The theoretical framework put forward by the authors consider natural resources, market potential, and agglomeration economies with a specific consideration given to the interaction between market accessibility to natural resources, and accessibility to the intermediate production inputs. The monograph offers not only an exhaustive long-run empirical analysis of U.S. regions, but also among the first narratives that provide a unified treatment of the emergence and persistence of the Manufacturing Belt.

The formation of the Manufacturing Belt is viewed as a combination of the accessibility to the natural resources, markets, and the creation of the national railway network. Particular attention is given to the building of the railways which enabled regional economic growth through three main channels: expansion of the centers of industrial production from the east coast towards Midwest; more accessible exploitation of the natural resources; promotion of industrial growth through railway's inter-industry linkages to the firms which supply intermediate inputs such as raw materials, and heavy machineries.

The dominant position of the Manufacturing Belt is the result of the interactions between the markets, natural resources, and cross-industry input-output linkages. Whilst a low transportation costs to access the natural resources is considered as one of the determinants of the initial industrial location in the nineteenth century, the long-lasting nature of the belt as the center of U.S. industrial production between 1910 and 1950s is linked to the two types of market access: low-cost accessibility to the consumer market, and low-costs accessibility to the intermediate inputs, especially for the industries heavily dependent on the final goods produced by other industries such as machinery parts, or capital goods.

A research monograph by Niemi (1974) *State and Regional Patterns in American Manufacturing* offers another systematic and critical treatment of the data collected by the Census of Manufacturers and is among the first study to use a multivariate analysis of the location of manufacturing industries between 1860 and 1900. Niemi greatly expands the work of *Population Redistribution and Economic Growth, United States 1870-1950* (1957, 1960), and Perloff et al (1960) by creating state-industry data set with twenty SIC 2-digit industries harmonized across time. This data serves as an empirical basis for testing numerous hypotheses

about a relationship between the location of industries and factor supply conditions in U.S. states. Niemi reasons – he calls it Heckscher-Ohlin hypothesis – that a region will exhibit a greater concentration of those industries which utilizes the area's relative abundant factor of production most efficiently. His findings cast doubt on the role of factor supply as the major explanation of industrial location across the U.S. states. Niemi concludes that "…spatial concentration was largely the result of local demand and that marker considerations were generally strong enough to offset variations in local factor supply conditions in most industries." (Niemi 1974, page 82). In addition, he conjectures that "…the immobile factors such as resource supplies, access to local demand, economies of scale, and external economies account for [spatial] patterns" (Niemi 1974, page 102).

Research by Allan Pred (Pred (1965), (1966)) concentrates on the development of urban sector in the nineteenth century. Whilst not explicitly framing his analysis in the context of the Manufacturing Belt, he provides important insights into the growth of urban sector throughout the nineteenth century which directly addresses the questions related to the existence and productivity advantage of locating in the Manufacturing Belt. Pred centers his narrative around agglomeration economies which allow firms locating in growing urban centers to increase their productivity and counterbalance high urban costs such as higher rents and wages. At the heart of agglomeration economies are industrial linkages which incentivize firms to locate in the near proximity of intermediate input producers. This is possible, however, only with the expansion of railway network and the reduction of freight costs as it allowed firms to economize on the costs of transporting their products to the final consumers (Pred 1966).

Summary Overall, early studies about the Manufacturing Belt are intimately linked with the seminal works that systematically use the U.S. Census data. Their main aim was to firm our understanding of the long-run spatial inequalities by providing harmonized, longitudinal data at U.S. state and regional level from the nineteenth century to their current time. Methodologically, they rest mostly on analytical narratives supported by quantitative as well as a wide range of qualitative evidence. The explanations they offer are eclectic and complex. Nevertheless, we can recognize a common thread. The evolution of the Manufacturing Belt is seen as an interaction process between market potential, economies of scale, industrial linkages and natural resources which was put into motion by the declining transportation costs caused by the spread of railways.

Historical studies

Historical studies about the emergence of the Manufacturing Belt focus on a complexity of the factors that affected its formation. They attempt to uncover interactions among multiple potential causes behind the formation of the 'belt' and support them with the qualitative and descriptive quantitative evidence. This makes them methodologically different from economic studies which often focus on a single factor or a cause behind the 'belt'.

Research by David Meyer (1983, 1989) offers a comprehensive narrative about the evolution of the Manufacturing Belt which focuses on the within-the-belt dynamics. He draws on the extensive U.S. economic history scholarship and recasts the narrative of the American regional development into a story of the emergence and a subsequent merger of two regional systems: one is east coast New England and Middle Atlantic, and the other is the Midwest on the other. His interpretation of the Manufacturing Belt can be summarized as follows.

The Manufacturing Belt is viewed as a set of replicated regional industrial systems that emerged during the antebellum years. Regional markets were at that time largely separated and focused on intraregional trade. However, later decades of the nineteenth century witnessed the increasing importance interregional/national market which is related to increase efficiency of the transportation and communication, economics growth and change in demand, and technological change. The first one relates to the increased efficiency of the transportation sector which allowed to increase speed and decrease the costs of railway services. This was the result of (i) the expansion and integration of railway network, (ii) larger engines and cars, stronger cars, and the unification of gauges, (iii) improved rail service quality, rail management, innovation of waybill and accounting practices. Interacted with the fast economic growth in the late nineteenth century, the resulting higher demand was capable to sustain standing long-distance shipments, thus creating conditions for a shift toward the interregional market and the merger of New England, Middle Atlantic, and Midwest into one regional system.

Meyer asks why Midwest actually industrialized between 1860 and 1880 and created a diverse set of manufacturing industries including high valued-added manufacturers when the New England and Middle Atlantic had already industrialized. Specifically, he wants to know what conditions allowed the Midwest to successfully compete with the firms on the east coast. He conjectures that the Midwestern firms had a window of opportunity between 1850 and 1870/1880 to develop large scale factories which New England and Middle Atlantic did not, thus preventing them to reduce the production costs low enough to dominate the national

market. Even though transportation costs were declining as the railroad network expanded and became more integrated, eastern firm still faced high enough costs to ship their products long distance (300-1000 miles) to the Midwest, the cost that the Midwest firm did not have to pay.

This is not to say that New England and Middle Atlantic products did not reach the Midwest. Manufacturers such as textiles, or shoes reached the Midwest and as generic goods, were distributed by wholesalers who, by purchasing large quantities of such products, received discounts from transportation providers, something that individual factories could not. Marketing costs of these generic products was low as well. All this allowed eastern products to be distributed cheaply to the Midwestern markets. Numerous other industries, however, manufactured not generic goods but rather technologically complex products that were not produced in large quantities and incurred high marketing costs (e.g. agricultural implements such as reapers, or machinery tools). This created an opportunity for the Midwestern firms to enter these industries without the competition from the New England and Middle Atlantic due to high transportation and marketing costs. Once the expansion and integration of the transportation network was completed and national market emerged, the Midwestern firms could successfully compete with eastern producers, allowing thus the east and the Midwest to coexist and create by and large a continuous industrial region spanning from the Great Lakes to the Atlantic coast.

Meyer's notion that the Manufacturing Belt is not a monolithic system but a cluster of heterogeneous regional systems with strong inter- and intra-industry linkages can be seen as a version of earlier accounts of nineteenth century urbanization which characterized the urban development as a cluster of hierarchically organized cities and towns (Pred (1965), (1966), Muller (1977)). Meyer's arguments have later found support in geography literature, especially in the works of Winder (Winder (1999), (2016)). He views the emergence of the Manufacturing Belt as a process of linking city-centred regional industrial systems by supply networks and the belt as a functioning industrial region in which manufacturers shared supply networks as well as regulatory and governance structure.

The monograph by Teaford (1993) *Cities of the Heartland* is a comprehensive study of the industrial Midwest from its inception to the decline in the 1970s and 1980s. It offers an economic, social, demographic and cultural portrait of this region and metamorphosis it underwent over a century and half. It also provides a narrative which tries to link together the emergence of the Midwest as an important industrial region, its rise to the national dominance,

and the demise manifested in becoming the core of the Rust Belt. The emergence of the Midwest as an important urban center with cities such as Cleveland, Saint Louis, Detroit, Chicago, Cincinnati, or Milwaukee is cast as a story of a favourable geographical position near navigable waterways: rivers of Ohio and Mississippi, the Great Lakes, and canals – Erie Canal opened in 1825, Miami Canal to Dayton, Ohio in 1828, Ohio Canal in 1833. They provided not only access to eastern Atlantic ports and served as a network connecting south, west and east via waterborne trade. They also provided waterpower. Thus, urban settlements were growing as commerce centers due to their strategic positions on the waterway system, and as manufacturing towns due to their favourable position near the power source. The advent of the railways reshaped the urban hierarchy and whilst some cities reinforced their dominance – Chicago or Cleveland – other cities were left behind, such as Cincinnati. Railroads also bounded together East and Midwest into the Manufacturing Belt.

Teaford sees the merging of the Midwest with East into one dominant industrial region as a story of the railway expansion. In Teaford's account, railways acted as a facilitator which lowered the transportation costs, hence eased access to natural resources, and markets. The geographical position of cities such as Chicago connected to the East with a dense railway network allowed firms to reach western parts of the United States cheaply, hence often relocating there to take advantage of it. Ease of access enable another crucial element for the Midwest to achieve its dominant industrial position – industrial linkages. These three elements – railways, natural resources, and industrial linkages – created conditions for the Midwest to have a specific industrial structure based on iron and steel, woodworking, food processing, and machinery industry producing farm machineries, freight cars or high-class carriages. It successfully competed with East and only the eastern textiles and wool manufacturers retained their national dominance. Industrial linkages were also at the center of Midwest's most visible industry – auto-making. Emerging in the 1880s and 1890s, car manufacturing took advantage of numerous machine shops producing carriages, buggies, wagons, and engines, all providing essential parts – intermediate inputs – into cars. As the industry matured, it created demand for the products of rubber and electrical engineering firms.

Teaford also offers some insights into the evolution of the Midwest in the post-World War II decades, though he focuses mostly on its implications for on urban life. Unlike Harris (1954) or Perloff et al (1960), he does not see the 1950s and 1960s and the heyday of the Midwestern industrial development, but rather as the decades during which the Midwest underwent its transformation into the Rust Belt. This long process started already in the 1940s

with a gradual movement of population to the south and California. He views this as a combination of the Midwestern poor industrial relations, and low-wage and low-unionized regions in the south and west which, as a result, caused companies to either relocate there, or completely avoid the Midwest when opening new plants. The industrial linkages are at the core of the Midwest's misfortune since firms departing this region bring about job losses not only because of plant closures but also because of the plant closures in the firms which were intermediate suppliers.

Summary Overall, the reviewed historical studies build upon the data sources provided by the early studies. The explanations they offer seem similarly eclectic, but unlike the early studies, they try look at the emergence of the belt from fresh perspectives. They see it more as a nuanced process in which the staggered expansion of railways in the middle of the nineteenth century created conditions that led to the existence of two industrial centers ultimately merging into the Manufacturing Belt. This is an important point because recognizing the heterogeneous nature of the Manufacturing Belt is important for the understanding of the causes behind its decline.

Explanations based on new economic geography models

Krugman (1991a, 1991b) has ushered an era of the new economic geography models. Although many ideas about spatial inequalities already existed in the geography and economic literature (see Fujita, Krugman, Venable (1999), Neary (2001)), the general equilibrium model put forward by Krugman explains spatial inequalities within a coherent economic framework. Krugman (1991b, 1991c) has used the Manufacturing Belt as *the* historical example to highlight the main mechanisms that cause firms to agglomerate together and create a manufacturing core-periphery constellation.

His account views the clustering of manufacturing firms as the interaction of increasing returns, transportation costs, and demand. Krugman's (1991a) seminal model derives necessary conditions for the concentration of manufacturing in one location. These can be stated as follows. Suppose that F is the fixed costs of opening a plant, x is the sales of a typical manufacturing firm, and t is the transportation costs of shipping a unit of manufacturers from one location to another, say from the Manufacturing Belt to the rest of the U.S. Then it is cheaper to service the rest of the U.S. from the manufacturing plants in the belt as long as $s_N x t < F$ where s_N the share of the population located in the rest of the U.S. If this equation does not hold, then the location of manufacturers will follow that of agriculture (Krugman 1991c, pp. 19-22).

This simple equation implies three key parameters that tell a stylized story of the Manufacturing Belt: F which captures economies of scale, t transportation costs, and the share of population outside the belt. In the early decades of the United States when the primary economic activity was agriculture, manufacturing did not show extensive economies of scale, and transportation was costly, there was no strong geographical concentration of manufacturing. With the onset of industrialization, manufacturing emerged in the areas with most of the agricultural population, which was in the north-east. During the second half of the nineteenth century, manufacturing economies of scale increased, transportation costs fell, and the demand for manufacturers increased. As a result, the initial advantage of this region was locked-in and even though new land and new resources were exploited in the west, the pull of that region was strong enough to sustain it as the manufacturing core until the early 1970s (Krugman 1991c, pp. 22-23). Krugman's reasoning is clearly linked to Harris's concept of market potential since the decline of the transport costs lowers the costs of delivering manufacturers to the consumers which, in turn, increases market accessibility. Stressing the interaction between the economies of scale and transportation costs, Krugman also ties together two important advances in the late nineteenth century American economy: the rise of large-scale businesses, and the construction of the railway network. Doing so, he brings forward the implication of the large-scale businesses for the U.S. economic geography and its core-periphery structure.

A more elaborate account explaining a manufacturing core-periphery is offered by Krugman and Venables (1995) and by Fujita, Krugman, Venables (1999) and even though they don't do it in the context of the Manufacturing Belt, they inspired other studies that do. This account incorporates industrial linkages and develops a more complete dynamics of manufacturing location relative to transport costs. The linkages offer additional channels through which the initial advantage of the Manufacturing Belt was cemented by the declining transportation costs. These explanations have been empirically tested by Klein and Crafts (2012) when they use the concept of market potential to capture the changes in the transportation costs. Their analysis focuses on (i) estimating the channels through which market potential attracted manufacturing employment, and (ii) comparing the market potential explanation of spatial concentration and the explanations based on factor endowments. They find that both industrial linkages and external economies of scale were important for locking-in, or 'cementing' of the Manufacturing Belt's dominant position as the center of U.S industrial

production between 1880 and 1920. Furthermore, they show that the role of factor endowments decreased whilst that of the market potential increased across the twentieth century.

Edward Glaeser in his monograph *The Triumph of the City* (2011) discusses the rise of the Manufacturing Belt region (though he focuses mostly on the Midwest) using the new economic geography arguments. His account stresses the role of transportation costs, market accessibility, and industrial linkages as the forces behind the rise of the Midwest. The construction of canals in early nineteenth century and then the spread of railways substantially lowered the transportation costs which allowed firms locate closer to urban consumers and other manufacturers without losing profits as they saved on these costs. Clustering in cities then enabled firms to take advantage of agglomeration economies. Proximity offers many cost advantages and Glaeser uses car manufacturing as an example of industrial linkages as an agglomeration channel behind the success of Detroit. In addition, he also points out to the entrepreneurial nature of the city before the rise of large-scale car-making factories producing for mass market.

The new economic geography explanation of the rise of the Manufacturing Belt has been scrutinized and some of its assumptions challenged by Healey (2014). He argues that the role of transportation costs and access to natural resources were driving factors leading to the emergence of the belt, rather than large firms and increasing returns to scale, as envisioned by the canonical Krugman (1991) model. Healey offers a deep historical analysis of Cleveland and shows how the transportation sector with the railroads encouraged industrialization and presents evidence that industrial linkages stimulated other industrial sectors including the extraction of natural resources

Other explanations

Other explanations of the existence of the Manufacturing Belt look for other factors than market access, economies of scale or industrial linkages. Kim (1995, 1999) in a series of papers explored the role of factor endowments behind the evolution of spatial distribution of manufacturing activities between 1860 and 1987. Kim (1995) tests whether economies of scale or natural resources explain the location of SIC 2-digit manufacturing industries. He finds that scale economies explain industry location over time whilst natural resources explain spatial patterns across industries. He concludes that long-run U.S. regional specialization is more consistent with the explanations based on factor endowments than the explanations based on the increasing returns, hence New Economic Geography models. In the follow up article from

1999, he attempts to confirm his earlier findings by studying a link between the factors of production and value added in the same time frame and set of industries. His findings suggest that that the geographical distribution of manufacturing activities can be explained by a handful of production factors such as labor, capital, agriculture inputs such as timber, tobacco, and minerals. Recently, research has been re-examining the role of European immigration to the United States during the Age of Mass Migration from about 1850s until 1920 (Abramitzky et al 2012, 2014). Ottinger (2020) has investigated a relationship between the European immigration and the patterns of manufacturing employment. He finds that the immigration influenced the initial location of manufacturing industries and acted as one of the 'initial conditions' which affected the subsequent concentration industrial employment in the Manufacturing belt.

Summary Overall, studies in the last two groups present a clear methodological break from 'early' and 'historical' studies. They use economic modelling and econometrics analysis and aim to uncover the causal effect leading to the emergence of the Manufacturing Belt. They build on the data sources developed by 'early studies' and complement them with additional Census data. Whilst they do not offer brand new explanations, they quantify the relative importance of the ones proposed earlier: market potential, economies of scale, industrial linkages, and initial factor endowments. The results show that factor endowments were important 'first-mover' advantage type factors that determined where the manufacturing belt will be located. Market potential, industrial linkages and economies of scale then locked-in this initial advantage into a long-lasting industrial dominance.

IV: Decline of the Manufacturing Belt and the emergence of the Rust Belt.

The decline of the Manufacturing Belt, or how the Manufacturing Belt turned into the Rust Belt, has many explanations, similarly to the literature reviewed above. However, it is less eclectic in terms of the underlying methodologies. We still have studies in geography, regional science, history and even sociology. However, majority use techniques of economic analysis and statistics/econometrics which makes it less challenging to compare and assess. We identify four strands in the literature, depending on the explanation they focus on: (1) transportation costs, (2) labor cost and labor unions, (3) factor inputs and productivity, and (4) other explanations which includes industrial product cycle arguments, state policies, right-to-work legislation, housing markets, and changes in the macroeconomic environment.

There is a literature in regional science and geography which has documented the decline on the Manufacturing Belt, mostly using shift-share analysis and its numerous variants (e.g. Wheat (1973) for a review of earlier work, Wheat (1986), Rigby (1992), Duffy (2001)). These studies offer valuable insights into the changes in the employment, labour productivity or output growth trends in the U.S. regions and shed light on the role that regions' industrial structure played in propagating these changes. Also, there is a voluminous literature examining the consequences of the Manufacturing Belt decline from economic, demographic, environmental, welfare, racial, education, and health perspective (e.g. Frey and Speare (1988), Cooke (1995), Kahn (1999), Feyrer et al (2007), Hobor (2013), Wilson and Heil (2020)). This literature offers insights into the Manufacturing Belt/Rust Belt as a region already in decline. Surveying it deserves a separate review and therefore is beyond the scope of this article.

<INSERT TABLE 4>

Before I proceed, it is important to note that the literature which emerged especially in the early 2000s associates the Rust Belt only with the Midwest.[9] This most likely reflects a recognition that this is the part of the former Manufacturing Belt which has struggled to recover after its industries declined whilst other parts of the Manufacturing Belt such as New England reinvented themselves (e.g. Glaeser 2005). Table 4 illustrates this point by showing real per capita income figures relative to the U.S. average from 1880 to 2007 in three broad regions – the Manufacturing Belt, South, and the rest of the U.S. – with the Manufacturing Belt split among the New England, Middle Atlantic, Midwest (called East North Central) and South Atlantic regions. We see that the Midwest has been experiencing the lowest per capita figures among all former Manufacturing Belt regions since the late 1980s. This is not to say that the Midwest has become a poor U.S. region. However, its per capita income has been stagnating below the U.S. average as opposed to above average income in the other parts of the former Manufacturing Belt.

Transportation costs It has been observed that the transportation costs declined considerably in the twentieth century (Glaeser and Kohlhas 2004). Many factors have contributed to it, but the construction of the Interstate Highway System especially has drawn a lot of scholarly attention (e.g. Baum-Snow 2007, 2020, Chandra and Thompson 2000, Duranton and Turner 2012, Duranton, Morrow, Turner 2014, Herzog 2021, Jaworski and Kitchens 2019, Michaels 2008, Brinkman and Lin 2022, Allen and Arkolakis 2022, Barde and Klein (2021)). These

---

[9] Alder et al (2021) also include West Virginian and the state of New York as well.

studies examine the impact of the interstate highways on various socio-economic aspects such as suburbanization, trade, employment, earnings, housing costs, amenities, road congestion or urban growth. However, no study has discussed the impact of the Interstate Highway System the Manufacturing Belt or the 'rise' of the Rust Belt.

The new economic geography models offer testable hypotheses linking transport costs decline to the spread of industries from the core to periphery, as explained in detail in the theoretical section. In a nutshell, declining transport costs high concentration of industries in the core puts upward pressure on factor prices such as wages. Over time, this erodes its competitive advantage based on external economies of scale and industrial linkages, and when the transportation costs decline low enough, firms had incentives to move out to the periphery with lower factor prices. Closest to explaining the Rust Belt using a new economic geography reasoning is Glaeser and Kohlhas (2004). They argue that the decline of transportation costs for goods lead to the spread of manufacturing out of densely populated areas and diminishes the importance of the proximity to consumers and suppliers for the manufacturing firms. This implies that the decline of manufacturing industries in the Manufacturing Belt might be accounted for by the declining transportation costs, something that has been observed most notably for the car-making industry (Rubenstein 1992).

Glaeser (2011) also discusses the decline of the Manufacturing Belt and offers a brief narrative that stems from new economic geography arguments. Specifically, Glaeser argues that the Rust Belt is a result of an interaction between transportation and labor costs. The Rust Belt is a region with high union density and high union wages. The Sun Belt, however, is a region with low-wage, pro-business, right-to-work environment. This, interacted with the decline of transportation costs in the post-World War II decades, led firms to locate to the south rather than in the Rust Belt to economize on the labor costs without worrying that they would incur high transportation costs, causing the decline of once dominant industrial region.

Labor cost and labor unions This explanation focuses on wages and union power and stresses the role of inflexible labour markets in the face of competition and changing economic environment. In general, the relocation of firms from the Manufacturing Belt is viewed as a response to high manufacturing wages that will economize on labor costs and assure firms' profitability. Labor unions and their practices are considered as the main reason for high labor costs as well as a source of labor market inflexibility which negatively impacts adjustments to competition and the implementation of new technology.

Alder et al. (2021) study focus on the role of labor conflicts to understand the dissolution of the Manufacturing Belt (the authors use exclusively the term Rust Belt). Their analysis which uses a multi-sector dynamic general equilibrium model, is based on two regions – the Manufacturing Belt vs non-Manufacturing Belt – and links unions and wage bargaining into the firm's decision to maximize profit. The two regions differ in their labor markets: The Manufacturing Belt firms bargain with a labor union while firms in the rest of the country hire labor in a competitive labor market and pay a competitive wage. Labor market conflicts such as the threats of strikes and work stoppage lead to strikes and firms pay wage premia above the competitive wage to avoid them. As a result, firms in the Manufacturing Belt have lower investment and productivity growth than in the rest of the country, which causes employment to move out from the Manufacturing Belt which lowers the share of aggregate employment in the belt over time. Their model can explain about 59 percent of the region's decline with the labor conflict and powerful unions. In addition, they also looks at the role of foreign competition as another source of the Manufacturing Belt decline but conclude that international forces are unlikely to explain much of the Manufacturing Belt's decline. They might have played an auxiliary role in its decline in the late 1980s and 1990s, but for the first three decades after the end of World War II, international trade was unimportant in accounting for the region's economic performance.

Crandall (1993), using state-level data, examines the effect of the annual earning per worker and the share of nonfarm workers in unions on the manufacturing employment growth in the years 1967-1977 and 1977-1989 and finds a consistently negative and significant effect. This lends support to the notion that labor market conditions had a negative impact on the employment in the Manufacturing Belt states. Glaeser (2011) offers a similar explanation, though he stresses the legislative development after World War II and the rise of right-to-work states. These states, which passed laws limiting the extend of unionization, and which are almost exclusively located outside the Manufacturing Belt, offered low wage costs and limited union militance, incentivizing thus firms to relocated there (Glaeser 2011). The effect of right-to-work legislation as a measure to limit the influence of labor unions and create a more pro-business-like environment is also highlighted by Ullmann (1988). Thomas Holmes (Holmes 1998), in his seminal study on the location of manufacturing, offers clear empirical evidence that the right-to-work states, hence out of the Manufacturing Belt region with low union density, were attractive destination of the manufacturing firms in the years between 1947 and 1992. This, by implication, means that the labor market of the Manufacturing Belt, dominated

by strong labor unions, acted as a dispersion force driving firms in the post-World War II decades to locate somewhere else. Lastly, several studies explored the role of labor unions using mostly qualitative evidence. Cobb (1982) discusses ample of qualitative evidence based on firm case studies that support the notion that the southern states were an attractive, low union density, and pro-business location for the manufacturing firms. Teaford (1993) and High (2003) make similar argument and consider high wages, unionized labor and inflexible labor markets as the main source of the industrial decline of the Manufacturing Belt.

Factor inputs and productivity There is a large body of research which investigates the sources of output and labor productivity growth in U.S states or metropolitan areas using growth accounting and related methods (e.g. Hulten and Schwab 1984, Beeson and Husted 1989, Beeson 1990, Moomaw and Williams 1991, Domazlicky and Weber 1997, Haynes and Dinc 1997). Some of them also offer a regional breakdown between the Manufacturing Belt and the Sun Belt. Whilst they don't provide an explanation why firms left the Manufacturing Belt for other regions, their analyses shed light on the proximate sources of its decline such as the role of labor, growth and productivity growth.

Hulten and Schwab (1984) decompose the real output growth in the Manufacturing and Sun Belt respectively between 1951 and 1978 respectively into the contribution of labor, capital, and total factor productivity. Their breakdown of the U.S. between the Manufacturing Belt (Snow Belt in their terminology) and the Sun Belt is rather crude though. The Manufacturing Belt includes West North Central region which includes Kansas, Nebraska, North Dakota, and South Dakota, states which are certainly not part of the Manufacturing Belt as has been long understood. They show that the lower growth in real manufacturing value added in the Manufacturing Belt relative to the Sun Belt is driven by slower growth of labor and capital input whilst total factor productivity of similar between the two regions. Also, they also find that labor productivity between the two regions in 1951-1978 is virtually the same and interpret it as a sign that slower output growth in the Manufacturing Belt is due to special interests who inhibit economic growth by encouraging migration of factor of production (Hulten and Schwab 1984).

Moomaw and Williams (1991) conducted a similar study but for a different time – 1954-1973. They largely confirm the findings of Hulten and Schwab (1984) except for total factor productivity which, unlike in Hulten and Schwab, is higher in the Sun Belt than in the Manufacturing Belt (they also call it Snow Belt). Haynes and Dinc (1997) study uses an

25

advanced variant of shift-share analysis which suggests that the Sun Belt states outperform six states in the Manufacturing Belt because of improvement in capital stock, technology, and infrastructure (the states include Illinois, Massachusetts, Michigan, New York, Ohio, Pennsylvania).

A more nuanced approach is presented by Beeson (1990) who looked at the sources of output growth at the level of metropolitan areas in 1959-1978. This study does not include West North Central into the Manufacturing Belt, but also excludes New England. The findings suggest that the decline of real industrial output in the Manufacturing Belt relative to the south was almost entirely due to the erosion of total factor productivity. The breakdown of the output growth into various subperiods confirms this finding except for the years 1959-1965 when output growth was slower due to insufficient labor input (Beeson 1990).

Yoon (2017) investigates the sources of the Rust Belt decline (as well as its overall welfare loses, and the effects of place-based policies) by building a dynamic spatial model. The Rust Belt is defined as a region consisting of Illinois, Indiana, Michigan, Ohio, Pennsylvania, and Wisconsin and the main reason for its decline is what the study calls 'location specific advantage' of an economic sector in located in the Rust Belt. In the model, it is a parameter that enters a sector-specific production function. Estimating the model Yoon argues that this location specific advantage made the Rust Belt 18 percent more productive than the rest of the U.S. in 1960, but it declined to only 6 percent by 2010.

Other explanations Various other explanations were provided in the literature. Technological change and the ability of respond to the emergence of ICT technologies is considered by some as a reason for the Manufacturing Belt decline (Norton and Rees (1979); Wienstein, Gross and Rees (1985), Crandall (1993)). The idea is based on Schumpeter's creative destruction, and it suggests that the shift of manufacturing away from the belt is caused by the emergence of new industries and new technological processes based on electronics which by-passed the old ones that emerged during the Second Industrial Revolution and found their footing in the belt. Another set of explanations focus on the changes in the macroeconomic environment such as oil-price shocks, appreciation of the dollar, and the increase of imports from abroad, especially Europe and Japan (Crandall (1993)). Oil-price shocks in the 1970s increased the cost of inputs which challenged the profitability of firms located in the Manufacturing Belt. The appreciation of the dollar further squeezed the profit margins of the firms in the belt because it acted as a

detriment to their exports abroad, and the penetration of the foreign firms into the U.S. market, locating usually outside the belt, created another channel of competitive pressures.

There is a literature which looks at the spread of manufacturing activities from the point of view of receiving regions, mostly the Sun Belt. According to Glaeser and Tobio (2008), increasing housing supply was particularly important in driving the rise of the Sun Belt and argue that faster housing supply growth in this region was as important as the rise of economic productivity. State policies to attract manufacturing firms received a considerable attention in the literature. This includes studies on the role of taxes, state subsidies, business environment, and right-to-work legislation on the location decision of firms. A review of early literature on the effects of right-to-work legislation is presented in Moore and Newman (1985), and already mentioned study by Holmes (1998) offers the most convincing account on the positive effects of right-to-work legislation on the increasing manufacturing employment in the post-World War II decades. Cobb (1982) presents an extensive account of economic policies employed at all levels of government to attract manufacturing firms to the south from 1936 to 1980, thus providing invaluable qualitative evidence of the practices used by government bodies to entice firms to relocate or start their business in the south. Quantitative studies which try to establish the causality and relative importance of various incentive schemes such as tax exemptions, corporate tax rate subsidies, right-to-work legislation, or bond financing include Newman (1983), Bartik (1985), Newman and Sullivan (1988), Crandall 1993, Lee (2008). Methodological challenges which they face do not come as a surprise given the complexity of the problem they examine. It will be a fair assessment to say that despite this, they indicate a statistically robust effect of state policies on the relocation of manufacturing to the south, though when it comes to their economic importance, the jury is still out there.

V: Conclusion

Ever since the industrial sector concentrated in the Manufacturing Belt, people tried to understand the reasons behind its existence. Research is diverse, presents multiple of methodological approaches, and various point of views. Altogether, it has built a multidimensional picture of the rise, dominance and decline of the major location of manufacturing industries over the course of a century and half. This article has surveyed this literature, offered its taxonomy and critical assessment, as well as an intellectual history of the Manufacturing Belt as a geographical concept. It has focused mostly on the work of

economists, economic historians, and geographers. Surveying the work of sociologists, environmental scientists, health care professionals, as well as scholars of literature, film, and architecture would be very important to better understand the overall impact which the Manufacturing Belt and the Rust Belt have had on the U.S. economy, and society in general.

Several important findings emerge in this survey. The location of the belt seems to be partly a result of a historical accident in a sense that part of the Manufacturing Belt coincides with the colonies and then first states that formed the United States. Access to natural resources helped to reinforce it, as well as the development of the canal system which redirected substantial portion of domestic trade away from Mississippi river and New Orleans towards New York City. The construction of the railway system was a crucial step in solidifying the belt's position, though a more nuanced argument was put forward saying that a staggered expansion of railways allowed the Midwest to industrialize and then join New England and Middle Atlantic to form the Manufacturing belt. By 1880, we can talk about a core and periphery structure of the American manufacturing. Such a dominant position had a potential to last but there was nothing inevitable about it. What 'locked-in' the Manufacturing Belt as the dominant industrial center was large market potential which facilitated economies of scale, easy access to intermediate inputs and large demand coming from consumers as well as producers. The productivity advantages, which this large, cross-state agglomeration delivered, outweighed its costs – specifically labor costs.

This lasted long, almost hundred years, but ultimately, its position eroded, and the Manufacturing Belt turned into the Rust Belt. The costs of this agglomeration began to outweigh the benefits as labor unions, high wages, and inflexible labor markets increased the production costs and caused firms to leave this region. Other factors such as the decline of transportation costs and diminished total factor productivity are considered important as well, though which were relatively more important awaits future studies. The decline of the manufacturing employment has not stopped with the Manufacturing Belt turning into the Rust Belt but continued into the first decade of the twenty-first century. Overall, the long history of the Manufacturing Belt has offered and still offers a unique opportunity to study the strengths of industrial agglomerations, their weaknesses, rise, sustainability, and, in the end, their demise.

References

Abramitzky, R., Boustan, L. P., and Eriksson, K. (2012). Europe's tired, poor, huddled masses: Self-selection and economic outcomes in the age of mass migration. *American Economic Review*, *102*(5), 1832-56.

Abramitzky, R., Boustan, L. P., and Eriksson, K. (2014). A nation of immigrants: Assimilation and economic outcomes in the age of mass migration. *Journal of Political Economy*, *122*(3), 467-506.

Alder, S., Lagakos, D., and Ohanian, L. (2021). Labor Market Conflict and the Decline of the Rust Belt. Mimeo.

Allen, T., and Arkolakis, C. (2022). The welfare effects of transportation infrastructure improvements. *The Review of Economic Studies*, *89*(6), 2911-2957.

Alvstam, C. G. (2018). From the American manufacturing belt to spatial clustering in transnational networks: the evolution of industrial geography as reflected in Geografiska Annaler. *Geografiska Annaler: Series B, Human Geography*, *100*(3), 300-307.

Barde, S., and Klein, A. (2021). Transportation Costs in the Age of Highways: Evidence from United States 1955-2010, CEPR Discussion Paper No. DP16734.

Bartik, T. J. (1985). Business location decisions in the United States: Estimates of the effects of unionization, taxes, and other characteristics of states. *Journal of Business and Economic Statistics*, *3*(1), 14-22.

Baum-Snow, N. (2007). Did highways cause suburbanization? *The Quarterly Journal of Economics*, *122*(2), 775-805.

Baum-Snow, N. (2020). Urban transport expansions and changes in the spatial structure of us cities: Implications for productivity and welfare. *Review of Economics and Statistics*, *102*(5), 929-945.

Beeson, P. E., and Husted, S. (1989). Patterns and determinants of productive efficiency in state manufacturing. *Journal of Regional Science*, *29*(1), 15-28.

Beeson, P. E. (1990). Sources of the decline of manufacturing in large metropolitan areas. *Journal of Urban Economics*, *28*(1), 71-86.

Boal, F. W., and Royle, S. A. (1999). *North America: a geographical mosaic*. London: Arnold.

Boustan, L., Bunten, D., and Hearey, O. (2018). Urbanization in American economic history, 1800–2000. *The Oxford Handbook of American Economic History, vol. 2*, 75.

Brinkman, J., and Lin, J. (2022). Freeway Revolts! The quality of life effects of highways. *The Review of Economics and Statistics*, 1-45.

Buenstorf, G., and Klepper, S. (2009). Heritage and agglomeration: the Akron tyre cluster revisited. *The Economic Journal*, *119*(537), 705-733.

Buenstorf, G., and Klepper, S. (2010). Why does entry cluster geographically? Evidence from the US tire industry. *Journal of Urban Economics*, *68*(2), 103-114.

Carter, S. B., Gartner, S. S., Haines, M. R., Olmstead, A. L., Sutch, R., and Wright, G. (Eds.). (2006). *Historical statistics of the United States: Millennial edition*. Cambridge: Cambridge University Press.

Chandra, A., and Thompson, E. (2000). Does public infrastructure affect economic activity? Evidence from the rural interstate highway system. *Regional Science and Urban Economics*, *30*(4), 457-490.

Cobb, J. C. (1982). *The Selling of the South*. Baton Rouge.

Cooke, P. (Ed.). (2020). *Rise of the rustbelt: Revitalizing older industrial regions*. Routledge.

Crafts, N., and Klein, A. (2021). Spatial concentration of manufacturing industries in the United States: re-examination of long-run trends. *European Review of Economic History*, *25*(2), 223-246.

Crandall, R. W. (1993). The continuing decline of manufacturing in the Rust Belt. *Washington, DC: Brookings Institution*.

Cronon, W. (1991). *Nature's metropolis: Chicago and the Great West*. WW Norton and Company.

Domazlicky, B. R., and Weber, W. L. (1997). Total factor productivity in the contiguous United States, 1977–1986. *Journal of Regional Science*, *37*(2), 213-233.

Duffy, N. E. (2001). The Regional Growth of Manufacturing: Markets, Wages, and Labor Consumption. *Review of Regional Studies*, *31*(3), 255-276.

Duranton, G., and Turner, M. A. (2012). Urban growth and transportation. *Review of Economic Studies*, *79*(4), 1407-1440.

Duranton, G., Morrow, P. M., and Turner, M. A. (2014). Roads and Trade: Evidence from the US. *Review of Economic Studies*, *81*(2), 681-724.

De Geer, S. (1927). The American manufacturing belt. *Geografiska Annaler*, *9*(4), 233-359.

Ellison, G., and Glaeser, E. L. (1997). Geographic concentration in US manufacturing industries: a dartboard approach. *Journal of political economy*, *105*(5), 889-927.

Eriksson, K., Russ, K. N., Shambaugh, J. C., and Xu, M. (2021). Reprint: Trade shocks and the shifting landscape of US manufacturing. *Journal of International Money and Finance*, *114*.

Fort, T. C., Pierce, J. R., and Schott, P. K. (2018). New perspectives on the decline of US manufacturing employment. *Journal of Economic Perspectives*, *32*(2), 47-72.

Frey, W. H., and Alden Jr, S. (1988). *Regional and Metropolitan Growth and Decline in the US*. Russell Sage Foundation.

Feyrer, J., Sacerdote, B., Stern, A. D., Saiz, A., and Strange, W. C. (2007). Did the rust belt become shiny? A study of cities and counties that lost steel and auto jobs in the 1980s [with Comments]. *Brookings-Wharton Papers on Urban Affairs*, 41-102.

Fujita, M., Krugman, P. R., and Venables, A. (2001). *The spatial economy: Cities, regions, and international trade*. MIT press.

Glaeser, E. L., and Kohlhase, J. E. (2004). Cities, regions and the decline of transport costs. In: *Fifty years of regional science* (pp. 197-228). Springer, Berlin, Heidelberg.

Glaeser, E. L., and Tobio, K. (2008). The rise of the sunbelt. *Southern Economic Journal*, *74*(3), 609-643.

Glaeser, E. L. (2005). Reinventing Boston: 1630–2003. *Journal of Economic Geography*, *5*(2), 119-153.

Glaeser, E. (2011). *Triumph of the city: How urban spaces make us human*. Pan Macmillan.

Guimaraes, P., Figueiredo, O., and Woodward, D. (2011). Accounting for neighboring effects in measures of spatial concentration. *Journal of Regional Science*, *51*(4), 678-693.

Guinness, P. G., and Bradshaw, M. J. (1985). *North America: a human geography*. Barnes and Noble.

Harris, C. D. (1954). The, Market as a Factor in the Localization of Industry in the United States. *Annals of the association of American geographers*, *44*(4), 315-348.

Hartshorne, R. (1936). A new map of the manufacturing belt of North America. *Economic Geography*, *12*(1), 45-53.

Haynes, K. E., and Dinc, M. (1997). Productivity change in manufacturing regions: A multifactor/shift-share approach. *Growth and Change*, *28*(2), 201-221.

Healey, R. G. (2014). Railroads, factor channelling and increasing returns: Cleveland and the emergence of the American manufacturing belt. *Journal of Economic Geography*, *15*(3), 499-538.

Herzog, I. (2021). National transportation networks, market access, and regional economic growth. *Journal of Urban Economics*, *122*, 103316.

High, S. (2003). *Industrial sunset: the making of North America's Rust Belt, 1969-1984*. University of Toronto Press.

Hobor, G. (2013). Surviving the era of deindustrialization: The new economic geography of the urban rust belt. *Journal of Urban Affairs*, *35*(4), 417-434.

Holmes, T. J. (1998). The effect of state policies on the location of manufacturing: Evidence from state borders. *Journal of Political Economy*, *106*(4), 667-705.

Holmes, T. J., and Stevens, J. J. (2004). Spatial distribution of economic activities in North America. In: *Handbook of regional and urban economics* (Vol. 4, pp. 2797-2843). Elsevier.

Hoover, E. M. (1936). The measurement of industrial localization. *The Review of Economic Statistics*, 162-171.

Hulten, C. R., and Schwab, R. M. (1984). Regional productivity growth in U.S. manufacturing: 1951-78. *The American Economic Review*, *74*(1), 152-162.

Jaworski, T., and Kitchens, C. T. (2019). National policy for regional development: Historical evidence from Appalachian highways. *Review of Economics and Statistics*, *101*(5), 777-790.

Jones, C. F. (1938). Areal Distribution of Manufacturing in the United States. *Economic Geography*, *14*(3), 217-222.

Johnston, L. and Williamson, S.H. *What Was the U.S. GDP Then?* MeasuringWorth, 2023

Kahn, M. E. (1999). The silver lining of rust belt manufacturing decline. *Journal of Urban Economics*, *46*(3), 360-376.

Kahn, M. E., and Tracy, J. (2019). *Monopsony in spatial equilibrium* (No. w26295). National Bureau of Economic Research.

Kim, S. (1995). Expansion of markets and the geographic distribution of economic activities: the trends in US regional manufacturing structure, 1860–1987. *The Quarterly Journal of Economics*, *110*(4), 881-908.

Kim, S. (1999). Regions, resources, and economic geography: Sources of US regional comparative advantage, 1880–1987. *Regional Science and Urban Economics*, *29*(1), 1-32.

Kim, S., and Margo, R. A. (2004). Historical perspectives on US economic geography. In *Handbook of regional and urban economics* (Vol. 4, pp. 2981-3019). Elsevier.

Klein, A., and Crafts, N. (2012). Making sense of the manufacturing belt: determinants of US industrial location, 1880–1920. *Journal of Economic Geography*, *12*(4), 775-807.

Klein, A. (2013). New state-level estimates of personal income in the United States, 1880–1910. In *Research in Economic History*. Emerald Group Publishing Limited.

Krugman, P. (1991a). Increasing returns and economic geography. *Journal of Political Economy*, *99*(3), 483-499.

Krugman, P. (1991b). History and industry location: the case of the manufacturing belt. *The American Economic Review*, *81*(2), 80-83.

Krugman, P. (1991c). Geography and trade. Cambridge, MA: MIT Press.

Krugman, P., and Venables, A. J. (1995). Globalization and the Inequality of Nations. *The Quarterly Journal of Economics*, *110*(4), 857-880.

Lee, E. S., Ratner Miller, A., Brainerd, C. P., and Easterlin, R. A (1957). *Population redistribution and economic growth, United States 1870-1950, I: Methodological considerations and reference tables*. The American Philosophical Society, Philadelphia.

Lee, E. S., Ratner Miller, A., Brainerd, C. P., and Easterlin, R. A (1960). *Population redistribution and economic growth, United States 1870-1950, II: Analyses of Economic Change*. The American Philosophical Society, Philadelphia.

Lee, Y. (2008). Geographic redistribution of U.S. manufacturing and the role of state development policy. *Journal of Urban Economics*, *64*(2), 436-450.

Lindstrom, D. (1978). *Economic Development in the Philadelphia Region, 1810–1850.* Columbia University Press, New York.

Manning, P. (2016). *Toward Rust Belt Aesthetics: Exploring the Cultural Projects of the Deindustrialized US Midwest* (Doctoral dissertation).

Meyer, D. R. (1983). Emergence of the American manufacturing belt: an interpretation. *Journal of Historical Geography*, *9*(2), 145-174.

Meyer, D. R. (1989). Midwestern industrialization and the American manufacturing belt in the nineteenth century. *The Journal of Economic History*, *49*(4), 921-937.

Michaels, G. (2008). The effect of trade on the demand for skill: Evidence from the interstate highway system. *The Review of Economics and Statistics*, *90*(4), 683-701.

Mitchell, R. D., Groves, P. A., and Groves, P. A. (Eds.). (1987). *North America: the historical geography of a changing continent*. Totowa, NJ: Rowman and Littlefield.

Moretti, E. (2012). *The new geography of jobs*. Houghton Mifflin Harcourt.

Morrison, J. L., Scripter, M. W., and Smith, R. H. (1968). Basic measures of manufacturing in the United States, 1958. *Economic Geography*, *44*(4), 296-311.

Moomaw, R. L., and Williams, M. (1991). Total factor productivity growth in manufacturing further evidence from the states. *Journal of Regional Science*, *31*(1), 17-34.

Newman, R. J. (1983). Industry migration and growth in the South. *The Review of Economics and Statistics*, 76-86.

Moore, W. J., and Newman, R. J. (1985). The effects of right-to-work laws: A review of the literature. *ILR Review*, *38*(4), 571-585.

Muller, E. K. (1977). Regional urbanization and the selective growth of towns in North American regions. *Journal of Historical Geography*, *3*(1), 21-39.

Neary, J. P. (2001). Of hype and hyperbolas: introducing the new economic geography. *Journal of Economic Literature*, *39*(2), 536-561.

Newman, R. J., and Sullivan, D. H. (1988). Econometric analysis of business tax impacts on industrial location: what do we know, and how do we know it?. *Journal of Urban Economics*, *23*(2), 215-234.

Niemi, A. W. (1974). *State and regional patterns in American manufacturing, 1860-1900.* Greenwood Press.

Ottinger, S. (2020). Immigrants, Industries, and Path Dependence, Mimeo, UCLA

Perloff, Harvey S., Lampard EE, and Keith RF. (1960). *Regions, resources, and economic growth.* Johns Hopkins Press, Baltimore (1960).

Pred, A. R. (1964). The intra-metropolitan location of American manufacturing. *Annals of the Association of American Geographers*, *54*(2), 165-180.

Pred, A. (1965). The concentration of high-value-added manufacturing. *Economic Geography*, *41*(2), 108-132.

Pred, A. R. (1966). *The spatial dynamics of US urban-industrial growth, 1800-1914: interpretive and theoretical essays*. MIT Press.

Rigby, D. L. (1992). The impact of output and productivity changes on manufacturing employment. *Growth and Change*, *23*(4), 405-427.

Rubenstein, J. M. (2002). *The changing US auto industry: a geographical analysis*. Routledge.

Safford, S. (2009). *Why the garden club couldn't save Youngstown: the transformation of the Rust Belt*. Harvard university press.

Smith, J. R. (1913). *Industrial and commercial geography*. H. Holt.

Strong, H. M. (1937). Regions of manufacturing intensity in the United States. *Annals of the Association of American Geographers*, *27*(1), 23-43.

Teaford, J. C. (1993). *Cities of the heartland: The rise and fall of the industrial Midwest*. Indiana University Press.

Thompson, J. H. (1955). A new method for measuring manufacturing. *Annals of the Association of American Geographers*, *45*(4), 416-427.

Ullmann, J. E. (1988). *The anatomy of industrial decline: Productivity, investment, and location in US manufacturing*. Praeger.

Warren, K. (1987). *The American Steel Industry, 1850-1970: A Geographical Interpretation*. University of Pittsburgh Press.

Wheat, L. F. (1973). *Regional growth and industrial location: An empirical viewpoint*. Lexington Books.

Wheat, L. F. (1986). The determinants of 1963–77 regional manufacturing growth: Why the South and West grow. *Journal of Regional Science*, *26*(4), 635-659.

Whitbeck, R. H. (1922). *High school geography IV*. Macmillan.

Wilson, D., and Heil, M. (2022). Decline machines and economic development: rust belt cities and Flint, Michigan. *Urban Geography*, *43*(2), 163-183.

Winder, G. M. (1999). The North American manufacturing belt in 1880: A cluster of regional industrial systems or one large industrial district? *Economic Geography*, *75*(1), 71-92.

Winder, G. M. (2016). *The American reaper: harvesting networks and technology, 1830–1910*. Routledge.

Wright, A. J. (1938). Manufacturing Districts of the United States. *Economic Geography*, *14*(2), 195-200.

Yoon, C. (2017). Estimating a dynamic spatial equilibrium model to evaluate the welfare implications of regional adjustment processes: the decline of the Rust Belt. *International Economic Review*, *58*(2), 473-497.

Zelinsky, W. (1958). A method for measuring change in the distribution of manufacturing activity: The United States, 1939–1947. *Economic Geography*, *34*(2), 95-126.

Table 1. Shares of Manufacturing Employment, and Population in U.S. Regions 1880-2007 (%).

	1880	1890	1900	1910	1920	1930	1940	1947	1958	1967	1977	1987	1997	2007
						Panel A: Manufacturing Employment								
Manufacturing Belt	**84.3**	**80.9**	**79.1**	**76.5**	**77.1**	**74.2**	**71.7**	**70.5**	**62.1**	**59.1**	**51.6**	**46.5**	**42.4**	**40.8**
New England	24.0	19.6	17.8	17.1	15.4	12.7	12.2	10.7	8.9	8.4	7.2	7.4	5.8	5.3
Middle Atlantic	37.5	35.7	34.4	33.7	32.6	29.7	28.1	27.5	24.6	21.7	17.5	15.0	11.9	11.1
East North Central	19.1	22.3	23.8	22.9	26.7	29.2	28.5	29.5	25.9	26.3	24.6	21.7	23.1	22.7
South Atlantic (part)	3.7	3.3	3.0	2.9	2.4	2.6	3.0	2.8	2.8	2.7	2.3	2.4	1.7	1.7
South	**9.0**	**9.4**	**11.5**	**13.7**	**12.0**	**13.8**	**16.4**	**17.1**	**18.5**	**21.6**	**26.4**	**28.2**	**30.7**	**30.4**
South Atlantic (part)	5.2	4.2	5.9	7.0	6.2	7.0	9.0	8.7	8.9	10.5	12.5	14.0	14.5	13.4
East South Central	2.7	3.3	3.5	3.9	3.2	3.9	4.4	4.8	5.0	5.9	7.3	7.5	8.1	7.8
West South Central (part)	1.0	1.8	2.1	2.8	2.7	2.8	3.0	3.6	4.5	5.1	6.6	6.7	8.1	9.2
Rest of US	**6.7**	**9.7**	**9.4**	**9.8**	**10.9**	**12.0**	**11.8**	**12.4**	**19.4**	**19.3**	**22.1**	**25.3**	**26.9**	**28.8**
West South Central (part)			0.0	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.8	1.0	1.0	1.1
West North Central	4.5	6.5	5.9	5.4	5.0	5.3	5.0	5.5	7.2	6.6	6.8	7.6	8.1	9.0
Mountain	0.4	0.6	0.8	1.0	0.9	1.1	0.9	1.2	1.8	2.1	2.9	3.4	4.0	4.6
Pacific	1.7	2.6	2.6	3.2	4.7	5.3	5.6	5.2	9.8	9.9	11.5	13.2	13.9	14.1
United States	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
						Panel B: Population								
Manufacturing Belt	**59.3**	**54.9**	**52.4**	**51.1**	**51.5**	**51.8**	**50.8**	**50.1**	**49.0**	**47.8**	**44.7**	**41.2**	**38.9**	**36.6**
New England	9.1	8.0	7.5	7.1	7.0	6.7	6.4	6.3	5.9	5.9	5.6	5.4	5.0	4.8
Middle Atlantic	22.9	21.0	20.3	21.1	21.0	21.5	21.0	20.2	19.4	18.7	17.0	15.6	14.4	13.5
East North Central	23.7	22.4	21.5	19.9	20.6	20.7	20.4	20.4	20.6	20.1	19.0	17.3	16.6	15.5
South Atlantic (part)	3.5	3.4	3.1	3.0	3.0	2.9	3.1	3.1	3.0	3.1	3.1	2.9	2.9	2.8
South	**28.1**	**29.3**	**28.0**	**26.9**	**26.1**	**25.6**	**26.5**	**26.4**	**26.0**	**26.3**	**28.3**	**30.1**	**31.2**	**32.9**
South Atlantic (part)	11.4	11.4	10.6	10.0	9.9	9.6	10.1	10.4	11.0	11.6	12.8	14.1	15.1	16.4
East South Central	11.5	11.2	10.3	9.2	8.4	8.1	8.2	7.7	6.8	6.5	6.5	6.3	6.2	6.0
West South Central (part)	5.3	6.7	7.1	7.8	7.8	8.0	8.2	8.3	8.2	8.2	8.9	9.7	9.9	10.4
Rest of US	**12.6**	**15.9**	**19.6**	**22.0**	**22.3**	**22.6**	**22.7**	**23.5**	**25.0**	**25.9**	**27.0**	**28.7**	**29.9**	**30.6**
West South Central (part)			0.4	1.8	1.9	2.0	1.8	1.5	1.3	1.3	1.3	1.3	1.2	1.2
West North Central	10.0	12.3	14.2	12.7	11.8	10.9	10.3	9.4	8.7	8.2	7.8	7.3	7.0	6.7
Mountain	0.8	1.3	1.9	2.9	3.2	3.0	3.2	3.2	3.8	4.0	4.8	5.5	6.2	7.1
Pacific	1.8	2.2	3.0	4.6	5.4	6.7	7.4	9.4	11.2	12.4	13.1	14.6	15.5	15.5
United States	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: Manufacturing employment: U.S. Census of Manufactures, 1880, 1890, 1900, 1910, 1920, 1930, 1940, 1947, 1958, 1967, 1977, 1987, 1997, 2007.

Population: 1880-1890: Historical Statistics of the United States, Millennial Edition, Volume 1, Population, CUP 2006, Tables Aa9-14, Aa2244-2340.

1900-2007: https://fred.stlouisfed.org/release?rid=118, accessed on December 9 and 10, 2020.

Notes: South Atlantic states inside the Manufacturing Belt are Delaware, Maryland, and West Virginia; West South-Central inside 'rest of US' is Oklahoma.

Employment is total number of employees except in 1880 and 1947 when employment is total number of wage earners.

Table 2: Manufacturing Employment 1880-2007.

	Year	U.S. (1)	Manufacturing Belt (2)	Rest of U.S. (3)
(1)	1880	2,680,400	2,260,198	420,202
(2)	1890	4,115,758	3,330,068	785,690
(3)	1900	5,191,601	4,104,856	1,086,745
(4)	1910	6,512,118	4,983,209	1,528,909
(5)	1920	8,663,523	6,677,102	1,986,421
(6)	1930	9,676,697	7,175,781	2,500,916
(7)	1940	8,708,332	6,245,286	2,463,046
(8)	1947	11,819,423	8,327,854	3,491,568
(9)	1958	15,783,829	9,808,517	5,975,312
(10)	1967	18,740,404	11,079,884	7,660,520
(11)	1977	18,900,864	9,748,773	9,152,092
(12)	1987	18,202,136	8,409,248	9,792,888
(13)	1997	16,725,933	7,089,867	9,636,066
(14)	2007	13,226,353	5,394,508	7,831,844
Change in manufacturing employment (levels of employment)				
(15)	1967-1997	-2,014,471	-3,990,017	1,975,546
(16)	1967-2007	-5,514,051	-5,685,376	171,324
(17)	1997-2007	-3,499,580	-1,695,358	-1,804,222
% change relative to U.S. manufacturing employment				
(18)	1967-1997	-10.7%	-21.3%	10.5%
(19)	1967-2007	-29.4%	-30.3%	0.9%
(20)	1997-2007	-20.9%	-10.1%	-10.8%

Sources: U.S. Census of Manufacturers 1880, 1890, 19100, 1910, 1920, 1930, 1940, 1947, 1958, 1967, 1977, 1987, 1997, 2007.

Table 3: Summary of Major Research on the Manufacturing/Rust Belt.

Category of studies	Study	Methodology	Main Findings
The Emergence and Dominance of the Manufacturing Belt			
Early Studies	Harris (1954)	pioneers the concept of market potential	market potential is crucial for the existence of the manufacturing belt
	Everett et al (1957, 1960)	describes patterns is manufacturing location using U.S. Census data	external economies of scale are the source of the manufacturing belt productivity advantage
	Perloff et al (1960)	describes patterns of manufacturing location using U.S. Census data, and correlates them with natural resources, and market potential	the manufacturing belt is a result of the interactions between markets, natural resources and industrial linkages.
	Pred (1965, 1966)	a narrative economic geography model, quantitative evidence based o US Census data	proximity to intermediate suppliers and expansion of railway network are at the core of high geographical concentration of manufacturing firms
	Niemi (1974)	a regression analysis using state-industry data set harmonized at SIC 2-digit level	local demand and external economies of scale were most important in forming the manufacturing belt
Historical studies	Meyer (1983, 1987, 1989)	historical narrative supported by U.S. Census data and qualitative evidence	the manufacturing belt is a set of heterogenous regional system developed at different points in time as a result of a staggered expansion of railways
	Teaford (1993)	historical narrative supported by US Census data and qualitative evidence	railway expansion and the declining transport costs allowed industrial linkages to achieve productivity advantage in the regions of the manufacturing belt
	Winder (1999)	historical business case study	the manufacturing belt is viewed as a network of manufacturers' supply linkages
New economic geography	Krugman (1991b, 1991c)	a core new economic geography model	initial advantage of the manufacturing belt was locked in as the manufacturing economies of scale increased, transportation costs fell, and demand for manufacturing products raised
	Glaeser (2011)	an analytical narrative using 'new economic geography' arguments	the rise of the Midwest is the outcome of declining transportation costs and increased proximity to intermediate suppliers combined with agglomeration economies offered by cities
	Klein and Crafts (2012)	regression analysis, IV identification, a horse-race between explanations based on factor endowment advantages and market potential	initial advantage of the manufacturing belt regions is 'cemented' by an interaction between market potential and economies of scale, and between market potential and industrial linkages
Other explanations	Kim (1995)	regression analysis, no IV strategy, horse-race between raw material endowment and economies of scale	raw material and economies of scale are correlated with industrial location between 1860 and 1987
	Healey (2014)	historical narrative, a case study of Cleveland, quantitative and qualitative evidence	transport costs decline and access to natural resources were important for the emergence of the manufacturing belt
	Ottinger (2020)	regression analysis, effect of European immigrants on industrial empoyment, IV identification	immigrants arriving to the U.S. between 1850 and 1920 affected the location of manufacturing employment in the manufacturing belt
Decline of the Manufacturing Belt and the "Rise" of the Rust Belt			
New economic geography	Glaeser and Kohlhas (2004)	analytical narrative supported by quantitative evidence	decline of transportation costs for goods diminishes importance of the proximity to consumers and suppliers for the manufacturing firms
Labor costs, labor unions	Crandal (1993)	regression analysis	a negative relationship between unionization and earning per worker, and employment growth
	Teaford (1993), High (2003)	analytical narrative	high labor union density is linked to labor market inflexibility which causes firms to relocate from the manufacturing belt
	Holmes (1998)	spatial differencing across state borders	low union density and right-to-work states incentivize movement of labor out of the manufacturing belt
	Glaeser (2011)	an analytical narrative	the rust belt is a result of an interaction between declining transportation and rising labor costs in the post World War II decades
	Alder et al (2021)	multi-sector dynamic general equilibrium model	labor market conflicts in the manufacturing belt leads to wage premia above market wage which then lowers investment and productivity growth
Factor inputs and productivity	Hulten and Schwab (1984)	growth-accounting decomposition of output growth for the years 1951-1978	lower growth in real manufacturing value added in the manufacturing belt is driven by slower growth of labor and capital input
	Moomaw and Williams (1991)	growth-accounting decomposition of output growth for the years 1954-1973	lower growth in real manufacturing value added in the manufacturing belt is driven by slower growth of labor, capital input as well as total factor productivity
	Beeson (1990)	growth-accounting decomposition of output growth for the years 1959-1978 at the level of metropolitan areas	decline in real output in the regions of the manufacturing belt is due to the decline in total factor productivity
	Yoon (2017)	dynamic general equilibrium model	decline of the 'location specific advantage' of the rust belt regions
Other explanations	Glaeser and Tobio (2008)	regression analysis	increase in housing supply in the South incentivized movement of labor out of the manufacturing belt
	Cobb (1982)	historical narrative supported by qualitative and quantitative evidence	economic policies employed at all levels of government to attract manufacturing firms to the south such as tax exemptions, corporate tax rate subsidies, or right-to-work legislation
	Norton and Rees (1979), Wienstein, Gross and Rees (1985), Crandall (1993)	analytical narratives	technological change and inability of respond to the emergence of ICT technologies caused ICT to bypass the manufacturing belt and move to the south
	Crandal (1993)	regression analysis, analytical narrative	macroeconomic shocks of the 1970s and 1980s: oil shocks, imports from abroad, dollar appreciations led to the decline of the manufacturing belt

39

Sources: see the text and 'References' section.

Table 4: Real per Capita Personal Income, Relative to U.S. Average, $US2000

	1880	1890	1900	1910	1920	1930	1940	1947	1958	1967	1977	1987	1997	2007
Manuf Belt	**122.8%**	**120.2%**	**123.2%**	**116.7%**	**120.8%**	**125.9%**	**122.0%**	**112.7%**	**109.3%**	**109.0%**	**105.9%**	**107.0%**	**107.5%**	**107.0%**
New England	139.5%	135.0%	137.2%	116.9%	124.4%	130.1%	128.3%	109.6%	108.1%	108.8%	102.9%	117.6%	117.6%	120.8%
Middle Atlantic	145.3%	142.1%	140.8%	129.0%	135.8%	144.4%	132.8%	119.1%	114.8%	114.1%	108.2%	112.9%	114.2%	112.5%
East North Central	101.9%	100.2%	107.0%	108.3%	108.0%	109.8%	112.3%	110.2%	106.5%	106.2%	105.3%	98.8%	99.4%	98.4%
South Atlantic (part)	81.7%	80.2%	84.2%	84.9%	95.2%	93.5%	99.6%	93.9%	96.2%	97.9%	102.5%	105.3%	102.7%	103.8%
South	**51.1%**	**53.2%**	**50.5%**	**56.5%**	**59.5%**	**52.4%**	**60.1%**	**70.7%**	**76.9%**	**80.3%**	**86.8%**	**88.8%**	**91.9%**	**90.7%**
Rest of US	**111.5%**	**112.9%**	**108.8%**	**114.6%**	**99.4%**	**94.7%**	**97.3%**	**105.8%**	**105.6%**	**103.3%**	**104.0%**	**101.6%**	**98.8%**	**100.9%**
United States	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Notes: South Atlantic states inside the Manufacturing Belt are Delaware, Maryland, and West Virginia.

Source: Easterlin (1957), Klein (2013), U.S. Bureau of Economic Analysis, Regional Data, Johnston and Williamson (2023).