NBER WORKING PAPER SERIES

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Working Paper 19041
http://www.nber.org/papers/w19041

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
May 2013

Forthcoming in The Oxford Handbook of American Economic History, edited by ed. Louis Cain, Price Fishback and Paul Rhode. We thank Robert Margo and Evan Roberts for useful conversations about data collection and Walker Hanlon for comments on the draft . The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

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NBER Working Paper No. 19041
May 2013
JEL No. N91,N92,R0

ABSTRACT

This handbook chapter seeks to document the economic forces that led the US to become an urban nation over its two hundred year history. We show that the urban wage premium in the US was remarkably stable over the past two centuries, ranging between 15 and 40 percent, while the rent premium was more variable. The urban wage premium rose through the mid-nineteenth century as new manufacturing technologies enhanced urban productivity; then fell from 1880 to 1940 (especially through 1915) as investments in public health infrastructure improved the urban quality of life; and finally rose sharply after 1980, coinciding with the skill- (and apparently also urban-) biased technological change of the computer revolution. The second half of the chapter focuses instead on the location of workers and firms within metropolitan areas. Over the twentieth century, both households and employment have relocated from the central city to the suburban ring. The two forces emphasized in the monocentric city model, rising incomes and falling commuting costs, can explain much of this pattern, while urban crime and racial diversity also played a role.

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I. Introduction

Over its two hundred year history, the US has become an urban nation. This chapter seeks to document the sources of this transformation. Workers and firms settled in cities following productivity shocks that were complementary to population density, including the new manufacturing technologies of the first and second industrial revolution and, more recently, the advent of computerization. In addition, workers were drawn to cities by improvements in the quality of urban life, especially in public health.

Seminal work in urban economics by Rosen (1978) and Roback (1982) suggests that the urban wage and rental premia can be used to disentangle these competing explanations for urban growth. We compile novel wage and rent series for urban and rural areas back to 1820 (wages) and to 1918 (rents). We find that the urban wage premium in the US was remarkably stable over the past two centuries, ranging between 15 and 40 percent, while the rent premium was somewhat more variable, reaching above 70 percent in 1940 and again more recently.

Urban premia rose through the mid-nineteenth century as new manufacturing technologies enhanced urban productivity; then fell from 1880 to 1940 (especially through 1915) as investments in public health infrastructure improved the urban quality of life; and finally rose sharply after 1980, coinciding with the skill- (and apparently also urban-) biased technological change of the computer revolution.

We supplement our analysis of the new price series with reviews of the literature on the productivity of economic activity and the quality of life in urban areas. Historical episodes provide useful variation to document the presence of agglomeration economies in cities and to understand the mechanisms through which density enhances productivity. An extensive literature documents that the urban public health investments of the late nineteenth and early twentieth

century led to dramatic reductions in urban mortality; newer work has collected and analyzed data on public health improvements at the neighborhood level.

The second half of the chapter shifts in focus from the process of urbanization to the location of workers and firms *within* metropolitan areas. Over the twentieth century, both households and employment have relocated from the central city to the suburban ring. The two forces emphasized in the monocentric city model, rising incomes and falling commuting costs, can explain much of this pattern, while urban crime and racial diversity also played a role.

The majority of the chapter emphasizes the dramatic mobility of the US population. Indeed, the housing units and commercial buildings that make up a city are often more durable then the city's population itself. The last section discusses the problems associated with "vintage capital" in cities – including the lingering housing stocks in declining cities as well as the coordination failures that delay redevelopment in existing neighborhoods.

II. Urbanization rates, 1790-2010

Since the country's founding, the US population has been moving from rural to urban areas and from smaller towns to larger cities. Figure 1 displays population trends over the past two centuries. The figure reports the share of the population that lives in an urban place, defined as a town with 2,500 or more residents, as well as the share of the population that lives in a metropolitan area. Metropolitan areas are geographic units defined by the Census Bureau to include one or more contiguous counties anchored by a central city of a sufficient size. The number of metropolitan areas increases over time from 66 in 1900 to 373 by 2010. As a result, in Figure 1 the metropolitan share increases both because existing areas attract a larger share of the population and because the number of metropolitan areas expands over time.

The US population experienced little growth in urbanization in the first decades of the nineteenth century, with the urbanization rate remaining below 10 percent. From 1830 to 1930, the pace of urbanization substantially accelerated: the share of the population living in an urban area increased six-fold to 60 percent. After a decade of stasis, the urban share again increased rapidly from 1940 and 1970 and then more slowly from 1970 to 2010, reaching 80 percent in 2010. The share of the population living in a metropolitan area tracks the urban share closely.

The trends in Figure 1 classify locations as "urban" (or "metropolitan") if they reach a certain population threshold. However, within the US, regions varied tremendously in their size and population density. Figure 2 graphs county-level population density for the median resident by region. Despite the rapid expansion of urbanization after 1830, population density rose more slowly through the nineteenth century. In the Northeast, the growth in population density accelerated after 1890, whereas density in other regions only began increasing rapidly after 1940 (West) or 1970 (South). Regional gaps in population density are driven both by variation in urbanization rates and by differences in density *within* urban areas.[1]

III. Historical Background

The pattern of urban growth over time and across regions has been shaped by historical shifts in transportation technology and industrial composition. The towns and cities of the early-

[1] The South has long lagged behind other regions in urbanization rates, although this gap has narrowed over time. As shown in Figure 1.1, in 1900 only 18 percent of southern residents lived in an urban area, compared to 66 percent of the Northeast. By 2010, the South had caught up with the Midwest but both regions still lagged behind the West and the Northeast. Meyer (1988) attributes this gap to differences between free and slave agriculture. He argues that free farmers held their wealth in land and therefore supported transport improvements, which indirectly supported city growth. Southern plantation owners, in contrast, held their wealth in slaves, the value of which was not tied to a particular place. In addition, farmers of staple grains sent their produce to town to be processed, while southern planters processed cotton on plantation. Further research on the history of this regional urbanization gap is needed.

to mid-nineteenth century served as “central places” for their agricultural hinterlands. That is, towns emerged as hubs for surrounding farmers to process and sell their crops and, once there, to purchase consumer goods and specialized services, such as legal and financial assistance. Weiman (1988) provides a useful case study of this process in Atlanta.

The location of these central places was strongly influenced by geographic advantages, such as the presence of waterways and the proximity to rich farmland, but was also reinforced by human investments in supportive infrastructure – what Cronon (1992) refers to as “second nature”. New York City, for example, was built around a natural harbor that provided access to domestic and international markets. In addition, the Hudson and East rivers offered connections to agricultural land in upstate New York and Long Island. The fertile farmland in these areas supported a large rural population that generated a customer base for the services offered in the city. However, beyond these natural advantages, New York City’s ascendancy was also strengthened by investment in the Erie Canal, which linked upstate New York to the Great Lakes, thereby expanding the city’s set of easily accessible markets.

The natural advantages that shaped the historical locations of cities in the US changed over time as innovation rendered existing transportation infrastructure obsolete. The stagnation of St. Louis in the twentieth century offers one such example. St. Louis sits at the junction of the Mississippi and Missouri rivers. Furthermore, the Mississippi river narrows at this point, preventing the passage of large steamboats traveling from New Orleans and requiring traders to offload their cargo onto smaller boats to complete their journey to northern markets. This confluence of trade created an opportunity for commercial activity and, hence, St. Louis emerged. Yet, as river transport was eclipsed by rail, which minimized the need for these trans-

shipment points, St. Louis became overshadowed by Chicago as the largest city in the Midwest (Cronon, 1992, p. 296).

However, even as natural advantages diminish, forces of path dependence can preserve a relatively stable array of city locations as long as the presence of "agglomeration economies" are sufficiently strong – that is, as long as the proximity to other firms is a sufficient draw to retain existing firms or encourage new firms to locate in the area. Even St. Louis, which has been surpassed in regional prominence, remains a city of 320,000 residents anchoring a metropolitan area of nearly 3 million in a location that was historically valuable but where there would perhaps be little independent reason to build a city today. Bleakley and Lin (2012) illustrate this point further by examining the contemporary fate of cities located at historical portage sites. We discuss this paper and other evidence of agglomeration economies in Section VI.

As the US economy shifted from agriculture to manufacturing over the late 1800s, cities expanded their functions from central places for the trade and shipment of agricultural products to the location of industrial activity.[2] By 1920, 69 percent of manufacturing employment occurred in a metropolitan setting, compared to only 43 percent of general work activity.[3] With the growth of the railroad, transportation costs fell and manufacturing establishments no longer needed to locate close to their customer base. Instead, manufacturing firms shipped their goods to a national set of consumers and concentrated production in regions that offered productive advantages, such as an abundance of natural resources (Kim, 1995). Furthermore, the switch

[2] Michaels, Rauch and Redding (2012) argue that the shift from agriculture to manufacturing and services can explain why population growth is positively correlated with initial population density at intermediate levels of population density from 1880 to 2000 in the US. At low density levels, population growth is driven by agricultural shocks, which are mean reverting, whereas at high density levels, population growth is due to non-agricultural employment growth, which is uncorrelated with initial density or city size.

[3] Authors' calculations from the IPUMS sample (Ruggles, et al., 2008).

from water power to steam power and, eventually, to electricity freed up firms from locating close to power sources (Rosenberg and Trajtenberg, 2004; Kim, 2005).

As the relative advantages of urban and rural locations change over time, where do workers choose to settle and where do firms choose to operate? The next section will review a standard Rosen-Roback model of firm and worker location in order to generate predictions about how the relative wages and rents in urban areas change with the desirability of urban locations. We then use these predictions to interpret historical time series of urban factor prices.

IV. Theoretical framework

This section describes a general equilibrium model of worker and firm location originally due to Rosen (1979) and Roback (1982). We then use this framework to draw inferences about the sources of city growth over US history from series of urban wages and rents presented in Section V. We present this logic for interested readers; those who are familiar with the Rosen-Roback framework can easily skip this section without loss of understanding.

Consider a group of workers and firms, each free to move between a set of cities. Cities are endowed with a fixed quantity of land (L) and distinguished by an amenity level (S). S can include consumer amenities (e.g. cultural activities) that attract workers as well as productive amenities (e.g. access to natural waterways) that attract firms. In each city *i*, workers receive a wage (w_i) and allocate their resources between a consumption good (X_i) and land for housing (L^h_i). Firms in location *i* produce consumption good X_i with a combination of labor, land for production (L^p_i) and – if relevant – the productive amenity S_i. Wages and rents adjust until, in equilibrium, each firm and worker is indifferent between locating in all possible cities. Implicitly, the model assumes that the consumption good can be shipped without cost between

markets, a condition that limits the applicability of the model to the nineteenth century but may be a reasonable approximation in the twentieth century.

Cities will grow if either workers are attracted to the area by a new consumer amenity or firms are attracted to the area by a new producer amenity. First, consider a new producer amenity such as a new port for international shipping in city *i*. Firms move to city *i* to take advantage of this local productivity boost. Firms in city *i* are now willing to pay higher wages because each worker generates more output, thereby inducing workers from elsewhere to move to city *i*. As firms and workers move to the area, competition over the fixed land resource drives up rents, offsetting the increase in wages and equalizing worker utility across locations. Despite the productivity advantage in city *i*, the need to pay higher rents and higher wages together ensure zero profits for firms. Therefore, we can infer that ***cities whose growth is due to the arrival of a new productive amenity will offer higher wages and charge higher rents***.

Next, consider a new consumption amenity like the development of a new theater district. This consumption amenity will attract workers to the area and thereby drive up rents. Firms facing higher rents will lower their demand for land, thereby reducing both workers' marginal products and their wages. The combination of higher rents and lower wages counterbalance the higher consumer amenity level, equalizing worker utility across cities. Therefore, we can conclude that ***cities whose growth is due to a new consumption amenity will offer lower wages and charge higher rents***. Note that, in both cases, the model predicts that urban growth is accompanied by higher rents; what distinguishes between producer- or consumer-led growth is the correlation between urban growth and wages.

V. Urban wage and rent premia in the United States, 1820 to 2010

In this section, we construct wage and rent series for urban and rural areas, and use the Rosen-Roback model to infer the underlying causes of urban growth in the US over time .

We use Census and American Community Survey data from the Integrated Public-Use Microdata Series (IPUMS) to construct the series for the period 1940 to 2010, while data from the Bureau of Labor Statistics' (BLS) Cost of Living Survey Series, the Iowa State Census and the Census of Manufacturing permit us to extend the series back to 1820 for wages and 1918 for rents (Ruggles, et al., 2008).[4,5] The calculations include working age men not living in group quarters or on a farm and not currently attending school. The wage series is further restricted to men who are currently employed (i.e. not unemployed or out of the labor force) in the civilian labor force and who report earning non-negative annual wage and salary income.[6] The rent series is calculated using contract rents.[7] All dollar figures for the period 1913 to 2010 are inflation-adjusted to 2010 values using the urban consumer price index from the BLS and from David and Solar (1977) before 1913. Before 1940, the series compares urban to rural workers using the 2,500 resident threshold; after 1940, we compare metropolitan to non-metropolitan workers.[8]

Figure 3 shows the US urban wage premium for the period 1820 to 2010, along with the underlying urban and rural wages; Figure 4 portrays the corresponding rent series for the period 1918 to 2010. Both the wage and rent premia are positive over the entire period – the wage

[4] The Weeks Report database, collected from the 1880 U.S. Census, also provides wage data for the mid-to-late nineteenth century period. However, because it is a retrospective survey of a non-random sample of surviving manufacturers and does not report the number of employees at each firm, it is inferior to the Census of Manufacturing for our purposes. In particular, we found that reported wages in rural and urban areas were substantially closer together in the Weeks Report data than in the Census of Manufacturing, likely because the rural firms that kept retrospective payroll records were larger and less remote than the typical rural firm.

[5] Other cost of living surveys in the BLS series could not be used to extend the rent series further back. The data from the 1888-1890 survey do not provide sufficient geographic precision, only identifying respondents' state of residence, while the microdata for 1901 have been destroyed.

[6] Given the data at hand, the nineteenth century observations contain only manufacturing workers while the twentieth century series is calculated using workers employed in all industries.

[7] Calculations using total income or gross rent, when available, yielded similar findings.

[8] Calculations using a consistent definition (such as an incorporated city of at least 2,500) or a consistent geography (such as the metropolitan statistical areas as of 1900, those as of 2000, or those consistently identifiable in the IPUMS data set) produced qualitatively similar results.

premium ranges between 13 and 41 percent over nearly two centuries, while the rent premium ranges between 20 and 81 percent – suggesting a consistent productivity advantage for urban areas despite the considerable decade-by-decade volatility in the series.

Taken together, the figures broadly illustrate four episodes of urban evolution in the US. The first era, extending through the mid-nineteenth century, was characterized by fairly flat wage growth within urban and rural areas but significant (if fitful) *growth* in the urban wage premium. Between 1820 and 1880, wages in each sector grew by only a third while the urban wage premium nearly doubled from 21 to 41 percent. Coinciding with a dramatic increase in the urban population (as shown in Figure 1), these trends suggest that cities were becoming more productive centers of economic activity as they increasingly came to serve as hubs of transit, trade and manufacturing activity.

The second episode, from the late nineteenth century to the mid-twentieth century, featured steadily rising wages coupled with a *declining* urban wage premium. From 1880 to 1940, wages in each sector more than tripled while the wage premium fell modestly from 41 percent to 36 percent. Because workers continued to move to the cities during this period, the slumping wage premium suggests an increase in urban consumption amenities like public health. Indeed, it is revealing that the urban wage premium collapsed, falling from 41 to 19 percent, between 1880 and 1915, the period of the most dramatic expansion in urban public health infrastructure. We discuss these public health investments in section VII below.

The third episode, spanning the mid-to-late twentieth century, was characterized by rapidly rising wages and rents together with *continued declines* in the urban wage and rent premia. Over the period 1940 to 1980, wages more than doubled in each sector while the wage premium fell substantially, from 36 percent to 23 percent. At the same time, rents increased by

about half while the urban rent premium declined substantially, from 81 percent to 46 percent. Moreover, throughout this period, the urbanization rate continued to increase. According to the Roback model, these patterns suggest that cities were experiencing a decline in productive amenities relative to non-metropolitan areas – perhaps due to the construction of interstate highways and the rise of trucking, which minimized the need to be near fixed transportation nodes in central cities (e.g. train depots or ports). These trends also suggest that the growth in the urbanization rate in the mid-twentieth century was likely driven by an increase in urban housing supply. That is, the substantial amount of homebuilding in the suburban ring in the decades after World War II reduced urban rents, thereby leading to an increase in urban residence despite the loss of relative urban productivity.

The fourth episode, from the late twentieth century to the present, is characterized by a sustained *increase* in both urban wage and rental premia for the first time in a century. From 1980 to 2010, the urban wage premium grew from 23 to 35 percent. Likewise, the rent premium jumped from 46 to 71 percent. At the same time, the urbanization rate grew modestly. In light of the Roback model's predictions, these trends imply that urban areas enjoyed a boost in productivity– coinciding with the diffusion of the personal computer and later the Internet. It is often suggested that the skill-biased technological change of this era contributed to rising income inequality by education level. What is less well known is that computerization was also associated with rising inequality between metropolitan and non-metropolitan areas. In other words, computers and cities appear to be complements; computers may facilitate the types of learning or worker-firm matching that take place in cities.

One caveat to the above analysis is the issue of worker quality. The Roback model assumes that all workers supply one identical unit of labor. Yet if the highest quality workers are

attracted to city living, then the urban wage premium could simply be due to worker sorting, rather than to the underlying urban productivity. Furthermore, it is possible that changes in sorting patterns over time could account for a rising (or falling) urban wage premium if the most talented rural dwellers leave for the city, thereby lowering the average rural wage and, at the same time, either increasing or decreasing the urban wage depending on how these in-migrants compare to the existing urban population. For a modern approach to address this selection problem, see Glaeser and Mare (2001).

VI. Agglomeration economies

Our historical wage and rental series suggest that the productivity of urban areas, relative to their rural counterparts, has fluctuated over time. Urban productivity appeared to increase sharply from 1980 to 2010. Perhaps as a result, academic interest in the concept of "agglomeration economies," or the potential productivity advantages of being in close proximity to other firms, has expanded tremendously in recent years.[9] This section emphasizes the contributions of economic history to this growing field, both in documenting the presence (or absence) of agglomeration economies in various historical settings and in using these historical episodes to distinguish between possible mechanisms underlying the forces of agglomeration.

The use of historical data allows scholars to chronicle the strength of agglomeration economies and contrast their roles under different technological regimes. Davis and Weinstein (2002) examine regional population growth in Japan over the past 8,000 years, in particular, highlighting the persistence of this spatial distribution – even in the face of the decimation of

[9] Google scholar catalogs fewer than 2,000 papers that mention the words "economics" and "agglomeration" in the year 1995-96. Ten years later, this number had increased to more than 11,000, expanding at a pace twice as fast as the recorded number of hits for the word "economics" alone. We acknowledge that this measure may not be exact because the relative reliance on terms used to describe agglomeration economies (such as "increasing returns" and "external economies") may have changed over time.

many cities during World War II. The authors claim that the post-war rebound of Japanese cities is more consistent with a story of locational fundamentals than one of agglomeration; that is, they argue that cities arise in geographic locations that are more productive to begin with, rather than asserting that density itself confers productivity advantages. Yet, they also find evidence of a shift in relative importance from "locational fundamentals" towards agglomeration economies (or, "increasing returns") as industrialization took hold, with the most productive regions growing relatively more populous in the more recent era.

The emergence of agglomeration economies in Japan after industrialization echoes the findings of Bleakley and Lin (2012), who document the long-run growth of early American cities established at portage sites. Portage sites emerged at river rapids when early travelers needed to disembark and carry their boats, generating opportunities for trade. Even as the initial *raison d'être* for these cities disappeared with the advent of canals, railroads, and trucking, these portage cities maintained their size advantage well into the twentieth century. While locational fundamentals provided the initial impetus for the location of portage cities, the long-term growth differentials suggest that these cities were subject to forces of agglomeration. Ahlfeldt, et al. (2012) find similar patterns in Berlin: the employment centers near East Berlin experienced falling land prices during the Cold War partition but rebounded soon after reunification, consistent with importance of agglomeration forces.

Although the benefits of agglomeration have been present throughout the industrial period, our long-run wage and rent series suggest that these forces have strengthened in recent decades. A burgeoning literature in urban and labor economics documents the presence of these spillovers at the firm level; Moretti (2004b) and Rosenthal and Strange (2004) provide useful

reviews of this contemporary literature. Recent studies like Fu (2007), Greenstone, Moretti and Hornbeck (2010), and Baum-Snow and Pavan (2012) continue to advance this research agenda.

Beyond documenting the presence of agglomeration economies, it is also important to understand the mechanisms by which proximity to other firms may generate productivity advantages. A growing literature is utilizing the historical record to shed light on possible benefits of locating in a city, including access to larger product markets, larger input markets and the ability to learn production techniques from a greater number of firms.

In the early nineteenth century, the large customer base available in cities allowed urban firms to economize on transportation costs. Sokoloff (1988) demonstrates the importance of market size in the nineteenth century by focusing on geographic variation in innovation, an economic activity with high fixed costs that often only becomes profitable if the resulting product can be sold in high volume (e.g., Krugman 1991). Sokoloff finds that, in the first half of the nineteenth century, patenting rates were higher in urban areas and along navigable rivers and canals.

With the rapid decline in transport costs accompanying first canals and then railroads, the importance of access to a large local customer base likely receded. Instead, agglomeration economies may arise due to the advantages of large labor markets in urban areas. Contemporary white collar and technical jobs require specialized knowledge or experience and, thus, educated workers are often more productive at firms that provide a match for their specific skills. The potential for finding better matches in the labor market provides an edge to firms locating in large urban areas. Costa and Kahn (2000) explore the role of thick labor markets in generating agglomeration economies by focusing on the location choices of dual-career couples. They find

that college-educated couples are more likely to live in large metropolitan areas and that this sorting has increased in recent decades alongside the growth in the urban wage premium.

Marshall (1890) theorized that the forces of agglomeration are strongest between firms in related industries that can more easily share ideas, inputs and output linkages, and workers. Moving beyond the concept of city-wide agglomeration forces to that of specific inter-industry linkages is a promising direction for future work.[10] Hanlon (2012), for example, traces the asymmetric effects of the cotton blockade during the American Civil War on the growth rates of various industries in cotton- and wool-producing towns in England. He finds that industries closely related to textiles, such as machine tools, experienced much slower employment growth during and after the Civil War in cotton-producing towns, both relative to industries less connected to textiles and relative to similar industries in wool-producing towns. That is, the removal of certain links in the local industry mix seems to have particularly strong and long-lasting impacts on firms in related industries.

Another promising direction for new research on agglomeration is the use of historical conditions to generate cross-city variation in persistent factors that may contribute to contemporary economic growth. Moretti (2004c), for instance, uses the historical allocation of a land grant universities to instruments for the share of a city's workforce with a college degree . Glaeser, Kerr and Kerr (2012) and Bunten et al. (2013) leverage the historical location of mining activity and other heavy industry to predict which areas will lack high levels of entrepreneurship today.

[10] Ellison, Glaeser and Kerr (2010) provide a general framework for measuring patterns of coagglomeration between industry pairs in a single cross section. They find that sharing inputs, workers and ideas all contribute to coagglomeration, in that order of importance. Hanlon and Miscio (2013) are extending this framework to historical data (1850-2000), in part to determine whether the patterns of coagglomeration and the channels generating such coagglomeration have changed over time.

VII. Amenities and disamenities in cities: The case of public health

The previous section focuses on productivity advantages that accrue to urban firms and workers due to their close proximity to one another. In this section, we turn to the amenities that households may enjoy – or the disamenities they may face – by locating in cities. Urban areas are characterized by their high population density. Recently, urban economists tend to emphasize the positive aspects of density – namely, that cities offer a wider array of shopping venues, cultural events, and bars and restaurants (Glaeser, Kolko, Saiz, 2001; Sinai and Waldfogel, 2004). However, in the past, the negative aspects of density likely outweighed the positive, most importantly the spread of communicable and water-borne disease. Simply put, cities were deadly places until investments in clean water and sewer systems were made. The role of public health in moderating urban mortality rates has been studied extensively in economic history, historical sociology and epidemiology. We will review this literature and then highlight potential areas for future research.

In 1900, death rates were substantially higher in urban areas than in rural areas, with infant mortality up to twice as high in cities, in large part due to infectious disease (Condran and Crimmins, 1980; Haines, 2001).[11] Part of the urban wage premium in the nineteenth century may have been a compensating differential for the health costs borne by urban residents (Figure 4).[12] The urban mortality penalty and corresponding wage premium both declined in the early twentieth century as cities began investing in clean water systems, sewage control and sanitation.

[11] Cain and Hong (2009) show that survival rates were higher in smaller cities than in larger cities in a sample of men who served in the Union Army. Kesztenbaum and Rosenthal (2011) use French military records to study the health consequences of moving to a city from a rural area. They find that rural newcomers enjoy a survival advantage for the first few years of urban residence but, within a decade, converge to the high mortality rates present in the city. Having been born in the city does not appear to confer a survival advantage due, say, to immunities to transmitted diseases; neither did having grown up in a rural area save migrants from the deadly conditions of the city.

[12] Williamson (1982) demonstrates that locations in England with higher infant mortality rates in the mid- and late-nineteenth century had higher wages, thereby compensating workers for this extra risk. The urban-rural health disparity was larger in 1840 than in 1905, necessitating a larger urban wage premium in that year.

Early work by Gaspari and Woolf (1985) on these investment projects in 122 cities in 1910 finds that the extent of sewer lines in an area has a negative association with mortality rates.

Cutler and Miller (2005) substantially improve on this analysis by following a subset of 14 cities from 1900 to 1930. The cities most likely to invest in clean water technology may have been those most susceptible to severe disease outbreaks or, alternatively, those with the most resources. By following cities over time, Cutler and Miller can control for fixed differences across cities and instead estimate how a city's health record changes after implementing a new public health project. They find that cities experienced a 13 percent reduction in total mortality after the introduction of their first clean water systems, primarily due to a decline in deaths from water-borne disease. By this estimate, clean water alone can explain nearly half of the urban mortality decline in the early twentieth century.[13]

Looking ahead, we believe that the recent explosion of data collection at the neighborhood level within cities is a promising trend in the study of urban public health . Kesztenbaum and Rosenthal (2012) compile information on mortality and sewer infrastructure, along with income and rents, for the 80 *quartiers* of Paris. In the mid-nineteenth century, the average life expectancy in Paris was five years lower than in the rest of the country; yet at the same time there was a twelve (!) year gap in life expectancy between residents of the healthiest and least healthy neighborhoods within Paris. In Paris, building owners had to pay a fee to receive a hook-up to the sewer main and so early sewer infrastructure widened the health disparity between wealthy and poor neighborhoods. In the US, in contrast, Troesken (2002) argues that even African-Americans, often a city's poorest residents, benefited from the

[13] Ferrie and Troesken (2008) analyze Chicago's three distinct water projects from 1867 to 1917. They find that each project reduced death both from typhoid fever, a typical water-borne disease, and from seemingly-unrelated causes of death. This pattern is consistent with the epidemiological theory that reductions in water-borne disease strengthened the population's resistance to other health shocks.

provision of water and sewerage systems, especially in cities with lower levels of residential segregation. The Center for Population Economics at the University of Chicago will soon release comprehensive neighborhood data for eight US cities. This data will allow scholars to measure local variation in disease and mortality rates and to understand how US cities were able to reduce disease in poor areas through public health investments (if, indeed, this result is borne out in the broader data).

In a related study, Villarreal (2012) shows that historical variation in the health conditions between neighborhoods can have persistent effects on neighborhood quality (as proxied by housing prices) over time. He focuses on neighborhoods built in the historical marshland in New York City, which had high rates of water-borne disease. Over time, this health disamenity disappeared as the marshes were drained and infrastructure for clean water and sewers improved. Yet the housing price disparity between former marshland and the rest of the city remained – and even grew – over time, in large part due to the persistent sorting of poor residents into historically disadvantaged areas.

VIII. Location of workers and firms *within* urban areas

Thus far, we have focused on workers' and firms' decisions to locate inside or outside of urban areas. Once inside an urban area, workers and firms have the choice to settle in many possible locations, some closer to the central city and others on the periphery. Over the twentieth century, the share of households and firms located in the central city has declined substantially. This section will present a simple framework to analyze households' location decisions within metropolitan areas and use this structure to summarize the literature on the causes of

suburbanization over the twentieth century. We will then turn to the decentralization of employment as firms, too, relocated outside of central cities.

A. Population suburbanization

Figure 5, which was originally published in Boustan and Shertzer (2013), documents trends in city and suburban growth from 1940 to 2000 for the 103 metropolitan areas anchored by a central city that had at least 50,000 residents by 1970. Over the second half of the twentieth century, the share of metropolitan residents living in a central city fell from 58 percent to 36 percent. Yet, with the exception of the 1970s, the average central city experienced positive population growth in each decade.[14] Despite population growth in central cities, the suburban population continued to grow at a substantially higher rate, leading to a steady decline in the share of the metropolitan population living in central cities.

The Tiebout model is a one useful structure for understanding the location decisions of households amongst various municipalities in a metropolitan labor market (Tiebout, 1955). Mobile households are free to choose amongst a variety of municipalities offering different bundles of public goods and tax rates. As incomes rise, households may shift toward locations with higher tax rates and better schools in the suburbs. Rhode and Strumpf (2003) caution that the long run data is not consistent with the Tiebout model, which implies that, as transportation costs fall, household sorting should rise. However, in samples of US municipalities and counties, Rhode and Strumpf show that jurisdictions have drawn closer together in their taxing and spending decisions.

[14] The growth of central cities in Figure 5 is partly driven by the expansion of land area in central cities via annexation. In 1940, the average city in this sample was 48 square miles; by 2000, it had grown to 117 square miles.

The Tiebout model describes population sorting among a set of jurisdictions but does not offer predictions about physical location within a metropolitan area. The monocentric city model – jointly attributed to the work of Alonso (1964), Muth (1969), and Mills (1972) – is the workhorse model for analysis of spatial location within metropolitan areas. A core feature of the model is the assumption that all employment is concentrated in a central business district (CBD). Households then decide whether to locate close to or far from the CBD, trading off a shorter commute for the higher rents of parcels closer to the CBD.[15]

According to the monocentric framework, suburbanization will occur – that is, households will move further from the CBD – when: (1) transportation improvements reduce the time cost of travel and (2) incomes rise, thereby increasing the demand for land and housing services and encouraging households to move to the periphery where prices (per square foot) are lower.[16] These hypotheses are borne out in the historical record. Margo (1992) demonstrates that rising real income can explain around 40 percent of suburbanization in the post-World War II period (1950 to 1980). At the same time, construction of the interstate highways reduced the time cost of commuting between the central city and outlying towns. Baum-Snow (2007) uses the original 1947 federal highway plan, which was designed for purposes of defense and inter-state trade, to instrument for the actual number of highways later built in a metropolitan area. He finds that another one-third of the change in relative city population can be explained by the availability of new highways.

[15] The assumption that all employment takes place in the CBD is not well-suited to most American cities, especially those that developed after the diffusion of the automobile and often feature two or more employment centers. Yet, despite its stylized nature, this framework generates sensible predictions for the conditions under which the majority of the population will live close to the city center and the conditions under which it will move further away.

[16] This prediction will hold as long as the income elasticity of demand for land area is greater than the income elasticity of commuting costs. Glaeser, Kahn and Rappaport (2008) show that, empirically, the income elasticity of demand for land is not large enough to account for very much of the association between income and suburban residence.

The core economic variables emphasized in the monocentric city model (rising income, falling commuting costs) explain a large portion of suburbanization over the twentieth century. Demographic and social changes within cities, including rising crime rates and growing racial diversity, also encouraged some households to relocate to insulated suburbs via Tiebout-style sorting. Property crime in urban areas doubled between 1960 and 1990. Cullen and Levitt (1999) find that a 10 percent increase in city crime rates corresponds to a 1 percent decline in city population. According to this figure, crime wave should have reduced city population by at least 10 percent, which, in combination with the other factors above, would greatly over-explain the decline in city population. Yet, since 1990, crime rates have fallen almost as dramatically as they initially rose, which may have counteracted some of the initial mobility response.

Boustan (2010) exploits variation in black migration from the rural South to northern and western cities to estimate the role of "white flight" in suburbanization process. She finds that each black arrival led to 2.7 white departures. By this estimate, white flight can account for around 10 percent of mid-twentieth century suburbanization, equivalent to the construction of one new highway. White departures from central cities contributed to a rise in racial residential segregation; by 1970, 80 percent of black and white households would have needed to switch residences in order for each neighborhood to reflect the racial composition of the metropolitan area of which it was a part (Cutler, Glaeser and Vigdor, 1999).

In the US, suburban households are not only more likely to be white but they are also more likely to be affluent (although the same is not true of many European cities; see Brueckner, Thisse and Zenou, 1999).[17] Glaeser, Kahn, and Rappaport (2008) suggest that the rich are more likely than the poor to live in the suburbs because, in the US, the rich tend to commute by car,

[17] The income gap between cities and suburbs in the US has widened over time. In 1940, the typical suburban resident earned only three percent more than his urban counterpart; by 2000, the city-suburban income gap increased to 16 percent.

whereas the poor rely on public transportation. Given that public transportation is more readily available in city centers, the poor are more likely to locate downtown.[18] In addition, once central cities began to attract poor residents, this concentration of poverty may have begotten more poverty, either due to an endogenous clustering of public services and private businesses attractive to the poor or to a lack of local role models or peers with attachment to the labor force.

Despite the strong predictive power of models allowing free mobility, in reality, households' optimal location decisions are often circumscribed by zoning restrictions. The first zoning laws were implemented in the 1910s and were upheld by the Supreme Court in 1926. Fischel (2001) models municipalities as selecting a trio of property taxes, public good and zoning rules to maximize property values for the median homeowner/voter. In this modified Tiebout approach, zoning regulations ensure that new households with different preferences are unable to simply move in and overwhelm the local service consensus. Historically, Fischel argues, zoning enabled municipalities to add industrial employment centers, low-income apartment buildings, and other disfavored uses only when the use generated municipal revenues capable of offsetting the nuisance and congestion costs imposed on local residents.

If zoning enables municipal coordination, then the introduction of zoning laws ought to have increased property values by improving the fit between resident preferences and local conditions. McMillen and McDonald (2002) examine the implementation of Chicago's first zoning ordinance in 1923 and find that blocks zoned residential – that is, where no industrial uses were permitted, save for those already in place – experienced an uptick in (estimated) land

[18] Of course, this association raises the question: why is there more transit in central cities? To a certain extent, downtown's identity as a transit center may be a legacy of the historical concentration of economic activity in central cities and/or may be a natural outgrowth of the design of transit systems in hub-and-spoke arrangements. Yet, it is also possible that the continued investment in downtown transit is in response to the demands of poor local constituents, rather than the main cause of their location decisions. Historical analysis could be used to disentangle the relationship between access to transit and neighborhood poverty.

values relative to areas zoned to allow both industrial and residential use. Although industrial zones may be an eyesore to local residents, they also generate additional tax revenue for municipal residents; future work ought to address this trade-off. The rapid implementation of zoning laws around 1920 presents a unique opportunity to study this process.

B. Employment decentralization

Over the twentieth century, metropolitan employment has increasingly left central cities for open land in the suburbs. Glaeser and Kahn (2001) document that, by 2000, majorities of both residences and jobs were located in the suburbs in the typical metropolitan area. Information-based industries like finance have not decentralized – hence the density of Manhattan, an extreme outlier – but the majority of cities have experienced ongoing employment decentralization since at least 1950.

The decentralization of employment may simply be a byproduct of suburbanization as firms follow workers out of the city, or it may be driven by independent forces that allow more efficient production to occur at greater distances from the city center. One factor that may have encouraged firms to leave central cities was the growing network of interstate highways and the rise of truck-based transport, which decoupled distribution from downtown rail depots. Indeed, Baum-Snow (2010) shows that, rather than increasing the number of suburb-to-city commuting trips, highway construction increased within-suburb commuting. That is, highways did not simply enable citizens to move outward and commute inward; rather they appear to have encouraged both households and firms to locate at a distance from the central city.

Baum-Snow's analysis cannot disentangle whether highways first encouraged households to move to the suburbs with firms following suit, or vice versa. Boustan and Margo (2009a)

analyze this interaction between workers and firms by contrasting the residential choices of workers whose employers are immobile, such as state government workers in state capitals or clerks at the US Postal Service, with similar workers whose employers moved to the suburbs. They find that these government workers are more likely to live downtown, suggesting that household location decisions are closely tied to firm location. Their results suggest that, if not for the decentralization of employment, suburbanization rates would be substantially lower today. Of course, employers may also follow households, so the two effects can be mutually reinforcing in a decentralized equilibrium.

The decentralization of employment opportunities has affected groups differently according to their ability to suburbanize. As noted previously, the arrival of black migrants in northern and western cities led to "white flight" to the suburbs, with blacks remaining behind in central cities (Boustan, 2010). Boustan and Margo (2009b) present indirect evidence that these urban blacks faced diminished employment opportunities by documenting a notable uptick in black employment at US Postal Service sorting facilities, a large employer that remained rooted in downtown areas, as other firms moved to the suburbs circa 1960. This shift towards postal employment is strongest in segregated cities where blacks were more likely to live in the central city and is present only for mail clerks, who tend to work downtown, not for mail carriers, whose job locations follow residential populations.

IX. Vintage capital and "lock-in" effects

Although cities are, most importantly, dense collections of people, cities are also made manifest physically through their architecture. The long-lived nature of urban buildings and neighborhoods has important implications for how people organize themselves within and

between cities. For instance, new residences can be constructed rapidly, but old houses decay only slowly. Glaeser and Gyourko (2005) generate and test a number of predictions from this observation: first, housing prices should not increase much as a city expands if rapid construction satisfies growing demand, but housing prices will fall quickly in contracting cities as demand for the existing housing stock declines. Lower housing prices will compensate residents for falling wages, thereby ensuring only a slow decline in population: while cities can explode overnight, they take decades or more to fade away. In the meantime, the population of declining cities will be disproportionately low-skilled and less-attached to the labor force. These predictions are borne out in the modern data but could be further tested over a longer range.

Intra-city housing dynamics are also affected by the longevity of the housing stock. In any metropolitan area, high-income residents tend to occupy houses that are newer, larger, and of higher-quality. As these houses age, their residents may seek newer homes, leaving the older units to "filter" down to lower-income denizens of the city. Brueckner and Rosenthal (2009) argue that, initially, filtering helped to explain why rich households were more likely to live in the suburbs with plentiful new construction; it can account for up to half of the observed income gaps between central cities and suburbs in the mid- to late-twentieth century. They predict that, going forward, this process will encourage gentrification as deteriorating homes and neighborhoods in the central city are redeveloped.

The distributional consequences – has gentrification over recent decades harmed existing residents – is an open question (see, for example, Vigdor (2010)). Turning to history, one particularly controversial incidence of central-city redevelopment was the massive urban renewal efforts of the mid-twentieth century. Proponents argued that the strong negative externalities of "slum" neighborhoods could limit economic activity in the rest of the city. Furthermore, they

asserted that private interests were unable to overcome the transaction costs of redevelopment and so local governments should use eminent domain to assemble land in affected neighborhoods and provide grants and loans to enable redevelopment. Differential passage of the necessary laws at state level provides plausibly-exogenous variation in these redevelopment projects across cities that Collins and Shester (2013) exploit to examine the eventual impact of these redevelopment projects. They find that redevelopment had a positive and long-lasting effect on city growth across a number of metrics. While leaving open the question of distributional impacts, the authors do argue that this result is not driven by the simple relocation of low-income former residents out of the metropolitan area.

Siodla (2012) studies another (accidental) example of large-scale twentieth-century redevelopment: the rebuilding of San Francisco following the 1906 earthquake and fire. In the early twentieth century, San Francisco was growing rapidly and yet its existing housing stock was primarily composed of low-density single family homes. Areas that were razed by the fire transitioned more rapidly to a streetscape of apartment houses and other dense infrastructure than did neighboring unburned areas. This differential persisted for over two decades, suggesting that the redevelopment costs faced by durable capital owners are indeed significant enough to prevent a rapid transition in the face of shifting demands.

This raises further questions: are durable capital owners constrained merely by the cost of reconstruction, or are there external coordination problems that they must also overcome? Hornbeck and Keniston (2013) address this possibility by looking at a similar fire that destroyed large swathes of Boston in 1872. They develop an urban model with possible externalities whereby owners' redevelopment decisions are shaped by neighborhood building quality, plot consolidation challenges, industrial agglomeration, and public good provision. When owners

face decisions about when to upgrade, their choices may depend on the choices of others; a large fire eases these constraints as all buildings are simultaneously upgraded, industrial choices are simultaneously made, and public good provision (e.g., street widening or sewer improvements) and plot consolidation can be undertaken more easily.

X. Concluding remarks

This chapter analyzes the sources of urbanization over two hundred years of US history. Using newly-compiled series on urban wage and rental premia, we argue that urban growth in the US was driven by a combination of urban-biased technological advances that enhanced productivity in cities and improvements in urban quality of life, especially due to investments in public health. Interest in agglomeration economies, their causes, and their implications for urban growth and persistence has been growing in recent years; historical work has much to contribute to this line of inquiry.

The second half of the chapter reviews the economic forces that encouraged both households and firms to leave central cities and settle instead in suburbs. A combination of rising incomes and major road-building projects in the mid-twentieth century spurred much of this relocation. Yet cities and suburbs are not only separated in space but are also jurisdictionally distinct. Aspects of local political economy, including differences in crime rates and police protection, public transportation investments, and zoning regulations, reinforced this spatial redistribution.

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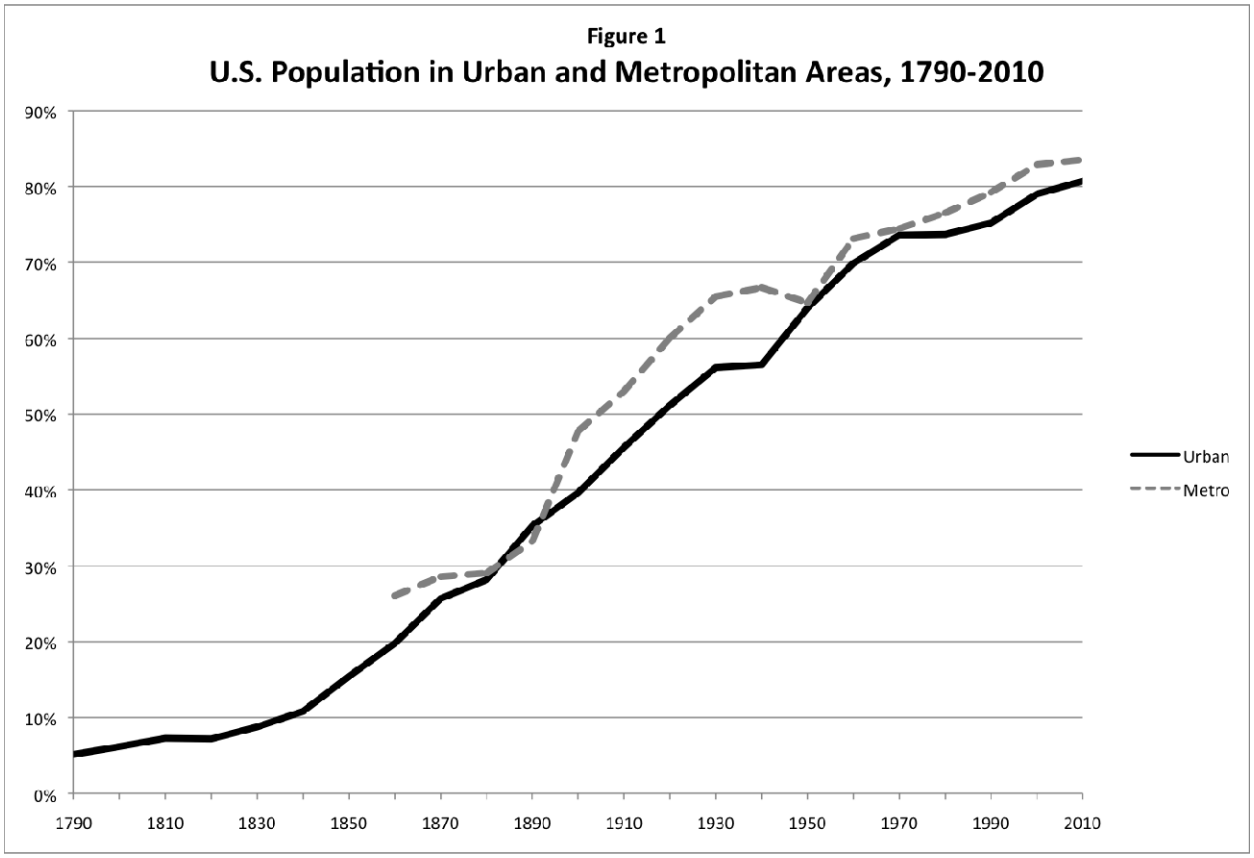

Figure 1: Before 1950, the urban share only includes residents living in incorporated places. From 1950 onward, the urban share includes residents living in both incorporated and unincorporated places. Data on urban population shares are from the U.S. Census Bureau. Metropolitan area population shares were calculated using data and the contemporaneous definitions provided by IPUMS in each year.

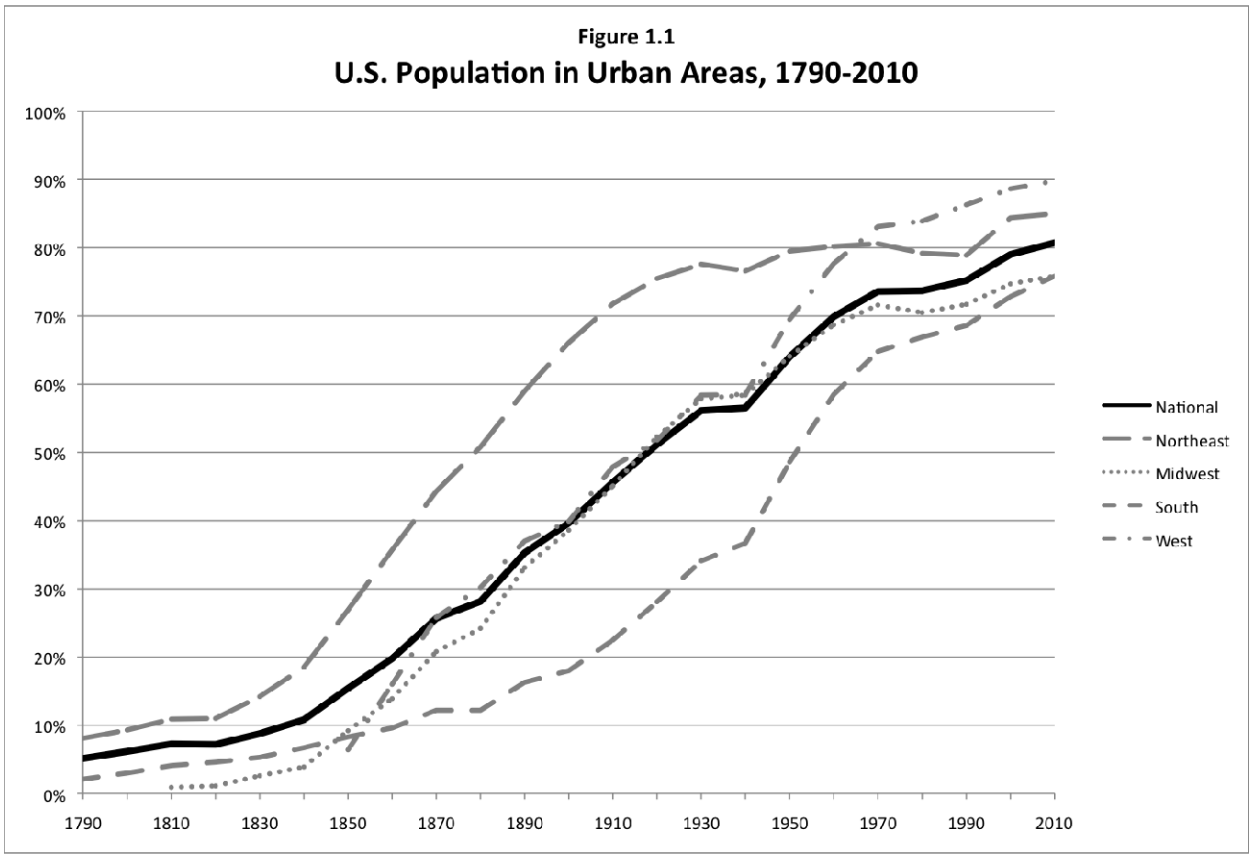

Figure 1.1: Before 1950, the urban share only includes residents living in incorporated places. From 1950 onward, the urban share includes residents living in both incorporated and unincorporated places. Data on urban population shares and region definitions are from the U.S. Census Bureau.

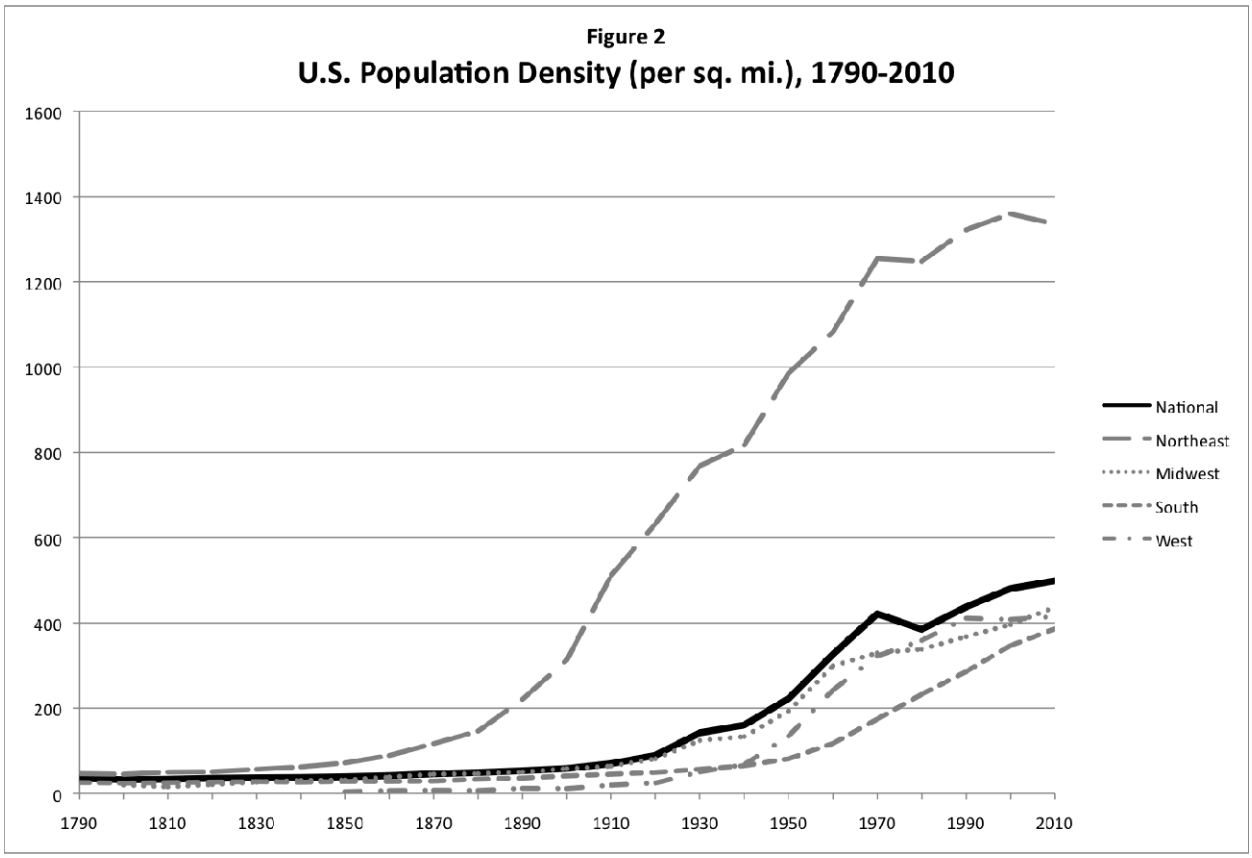

Figure 2: Population densities were calculated from Haines (2010). Region definitions follow the Census.

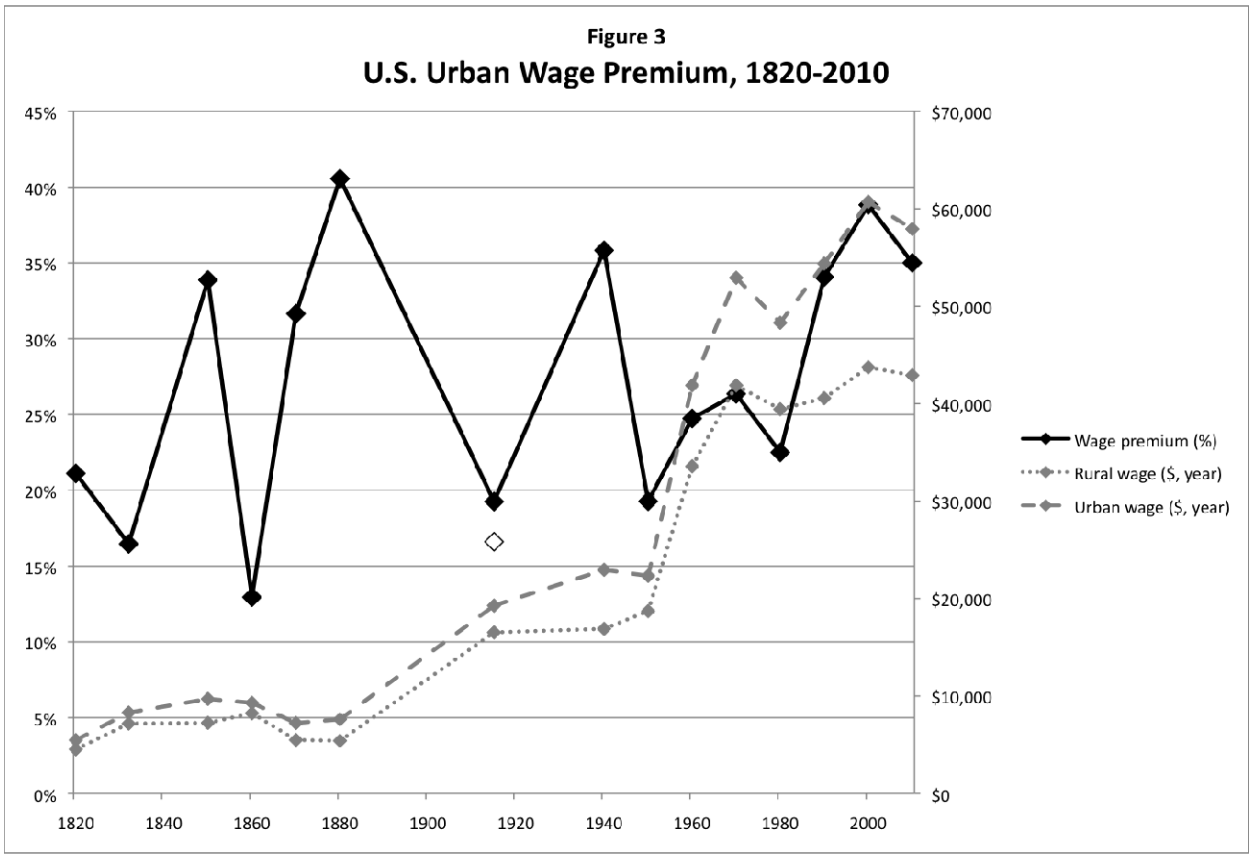

Figure 3: All dollar figures for the period 1913 to 2010 are inflation-adjusted to 2010 values using the urban consumer price index from the BLS; David and Solar's (1977) historical cost of living estimates are used for years prior to 1913. The values for 1820 and 1832 are from Sokoloff and Villaflor (1992), and represent the urban wage premium in New England and the Mid-Atlantic for male manufacturing workers in a county with at least one city of 10,000 residents or more, or in a county adjacent to such a county. The premium for 1850 to 1880 was calculated using data from the Census of Manufacturing, and represents the premium nationally for men (and women for 1870 and 1880) employed in non-farm industries earning non-negative wages in incorporated cities of at least 2,500 residents (Atack and Batemen, 2004; Atack, Weiss and Bateman, 2004). The urban wage premium for 1915 was calculated using data from the Iowa State Census and represent the premium in Iowa for working age men employed in non-farm industries earning non-negative wage income annually in Des Moines, Davenport and Dubuque (Goldin and Katz, 2010). The open white diamond in 1915 represents the actual urban wage premium in Iowa in 1915, whereas the closed black diamond represents the Iowa premium adjusted upward using the Iowa premium relative to the national premium in 1940. The urban wage premium for 1940 to 2010 was calculated using data provided by IPUMS, and represents the premium nationally for working age men employed in non-farm industries earning non-negative wage income annually living in metropolitan areas. Results are similar if we instead use men living in urban areas, defined as towns with at least 2,500 residents.

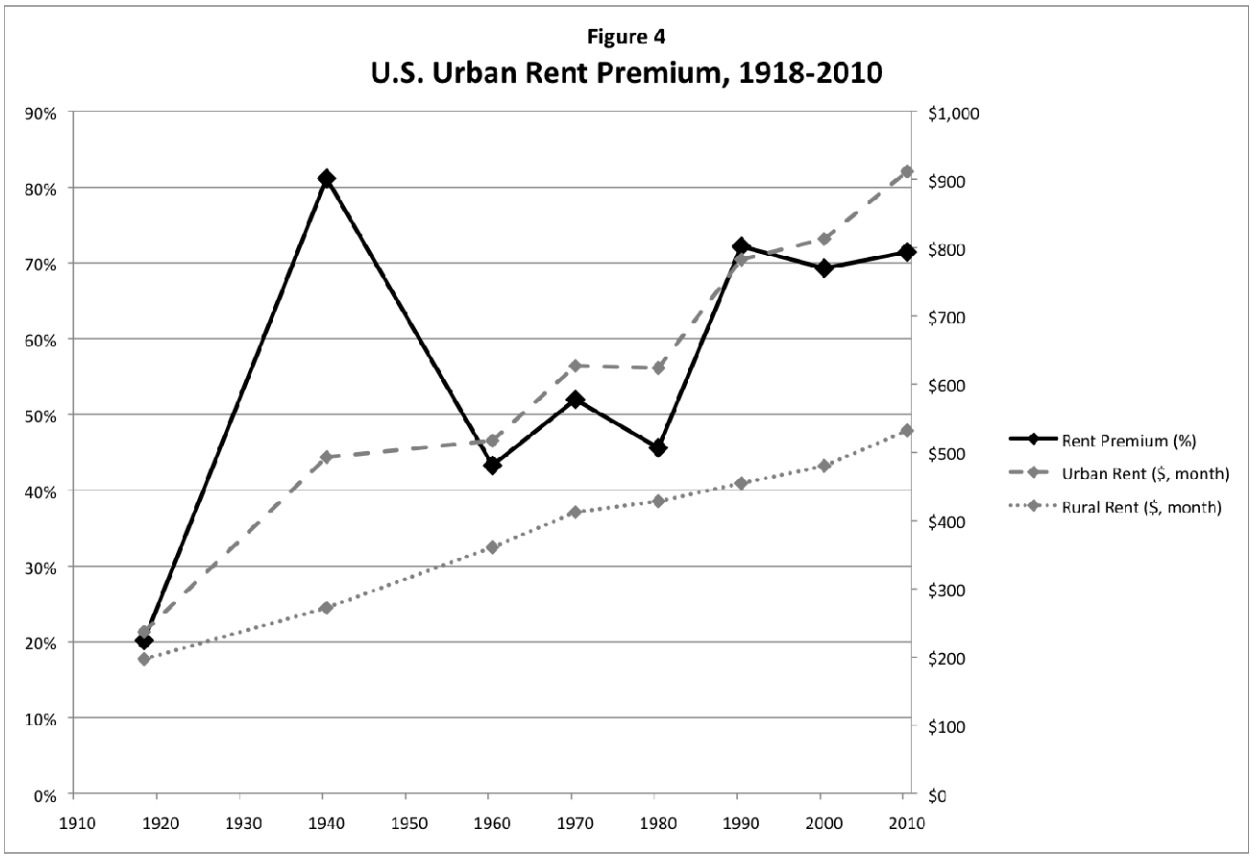

Figure 4: All dollar figures for the period 1913 to 2010 are inflation-adjusted to 2010 values using the urban consumer price index from the BLS; David and Solar's (1977) historical cost of living estimates are used for years prior to 1913. The value for 1918 was calculated using data from the Bureau of Labor Statistics, and represents the premium nationally for households of industrial workers living in cities with populations above the 70th percentile compared with like workers living in cities with populations below the 30th percentile (US Department of Labor, 1986). The values for 1940-2010 were calculated using data from IPUMS, and represent the premium nationally for non-farm households headed by working age men in metropolitan areas.

Figure 5: City and suburban population growth by decade, 1940–2000

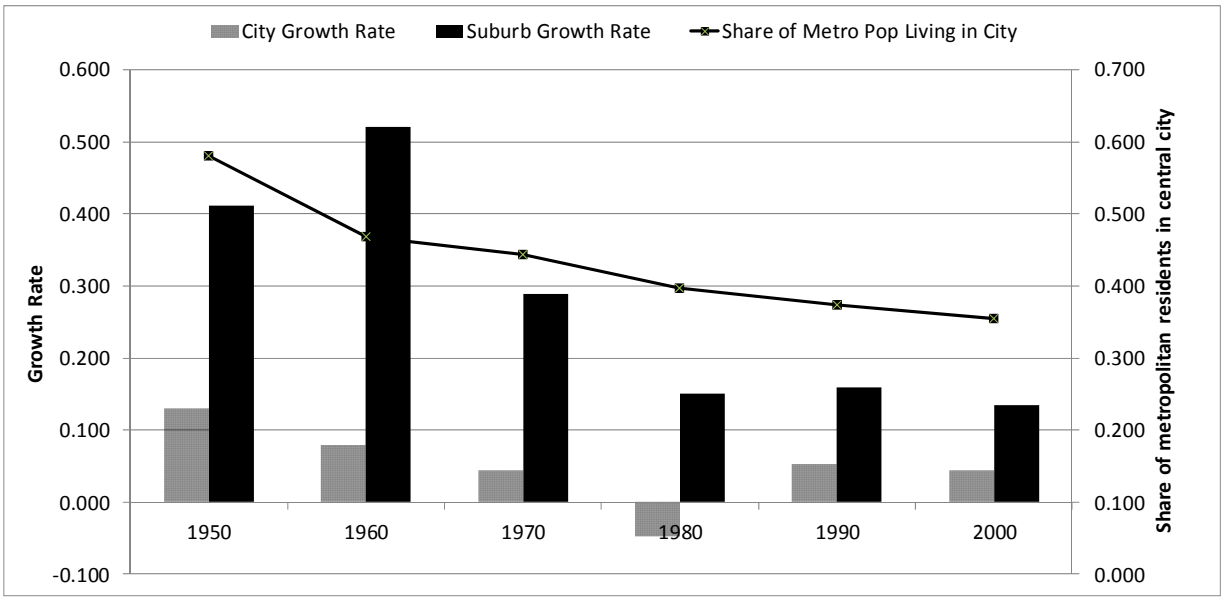

Figure 5: Source is Boustan and Shertzer (2013). Values refer to the decade ending in the census year on the *x*-axis. Sample includes 103 metropolitan areas anchored by a city that had at least 50,000 residents in 1970. City and county population are taken from the City and County Data Books. The 1970 county definitions of metropolitan areas are applied in all years. Suburban population is computed as the total metropolitan area population minus the city population.