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Abstract

This article reviews recent literature using insights from history to answer central questions in urban economics. This area of research has seen rapid growth in the past decade, thanks to new technologies that have made available increasingly rich data stretching far back in time. The focus is to review innovative methods to exploit historical information and discuss applications of these data that provide new insights into (i) the long run growth of cities or regional economies and (ii) the spatial organization of economic activities within cities. The review also surveys the growing literature outside urban economics that uses the historical urbanization as a proxy for economic growth, discusses differences between how economic historians and urban economists think about the relationship between urbanization and growth, and considers how these views might be reconciled.

JEL Classification: R00, N7, N9

Keywords: Urban Economics, economic history, Urbanization, growth, Review

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History and Urban Economics*

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September 15, 2020

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1 Why turn to history?

The past decade has seen rapid growth in studies using historical data to address some of the central questions in urban economics. The left panel of Figure I illustrates this phenomenon. The columns in this figure show the count of papers with a historical theme published in three leading urban economics journals, the *Journal of Urban Economics*, *Regional Science and Urban Economics*, and the *Journal of Economic Geography*.[1] The line plots the number of papers across all economics journals (using the EconLit database) that list one of the economic history JEL codes with topics related to urban or regional economics (starting with N9). Both series show an increase in papers at the intersection of urban economics and economic history starting from about 2010, relative to the previous decade.[2]

As a second approach to tracking this development, we pick one prominent dataset on the development of cities, Paul Bairoch's data on urban populations in Europe and the world from the year 800 on, and track its use over the past few years.[3] Studies relying on Bairoch's data are only a small subset of work at the intersection of urban economics and economic history, but they are easy to identify and provide further insight into research on urban development over time. The right panel of Figure I shows citations of the "Bairoch data" in economics articles.[4] The datasets for Europe and the world (Bairoch *et al.* , 1988; Bairoch, 1988) have been cited 172 times over this period. Most of these citations reflect papers using the data. The graph shows a steady increase of citations over the past few years. Closer inspection of the citations provides additional insight into who is interested in urbanization. Out of a total of 172 citations in economics journals between 1992 and 2016, the "top five" journals in economics cited Bairoch 23 times and another 21 citations come from other highly ranked general interest journals.[5] Economic history journals cited Bairoch 38 times closely followed by 37 citations from urban economics journals.[6] Finally, there are 23 citations in development and growth journals.[7]

Motivated by the increase in research at the intersection of urban economics and economic history documented in Figure I, this article aims to provide an overview of key research trends in this area. A natural first question, then, is why has this recent increase

[1] Specifically, this is the number of papers with at least one economic history JEL code (starting with N).

[2] At this point, it is hard to interpret the drop we observe in the last two years. It may either be a general trend decline driven by an increasing interest in big data that are typically not available for the past or it may indicate that the low-hanging fruit (e.g. archival records that can easily be digitized) are picked and we new methods to unlock additional historical information.

[3] See (Bairoch, 1988; Bairoch *et al.* , 1988).

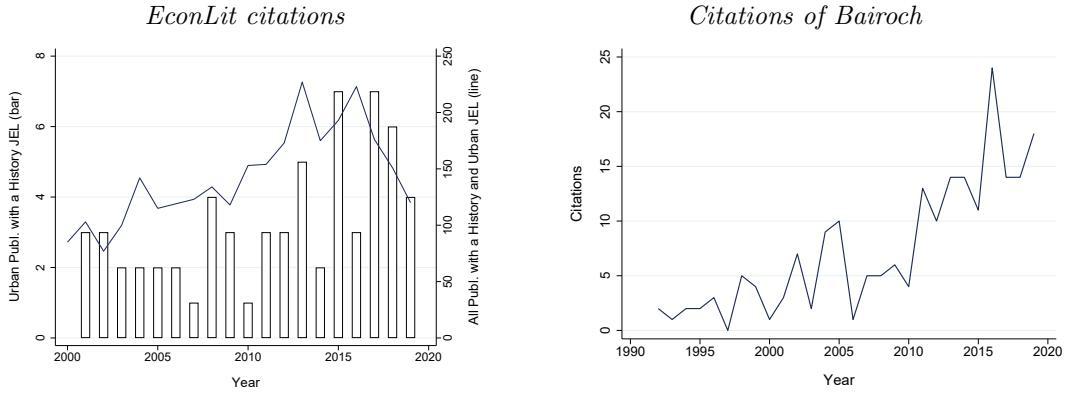
[4] We use the definition of "article" and "Economics" from the Web of Science.

[5] Among the top five, we observe QJE: 11; AER: 6; JPE: 3, ReStud: 3. Other top general interest journals include EJ, JEEA, AEJ, and ReStat.

[6] For history, we consider citations in JEH, EHR, EEH, EREH and for urban economics JUE, RSUE, JRS, JoEG

[7] This includes JDE, JEG, WD, JCE, WBER, RED.

Figure I: Tracking the growth of historical papers dealing with urban economics topics



Notes: The left panel plots, in columns, the number of publications in the urban journals JUE, JoEG and RSUE with a history JEL code (starting with N)) and, in the line, the overall number of publications in all economics journals with urban and history JEL codes (starting with N9). The right panel of the figure plots the number of citations of "Bairoch 1988" or "Bairoch et al. 1988", the sources of Bairoch's city growth data, in English-speaking economics journal publications. *Source*: EconLit and Web of Science database.

in urban-history research occurred? This trend is undoubtedly related to the increasing availability of historical data as digitization methods and computing technologies advance (Mitchener, 2015). Until recently, the advantages of using historical data to study cities have been balanced by the constraints imposed by data availability. However, recent innovations have substantially increased the quantity and quality of data available for studying cities. Given their importance, we begin this article, in Section 2, with a brief review of data sources that help us quantify economic activities in the past and recent methodological advances to make this data usable.

However, there is more to the rise of historical themes in urban economics than data availability. While there have been amazing advances in the availability of incredibly detailed and high-frequency data in modern settings, from cellular phones, taxis, web reviews, and other sources, many of the core questions of urban economics deal with forces that play out over long periods of time. For these questions, taking advantage of historical data offers insights into urban economic processes that cannot be obtained from modern data alone.

For example, one question at the heart of urban economics is, why do cities exist? Urban theory suggests that exogenous location factors (first nature geography) together with endogenous agglomeration and congestion forces (second nature geography) explain observed differences in productivity and amenities. Yet these factors often play out over many years, decades, or even centuries. First nature advantages, such as those offered by

the portage sites studied by Bleakley & Lin (2012) or the sources of water power highlighted by Crafts & Wolf (2014), change slowly over time as technology advances.

Similarly, the urban built environment, and the infrastructure that connects cities, evolves slowly. Large scale infrastructure projects, such as the rail network studied by (Heblich *et al.* , 2020b), take years or decades to construct: Rome wasn't built in a day. And once constructed, these enormous infrastructure investments depreciate slowly (Glaeser & Gyourko, 2005). Historical buildings, bridges, sewer systems, and the layout of railway tracks or roads are often testimonials of the distant past. This makes it particularly difficult to trace the factors that contribute to city dynamics using short-run data. Thus, while short-run or cross-sectional data can shed light on processes that determine the existence of cities, much more can be learned through the use of long-run historical data that explain path-dependencies.

A third reason why we might have to reach deep into the past is that some important economic changes occur only infrequently. One recent example is the 2008 housing bubble. Glaeser (2013) goes back in U.S. history to trace precedents and points out an optimistic assessment of future price growth and the neglect of long-run elastic supply as important similarity. Detecting such regularities is an important starting point for the design of public policies. In a similar vein, catastrophic events like major earthquakes or urban fires that destroy large parts of a city are luckily rare events (Belloc *et al.* , 2016; Hornbeck & Keniston, 2017). Nevertheless, they occur and studying them provides important insights into the importance of location factors and the dynamice underlying the subsequent readjustment.

Beyond the fact that many urban processes play out over long time scales, studying urban economies through the lens of history also offers features that can help us identify causal economic connections. By looking back in time we expand the types of variation that can be harnessed. History offers a range of natural experiments that can help us identify key features of urban economies. As pointed out by Holmes (2010), controlled experiments are often not viable in an urban or regional context (in his words "Good luck to the researcher trying to get a National Science Foundation grant to run a controlled experiment to set up a new city!", p.14) which is why we rely on quasi-experimental variation to identify key relationships. In the following sections we review papers drawing on natural experiments as diverse as the bombing of Japan during the Second World War, the fall of the Roman Empire, the construction of the U.S. highway system, and the division and reunification of Germany. Each of these events provide a unique window into the working of urban economies. Drawing on history also allows us to study cities across a broader range of institutional and technological environments. As an example, in Section 3 we review a set of recent studies suggesting that the impact of location fundamentals on city formation evolves as technology changes.

Another identification advantage offered by some historical settings is that there are

fewer interdependencies between separate economic units, which can make mechanisms more easily observable. To cite one example, Steinwender (2018) studies the impact of the first trans-Atlantic telegraph cable on trade between the U.S. and Britain.[8] Here, history offers a setting where information flows can be isolated in a way that would be difficult in a more modern and interconnected economy. A similar argument applies to regulations that were often absent or less developed in the past, thus allowing researchers to focus on the underlying economic mechanism.

Of course, identification advantages arising either from the availability of a natural experiment or from a unique institutional context also come with limitations. Most importantly, we should be vigilant in assessing the generalizability of the results and, in particular, the extent to which lessons can be applied to current policy debates. Another word of caution is also required. While we believe that history holds many insights that contribute to our understanding of spatial distributions today, harnessing the past successfully requires a careful understanding of historical circumstances. Knowledge about contextual factors like the socio-economic environment, political institutions, available technologies, etc. is the key to working out sources of exogenous variation.

Finally, recent research has highlighted the potential for historical work on urban and regional economies to inform our understanding of economic growth. At least since Adam Smith's inquiry into the nature and causes of the Wealth of Nations, economists have sought to uncover the factors that drive differences in development. A natural starting point for doing so is a comparison across countries, but one quickly realizes that countries vary so dramatically in their features, from city-states like Singapore and Monaco to the enormous expanses of Canada and Russia, that they may not be the most relevant unit at which to analyze economic growth. Moreover, the borders of countries change over time, sometimes for largely arbitrary regions. Often a more relevant unit to study is the city or region, and since the study of growth naturally requires looking over larger times scales, this inevitably leads to the use of historical data. This is a topic that we explore in Section 5.

In the next section of this paper, we review recent methodological advances in the use of historical data to address urban economics questions. The next two sections then review the major stands of recent research in this area. In Section 3, we take a *between*-city perspective where we attempt to understand the historical origins of why cities grow and develop, how they interact and why they differ in size and perform different activities. This includes a review of work on agglomeration forces, city amenities, or transportation links between cities and regions. Then, in Section 4, we narrow our focus on look *within* cities. Specifically, we turn our attention to the spatial distribution of people and economic activities within cities and examine how this distribution is affected by factors such as new transport technologies,

[8] In a similar vein, Koudijs (2015) studies how variation in sailing conditions affected the financial markets in London and Amsterdam in the 18th century.

health infrastructure, local amenities and urban policies. Finally, Section 5 discusses the use of urban data to understand long-run patterns of economic growth.

Overall, our review reveals a vibrant literature using history to understand cities. While recent methodological advances have led to a rapid growth in work in this area, many interesting questions, particularly those related to long-run processes, remain to be explored.

2 Innovations in historical research

One important challenge in harnessing the past in order to improve our understanding of urban economies is the availability of data. However, recent advances in computing technology and creativity in the use of new applications and data sources have opened up a digital window to the past. This section briefly introduces important sources for historical data along with approaches to make these data usable for research.

We first look at ways to digitize historical data from official statistics and other historical sources that are available in print. Next, we turn from text to images and discuss ways to unlock the information that is included in historical maps. Statistics and maps present the most reliable sources of spatial information about the past. In the absence of such detailed insight, there are other ways to look back in time. One approach is to focus on location features that are observed today but likely did not change much over time. Such factors can *predict* historical outcomes and thus provide useful covariates for historical studies. Another way to predict historical outcomes and complete the picture is to use economic modeling. A rising amount of research combines observed historical data with structural models that solve for unobserved parameters and allow researchers to evaluate actual outcomes relative to counterfactual development paths.

2.1 Historical statistics

Archives are one way to open the door to the past. Probably the most comprehensive source of historical data with a spatial dimension are printed publications of official statistics such as censuses, birth and death records, trade registers, patent records, immigration lists, or tax records. More and more of these data have been digitized over the last few years thanks to national archives and libraries, genealogy platforms, or large-scale academic projects.

A central challenge in using archival data is that historical records are in many cases not already digitized. Two approaches to digitization have emerged over the past years. One relies on automated optical character recognition (OCR) programs that may embed elements of machine learning. The accuracy of this approach depends on the quality of the original printing as well as the scans. In particular, historic documents often present a challenge for OCR methods because (i) the quality of the original records is low, (ii) the

historical typesetting process was not automated and thus noisy, and (iii) characters and fonts differ. Hand-written documents present an additional layer of complexity.

An alternative way to digitize data from printed documents is to outsource this process to specialized service providers who rely on manual labor and some automation. The use of outsourcing companies, principally in developing countries, has dramatically reduced the cost of digitizing data over the past decade. The main limitations to this approach are historic records that are hand-written or printed in font styles (e.g. gothic or fraktur) that are hard to recognize by laymen. A less expensive and viable way to digitize non-standard records are crowdsourcing projects. For example, the British Library developed the platform *LibCrowds* that allows users to help digitize records. Similarly the German Society for Computer Genealogy developed a tool to administer the digitization of casualty lists from the First World War (Zedlitz, 2017).

Information from official statistics can be combined with other historical data sources like the the *Encyclopedia Judaica* and the *Germania Judaica* which document the historical location of Jewish communities across German cities (see for example Becker & Pascali, 2019; Johnson & Koyama, 2017; Voigtländer & Voth, 2012, for details). One way to combine datasets is to assign them to common spatial units like counties or parishes which are mapped. Linking these units over time is, however, often complicated by changes in the geographic boundaries of spatial units. One way to overcome this is to fix boundaries in one reference year and disaggregate units in other years into these boundaries using area weights (Eckert *et al.* , 2020). If one is concerned that area weights do not adequately represent the spatial distribution of individuals or activities in space, one could aggregate units using a transitive closure algorithm (Kitson *et al.* , 2012) or specify alternative weights. But what weights can we use? If administrative data come with address information, one could use the approach in Heblich *et al.* (2016) to geolocate addresses and create population-adjusted weights. The approach combines fuzzy text matching with an algorithm that exploits the spatial clustering of entries in enumeration books to infer the location of unmatched addresses in historical UK censuses.[9]

Some data sources are not organized in administrative boundaries but include geographic information in the text. In this case, methods from computational linguistics can help researchers to extract information from texts. For example, Perlman (2015) and Packalen & Bhattacharya (2015) apply automated text analysis to historic U.S. patents which allows them to document the movement of idea-use over time and space. Dittmar & Seabold (2020) go one step further. They build on work by Gentzkow & Shapiro (2010) to measure changes in the language of historical book titles. In this way, they track the dissemination of new religious ideas across German-speaking Europe between 1454 and 1600.

[9]Another promising way to exploit the systematic nature of enumeration books is to measure the social composition of neighborhoods (Logan & Parman, 2017; Shertzer *et al.* , 2018).

An alternative to joining data at a spatial level is to employ computationally more demanding matching methods that link individual names between censuses and registers or across census waves. An early application is Abramitzky *et al.* (2012) who used fuzzy name matching algorithms to identify distinctive immigrant names in U.S. censuses; in another application, Dippel & Heblich (2020) link civil war rosters and immigrant ship lists to U.S. census data and Heblich *et al.* (2020a) follow individuals in the English and Welsh census between the years 1851–1911. For a more detailed discussion of name matching techniques, we refer the interested reader to recent reviews by Abramitzky *et al.* (2020) and Bailey *et al.* (2020).

2.2 Maps

Historical maps present another great source to learn about the past. Maps often contain spatial information about historical features such as political or cultural borders, neighborhoods and building footprints, land cover, infrastructure, etc. Similar to historical texts or statistics, maps are becoming increasingly available thanks to the digitization efforts of archives and libraries. However, scanned maps still require substantial digital processing before the spatial information they contain can be analyzed. Moreover, relative to scanned texts or tables, maps (and especially historical maps) present even more complex challenges to automated pattern recognition methods, owing to the mix of symbols, lines and area objects used to portray geographic information. As a result, researchers often have to rely on time-consuming manual digitization.

A common use of historical maps in economic research is to identify transportation infrastructure (Bogart *et al.* , 2015; Donaldson, 2018; Duranton & Turner, 2011; Hornung, 2015), boundaries (Becker *et al.* , 2016; Dell, 2010; Michalopoulos & Papaioannou, 2013; Wahl, 2017), bilateral distances (Becker & Woessmann, 2009; Dittmar, 2011b), or trade activities (Wahl, 2016). One complication for these approaches is that historical maps often lack precision. This can be critical, e.g., for projects that study discontinuities along boundaries. To overcome this, Sequeira *et al.* (2020) overlay an accurate modern shapefile of the railway infrastructure over scanned and georeferenced versions of the historical maps and trim the modern railway network to match the historical map. If significant changes render this procedure unworkable, an alternative is to glean historic texts for information that improves the precision. For example, historic texts might mention towns or landmarks along historic roads that still exist today and thus serve as anchor points.

Once digitized, historical maps can provide a wealth of information. One common use of map data is to reconstruct the structure of cities and neighborhoods in the past. Examples include Ahlfeldt & McMillen (2018) who use printed maps from *Olcott's Blue Books of Chicago* to derive detailed land value estimates for buildings in Chicago; Hornbeck & Keniston (2017) who assembled plot-level data for Boston between 1867 and 1894; and

Redding & Sturm (2016) who digitized bomb damage maps that recorded World War II destruction in London at the level of individual houses.

2.3 Time invariant factors

One way researchers compensate for a lack of controls that might explain the spatial distribution of economic activity is to use modern data describing features that are time-invariant (or change very slowly over time) in order to infer historical conditions. For example, Combes *et al.* (2011) discuss the use of plausibly time-invariant geological characteristics from the European Soil Database to explain the emergence of population concentrations. The underlying logic is that geology and the nature of soils were an important predictor of past settlement patterns and have changed little over time. Bosker *et al.* (2013) take this one step further. To measure the importance of geography, they determine the agricultural productivity of cities' hinterland using a combination of time-invariant soil and terrain characteristics and climate conditions.

Time invariant location factors may be used in balance tests that assess the instrument validity or they may be interacted with year indicators in panel regressions where historical records inform the researcher about the time when the location factor gained importance. A canonical example of such a difference-in-differences strategy is Nunn & Qian (2011), which combines historical knowledge about the timing of the arrival of the potato to Europe with modern data on the spatial variation in local suitability for potato cultivation.

Another group of time-invariant factors that have been productively used in economic research are genetic markers and linguistic traits. Genetic databases as well as detailed language and dialect surveys provide spatial variations which are employed to predict cultural borders in space that limit integration or migration. The underlying idea is that differences in cultural traits explain spatial disparities in economic development, possibly through better functioning institutions (see Tabellini, 2010).[10] Early papers that used genetic markers to predict cultural borders across space include Spolaore & Wacziarg (2009) or Guiso *et al.* (2009). Falck *et al.* (2012) introduce an alternative measure to predict cultural boarders. They exploit linguistic micro-data from a unique language survey conducted around 1880 in German schools to derive a measure of cultural similarity between German regions.

2.4 Predicting outcomes

Historical conditions can also be inferred with the help of models from outside of economics, such as transportation, engineering or atmospheric models, that predict conditions in the past. One illustrative example is Pascali (2017), who simulates the routes of sailboats

[10] Nunn (2014) and Alesina & Giuliano (2015) review the growing body of literature on institutions, culture and long-run economic growth.

to understand how the introduction of steamships changed trade patterns. To calculate bilateral sailing times between country pairs, the paper divides the world into grid squares and determines for all sea-cells the average velocity, direction of sea-surface winds and ocean current. Knowing that these factors determined the sailing routes, one can predict least-cost paths for sailing vessel between country pairs and compare them with, e.g., entries from logbooks. In a similar vein, Feyrer & Sacerdote (2009) use wind patterns to identify islands near prevailing sailing routes to show that they were more easily revisited and colonized.

Historical travel routes on land can be predicted with the help of engineering rules. Bogart *et al.* (2019) use insights into nineteenth-century railway construction to calculate least-cost paths. Voigtländer & Voth (2014) and Faber (2014) use a similar approach to calculate least-cost paths for roads. Information on historical travel speeds in combination with transportation networks further provides a way to predict historical transportation costs (Donaldson & Hornbeck, 2016; Donaldson, 2018; Heblich *et al.* , 2020b).

A somewhat different example is provided by Heblich *et al.* (2016), who model the dissemination of coal smoke from georeferenced industrial chimneys in 19th century England in order to predict neighborhood pollution exposure. This study combines recent data on meteorological conditions and terrain with historical information on height, exit velocity, and combustion temperature obtained from historic documents to predict pollution dissemination patterns.

Lastly, Flückiger *et al.* (2019) make creative use of archaeological data from excavated Roman ceramics which name the production location. Combined with precise information on the location of archaeological excavation sites, this enables them to predict interregional trade volumes within Western Europe during the Roman era and they show that connectivity differentials observed in the past continue to influence cross-regional firm investment behavior until today.

2.5 Structural models

A growing strand of research now combines historical data and modeling to rationalize observed outcomes. The latest generation of quantitative spatial models are sufficiently rich to incorporate a large number of heterogeneous, interconnected locations and rationalize them as an equilibrium of the model. If a unique equilibrium is identified and the structural fundamentals are stable and invariant to interventions, this framework will enable researchers to quantify key theoretical mechanisms, evaluate policy interventions and simulate counterfactual outcomes. An illustrative example of this approach is Nagy (2020) who combines novel historical data for the U.S. on population, trading routes and agricultural productivity at a high spatial resolution with a dynamic quantitative model of economic geography to show that the availability of farm hinterlands fostered urbanization and aggregate growth. The model captures key patterns of U.S. urbanization and city formation

and counterfactual analysis help quantify the effect of geography on cities and growth.

Another recent paper illustrates how the creative use of economic modeling can help us draw a more complete picture from quantitatively observable fragments of the past. Assyrian merchants used clay tablets to record their shipment consignments, expenses, and contracts. Excavated samples that were translated provide insights into merchants' trade networks during the Bronze Age. Barjamovic *et al.* (2019) build on these data and combine them with a structural gravity model of trade. Based on the model, they predict the locations of yet undiscovered cities, some of which overlap with historians' conjectures. Future excavations will tell us about the validity of these predictions.

A more detailed review of this growing strand of literature goes beyond this brief overview. Instead, we refer the interested reader to a review on Quantitative Spatial Economics by Redding & Rossi-Hansberg (2017).

3 Long-run studies of cities and regions

One of the more fertile areas of urban economics research over the past two decades has been the use of historical data to study the factors affecting the distribution of population across space and, in particular, the existence of cities. This strand of research is well integrated in a broader research agenda on the importance of history for economic development as reviewed by Nunn (2014). Studies in this area address classic urban economics questions, such as the size and type of cities, agglomeration benefits, the importance of locational advantages, and the impact of place-based policies. Yet new lines of work are also building bridges between urban economics and other areas of study, including international trade, education and human capital, and structural change.

Many of the papers described in this section are, in one way or another, related to two classic urban questions. Why do cities exist? What causes them to grow or decline? Among the answers considered by the papers reviewed below are locational fundamentals, productivity advantages, amenities or disamenities, trade and market access, education and information technology, and structural transformation. These answers, in turn, can inform other questions, such as whether cities are too large or too small, which we discuss at the end of the section.

3.1 Locational fundamentals

One influential line of research in this area draws on historical natural experiments to inform the theoretical debate over the fundamental drivers of city growth. A starting point for this literature is Davis & Weinstein (2002), which used the U.S. bombing of Japanese cities during the Second World War to study whether large temporary shocks have a long-run impact on city size. Surprisingly, they found that, despite the severity of the bomb damage,

Japanese cities fully rebounded within a few decades. This result suggests that locational fundamentals play a key role in shaping the distribution of economic activity across space, while their results run counter to models of random growth (Gabaix, 1999) or those featuring multiple equilibrium city locations (Krugman, 1991).[11]

A second seminal paper in this literature, Bleakley & Lin (2012), studies cities in the U.S. that were located on portage sites. Historically these were important trading locations, but their natural advantages became irrelevant as river shipping declined in importance.[12] Yet Bleakley and Lin show that these portage sites remained important urban centers many decades after the value of their initial natural advantage disappeared.[13] These result suggests that there must be important factors other than locational fundamentals generating the spatial distribution of economic activity that we observe.

The strikingly different results found in the two seminal papers described above have motivated a growing body of follow-on research. Recent studies have taken several approaches to making progress in this area. One approach focuses on building up evidence from a variety of different empirical settings. Hanlon (2017), for example, looks at the impact of a large economic shock to British cities that were heavily reliant on cotton textile production resulting from the U.S. Civil War, which sharply reduced cotton supplies. This paper provides evidence that the temporary shock had a persistent impact on city size.

Persistent effects of a temporary relocation of population are also documented by Schumann (2014), which studies the resettlement of Germans after the Second World War who were expelled from land controlled by Germany prior to the war.[14] This study uses an RD approach that takes advantage of the fact that resettlement was generally not allowed in the part of Germany occupied by France after the war. The results show that the differences in population generated by the resettlement were quite persistent.[15]

Comparing the settings considered by Hanlon (2017) and Schumann (2014) to the Japanese cities studied by Davis & Weinstein (2002) offers a potential explanation for

[11]The basic approach introduced by Davis & Weinstein (2002) has been applied to German cities by Brakman *et al.* (2004), Bosker *et al.* (2007), and Bosker *et al.* (2008) with mixed results. Another related paper, Miguel & Roland (2011), looks at whether the bombing during the Vietnam War had persistent impacts on outcomes such as the local poverty rate, consumption levels, literacy, etc. They find no evidence of persistent effects.

[12]The location and purpose of cities was typically determined by defense considerations (Dincecco & Onorato, 2016; Glaeser & Shapiro, 2002) or their commercial capabilities (Bakker *et al.* , 2020; Michaels & Rauch, 2018; Acemoglu *et al.* , 2005).

[13]Using data on colonial railroads in Kenya, Jedwab *et al.* (2017) show that temporary advantages related to railroad access can generate population agglomerations that persist, even after many of the benefits of such access have disappeared. Maloney & Valencia Caicedo (2016) present a similar finding for the Americas.

[14]Other recent papers that look at the economic effects of the inflow of expellees in Germany include Braun & Kvasnicka (2014), Braun & Omar Mahmoud (2014), Burchardi & Hassan (2013), or Peters (2019).

[15]Sarvimäki (2012) presents similar results for the forced relocation of 11 percent of the Finnish population after Finland ceded its eastern parts to the Soviet Union. The exogenous increase in the local labor force had a positive effect on later population growth, industrialization and wages.

why these two studies find results that differ from those obtained by Davis & Weinstein (2002). In Hanlon (2017), the cities affected by the shock were surrounded by many other geographically-similar nearby locations where unemployed workers could move. Similarly, Schumann highlights the fact that the border used in his RD setting runs through territory that is fairly homogeneous in terms of topography and climate. In contrast, Japan's more extreme mountainous geography may have limited the set of alternative locations. This suggests that locational fundamentals may be key when differences across locations are large, but other factors will dominate as locations become more similar.

Two other papers falling into this literature look at the impact of shocks associated with plague outbreaks on cities. Bosker *et al.* (2008) looks at the impact of plagues outbreaks on the size of Italian cities. Jedwab *et al.* (2020) looks at the short and the long-run impact of a plague outbreak across European cities. They find that cities recovered their pre-plague population over two centuries, a much slower response than the one found by Davis and Weinstein in Japan. They also provide evidence that the recovery from the Black Death was heterogeneous, with cities in more advantageous locations recovering more rapidly. This heterogeneous recovery links to work by Michaels & Rauch (2018) which we will discuss later.

Bosker & Buringh (2017) add another perspective by highlighting that the success of a city not only depends on a location's own fundamentals but also on the distribution of fundamentals in the surrounding region. Comparing 250,000 randomly drawn potential city locations to actual European city locations over the period between 800–1800, they find geography to be the dominant factor underlying city location choices. Second nature geography effects are less relevant but follow the regularity of so called market potential curves that assign to every location in a given distance from an existing city the likelihood to become a city as well (Fujita & Mori, 1996).

Historical studies also have the potential to help us understand how the impact of locational fundamentals on city growth changes over time as new technologies are introduced. A seminal paper in this area is Nunn & Qian (2011), which shows that the introduction of the potato to Europe had a substantial effect on city growth. To gain identification, they interact the timing of the arrival of the potato with measures of local agricultural suitability for the crop based on climatological features.[16] This identification strategy is now being applied in a variety of similar studies. Two other similar studies in this area focus on issues of central importance to economic historians. Crafts & Wolf (2014) look at the factors that drove the spatial distribution of the cotton textile industry in Britain, while Fernihough & O'Rourke (2014) study the impact of coal reserves on economic growth in Europe during the Industrial Revolution.[17] Another paper in this area is Brooks *et al.* (2016), which looks

[16] In a similar vein, Chen & Kung (2016) study the adoption of maize in China from 1600 to 1910.

[17] Also see Ploeckl (2012), which looks at the impact of locational advantages on the spatial distribution of population in Saxony in the 19th century.

at how the introduction of containerized shipping affected economies near ports depending on whether geographic factors made the port well-suited for handling large container ships. They find that ports with geographic features that accommodated large ships experienced increases in population and employment following the introduction of containerization. All of these studies show that locational fundamentals matter, but that their importance is also determined by the technologies available at any point in time. This raises questions about the extent to which churning in city size or regional economic development can be explained by the interaction of locational fundamentals and new technologies. This is likely to be a fruitful area for future research.

An innovative paper by Michaels & Rauch (2018) pushes our understanding of locational fundamentals forward, by asking whether urban systems can be locked into patterns that are sub-optimal as technologies change. They focus on a comparison of the urban systems in Britain and France from 117-2012. They argue that the collapse of the Western Roman Empire by 410 CE led to the collapse of the urban system in Britain, while the urban system remained largely intact in France. In addition, they note that the Romans tended to rely on road transport, while access to water transport became much more important later. Using this variation, they show that after the re-establishment of urban centers in Britain, the location of British cities tended to be further from the earlier Roman cities, compared to the pattern observed in France, and closer to advantageous geographic features such as seaports. Thus, they argue that path dependence trapped French cities in less advantageous positions. This study opens a new range of interesting questions in urban economics, but it remains to be seen whether additional settings can be found that allow these issues to be investigated further.

3.2 Productivity effects of agglomeration

Results from papers such as Bleakley & Lin (2012) suggest that, while fixed locational features are important, other agglomeration benefits also matter. One potential source of these other agglomeration forces are productivity advantages related to city size or the clustering of particular industries. Next, we review papers using history to look at the productivity effects of agglomeration. In reviewing this literature, it is important to note that the approach used in long-run papers looking for productivity effects differs from that used in short-run papers with modern data. In particular, in historical data, direct measures of wages or firm productivity, which may be the outcome of interest in papers using modern data, are generally unavailable. To overcome this challenge, historical papers often look at employment or city size as the outcome of interest. The use of either wages or population/employment as a measure of agglomeration forces relies on similar theoretical foundations. However, one important difference between these approaches is that estimates obtained using population or employment as the outcome of interest end up being denominated in terms of jobs or

population, rather than in value, which can make them more difficult to compare across different contexts.

Following up on their 2002 study, Davis & Weinstein (2008) considers the impact of the bombing of Japanese cities at the level of city-industries. They find no evidence that Second World War bombing reallocated industries across locations. In contrast, Redding *et al.* (2011) show that the division of Germany did have a permanent effect on the location of the main German airport, even after reunification. Even more focused studies are provided by Buenstorf & Klepper (2009) and Buenstorf & Klepper (2010), which study the cluster of tire manufacturers in Akron, Ohio; Cabral *et al.* (2018), which studies the development of the early auto industry; and Klepper (2010), which looks at clustering among automakers in Detroit and semi-conductor manufacturers in Silicon Valley. A slightly different approach is taken by Borowiecki (2013), who focuses on a specific group of individuals, European classical composers in the late 18th and 19th centuries, and estimates the impact of proximity to other composers on their productivity. Being located in a contemporaneous cluster of composers has a pronounced effect on individual productivity, but historical cluster locations or large cities in general have no effect, suggesting that second nature geography is the driving agglomeration force. In a similar vein, Mitchell (2019) finds that prominent authors born in the UK and Ireland in 18th and 19th centuries experience huge productivity increases when they were residing in London, the only major literary cluster. These very detailed studies provide evidence that can be used to inform our broader understanding of agglomeration economies.

The focus on industry-level outcomes connects to a classic line of work in urban economics which compares city-industry growth over several decades to initial city features, such as industry concentration or diversity (Glaeser *et al.* (1992), Henderson *et al.* (1995)). While innovative at the time of publication, these papers were constrained by limitations on the availability of historical data on city-industry employment or output. However, new datasets tracking city-industry employment over long periods are increasingly available, allowing a richer analysis. In the U.S., data from the County Business Patterns going back to 1957 have been digitized by Duranton *et al.* (2014) while data from the U.S. Census covering an even longer period has been digitized by Lee (2015) and Klein & Crafts (2020). Recently, Hornbeck & Rotemberg (2019) digitized the U.S. Census of Manufactures for the years 1860, 1870, and 1880 as a source of county-by-industry variation. In the U.K., Hanlon & Miscio (2017) digitize consistent data on city-industry employment for 1851-1911. These data are then used to look at how the composition of industries in a city affects city-industry growth. They find that industries grow more rapidly when they have more local suppliers or other industries using occupationally similar workforces, while they find no evidence that industries grow more rapidly in locations in which are initially large. This suggests that cross-industry (Jacobs) spillovers are likely to be more important than within-industry

(MAR) spillovers.

Another interesting paper in this area is Severnini (2014), which looks at the long-run impact of hydroelectric power on local economic activity. Crucial for his identification strategy is the fact that prior to the 1950s transmitting power across longer distances was expensive, so dams provided a location-specific advantage, while the introduction of high-voltage transmission cables after 1950 eliminated these advantages. The paper finds that access to early, but not late, hydroelectric dams had both short and long-term effects on local population and employment growth. In a related paper, Lewis & Severnini (2020) find that the expansion of the U.S. electric grid into rural areas increased agricultural employment, but that this crowded out non-agricultural work.

Geographic concentration may also come with countervailing costs as firms compete for scarce local inputs. The effect of increased local agglomeration on incumbent firm performance is thus ambiguous. Falck *et al.* (2013) identify the impact of local firm concentration on incumbent performance in the context of the German machine tool industry after the Second World War. During that time, many firms fled the Soviet-occupied zone to prevent expropriation. In the aftermath of the war, these location decisions were driven by non-economic factors and thus quasi-random. The paper finds that relocating firms increased the likelihood of incumbent failure in destination regions because they increase competition for labor.

One reason to care about how agglomeration affects productivity is that these effects have implications for the use of place-based policies. Place based policies are widely used and can be very costly, but evidence on their efficacy remains somewhat sparse. An important recent paper that speaks directly to this issue using historical data is Kline & Moretti (2013). They study the impact of a very large local development policy, the Tennessee Valley Authority (TVA) project. This project, which began in the 1930s, peaked in the 1950s, and effectively ended in the 1960s, involved investments such as new dams, roads, and canals, in several U.S. states. Taking advantage of the spatial and temporal variation offered by this project, Kline & Moretti provide evidence that these investments had a long-run impact on manufacturing employment but not on agriculture, a pattern that can be explained by the presence of agglomeration economies in manufacturing. In addition, they use a structural model to assess the aggregate impact of the program, which they find to have net positive effects on national manufacturing productivity.

Ehrlich & Seidel (2018) looks a temporary place-based subsidies for the West German regions that were located along the inner-German border to compensate firms and households for their loss in market access (see Redding & Sturm, 2008). The paper finds persistent effects on economic density which is attributed to physical infrastructure investments in locational advantages such as industrial parks, roads, power networks, or sewage systems. The benefits of the policy are capitalized in land rents.

Becker *et al.* (2018) study a specific form of a place based policy, the decision to create public sector jobs as an instrument to address employment problems in declining areas. However, these employment effects may be offset if the location of public employment affected private sector activity through wage effects, increasing housing costs and potential productivity and amenity spillovers. The paper exploits the relocation of the (West) German federal government from Berlin to Bonn after the Second World War as exogenous shock to study the effect of public employment on the spatial distribution of private sector activity. As expected, Bonn experienced a substantial increase in total employment and population which was mostly due to the increase in public employment. Private sector employment remained largely unchanged. This is in line with the predictions of a simple economic geography model where public sector employment in a city can crowd out private employment through higher wages and house prices, but also generates potential productivity and amenity spillovers. Further empirical evidence suggests that the results are driven by an increase in amenities in Bonn while productivity in the private sector remained largely unchanged.

3.3 Amenities and disamenities

Another classical urban economics question addressed using historical data is the role of amenities or disamenities in contributing to city growth. On the amenities side, Falck *et al.* (2011) uses history to provide plausibly exogenous variation in the location of baroque opera houses across Germany and shows that these locations attracted high-human-capital workers which in turn has positive growth effects. On disamenities, Hanlon (2020) studies the impact of industrial pollution on city growth using British cities in the 19th and early 20th century, which experienced extreme levels of air pollution. This paper finds that industrial pollution substantially affected the growth of employment and population in British cities during this period. Moreover, most of this effect appears to come through the impact of pollution on the productivity of workers and firms, rather than through impacts on residents' utility.[18]

Another historically important disamenity associated with cities, and one that continues to affect urban areas in developing countries today, is poor sanitation. The impact of sanitation improvements on cities has been the focus of a number of studies at the intersection of urban economics and economic history. We review this literature in Section 4.2.

[18] Other recent contributions on historic pollution effects include Barreca *et al.* (2014); Clay & Troesken (2011); Clay *et al.* (2016).

3.4 Trade and market access

A very active line of research on cities using historical data explores the impact of trade or "market access" on the development of local and regional economies. A transformational paper in this literature was Donaldson (2018), which provided an early indication of the types of rich historical data that could be brought to bear on this topic. Focusing on India, this paper showed how theory and historical data could be combined to measure the local impact of transportation infrastructure improvements. This contributes to a larger literature looking at the impact of railroads or other transportation improvements on the spatial distribution of economic activity.[19] A follow up paper, Donaldson & Hornbeck (2016), provides additional tools for assessing the impact of transportation infrastructure on local economies and applies them to U.S. data from the 19th century. One application of the market access approach that they introduce is provided by Jaworski & Kitchens (2019), who study the impact of the construction of the Appalachian Development Highway System on regional economic development. Another, Morten & Oliveira (2018), looks at the construction of Brazil's the new capital city Brasilia in 1960 which triggered the development of a new highway network that connected the national capital to the existing state capitals. That paper finds a positive effect of the road improvement on both goods markets and labor markets. In an extension, Hornbeck & Rotemberg (2019) use data from the U.S. Census of Manufactures between 1860 and 1880 to show that improved market access from railway expansions benefited manufacturing productivity. A key contribution of their paper is highlighting the importance of the interaction between market access and factor misallocation.

Redding & Sturm (2008) also study the impact of market access on city growth, using the change in market access induced by the division of Germany following the Second World War and the subsequent reunification in 1990. Their results provide strong evidence on the impact of market access on the growth of cities.[20] A recent paper by Johnson & Koyama (2017) suggests that cities in Europe with Jewish communities grew faster than cities without Jewish communities over the period between 1400 and 1850, a result of Jewish communities' ability to exploit increases in market access after 1600.

Another study focused on how transport costs affects cities is Fajgelbaum & Redding (2014), which uses data from Argentina in the 19th century to investigate the interaction of

[19] Atack *et al.* (2010) studies the relationship between urbanization, population density and the coming of the railroad in the U.S. Midwest in the mid-19th century. Berger & Enflo (2017) looks at the impact of railroads on 150 years of urban growth in Sweden. Hornung (2015) undertakes a somewhat similar exercise to Donaldson using data from Prussia in the 19th century. Bogart *et al.* (2015) compares the growth contribution of railways in India and Latin America. Crafts & Mulatu (2006) studies the impact of transportation improvements on the location of industry in Britain in the period before the First World War.

[20] Another interesting historical paper looking at the impact of access to trade on city growth in a very different context is Jia (2014), which studies the development of Chinese treaty ports.

falling international trade costs and internal transportation costs on the spatial distribution of economic activity. Their data show that a reduction in international trade costs led to relative increases in population density in locations with better access to external markets, a pattern that they rationalize with a model in which improvements in market access lead transport hubs to shift away from agriculture toward services and manufacturing, which use land less intensively and therefore allow greater density.

In a somewhat related vein, Nagy (2020) uses historical data, together with a dynamic model of trade, labor mobility, and endogenous growth, to assess the impact of the construction of railroads on the U.S. urban system on economic growth in the 19th century. Longer-run effects of early transport-infrastructure investments that facilitated interregional trade are reported in Flückiger *et al.* (2019) and Dalgaard *et al.* (2018) who study the persistent effects of the Roman road network across Europe. The former argues that trade-links led to cultural integration which facilitates economic interactions today. The latter paper adds an interesting perspective when it shows that the effects only persist in areas where the road infrastructure was permanently used and supplemented with the emergence of market towns. This in line with Wahl (2016) who shows that involvement in medieval trade has a lasting effect on contemporary regional economic development across European countries. The persistent effect of historical infrastructure investments is the underlying motivation for studies that employ historical infrastructure investments as an instrument in contemporaneous studies of road infrastructure and interegional trade (Duranton *et al.* , 2014; Baum-Snow *et al.* , 2017; Volpe Martincus *et al.* , 2017).[21]

All of the studies cited in this subsection suggest that locations benefit from improved market access, in terms of greater population density, land prices, or productivity. However, a recent study at the industry level by Juhász (2018) shows a somewhat different pattern. Juhasz studies a temporary increase in trade barriers in France in the early 19th century caused by the Napoleonic Blockade of Britain. This sheltered French textile firms from competition from more advanced British textile producers. Juhasz shows that this had a long-run positive effect on the development of the local cotton textile industry, a finding that suggests that temporary trade protection may have long-term benefits for certain local industries, and perhaps local economies as a whole.

3.5 Education, information and finance

One of the most active areas of research at the intersection of urban economics and economic history focuses on the long-run impact of education and human capital on local economic development. Historical research has a natural advantage in this area because it makes available natural experiments that can provide exogenous variation in the location of educational institutions or labor force skills, which is often difficult to obtain in modern

[21] Section 4 refers to other studies that employ historical transport infrastructure as an instrument.

settings. In addition, many of the benefits of educational investments may accrue slowly over time.

One strand of work in this area looks at the impact of educational institutions on the local economy. Cantoni & Yuchtman (2014), for example, provide evidence on the long-run contribution of medieval universities to local economic development using an identification strategy that relies on the founding of new universities following the Papal Schism of 1386. In a very different context, Kantor & Whalley (2019) find evidence of spillovers from agricultural experiment stations in the U.S. which peak decades after the opening of the stations. Thus, both studies suggest that investments in educational and research institutions can have important long-run effects which may take decades to fully manifest themselves. In contrast, Andrews (2020) uses historical details on the founding of U.S. universities to identify their (surprisingly modest) impact on local innovation rates.

A second line of work in this area looks at the impact of transfers of knowledge or skills across urban areas. Dittmar (2011b) focuses on the example of the printing press, a groundbreaking technology that was invented in Mainz, Germany in the 15th century (see also Rubin, 2014). He shows that cities that had earlier access to printing technology thanks to their proximity to Mainz grew 60% faster from 1500-1600 than other similar cities. Hornung (2014) provides evidence on the impact of inflows of skilled workers by looking at the migration of the Huguenot Diaspora to Prussia following their expulsion from France in the 17th century. He finds that these skilled workers had a long-term positive effect on productivity in the receiving cities. One implication of these studies is that the gains that urban areas receive from market integration may go far beyond access to goods alone.

A third strand of work looks at the impact of education on industrialization and long-run economic development. Becker *et al.* (2011) focus on Prussia, where detailed census data are available at the county level before and after the onset of the Industrial Revolution, which reached Prussia in the 1830s. Using instruments based on pre-Industrial Revolution data, they provide evidence that education was associated with industrialization.[22] More recently, an innovative paper by Squicciarini & Voigtländer (2015) uses data on purchasers of the *Encyclopédie* in mid-18th century France to identify the location of "knowledge elites" and then shows that these locations experienced more rapid city growth after the onset of industrialization in France. Bai & Kung (2015) look at China and show how Protestant missionaries promoted economic prosperity during the period from 1840 to 1920. While the missionaries converted few Chinese, their presence triggered urbanization driven by knowledge diffusion from the schools and hospitals that they established. In a similar spirit, Caicedo (2019) shows that Jesuit missionaries instructing indigenous inhabitants in reading, writing, and crafts had lasting effects on educational attainment and income in

[22] In a somewhat related exercise, Cinnirella & Hornung (2016) study the relationship between large landownership concentration and the expansion of mass education in nineteenth-century Prussia. The stepwise abolition of serfdom increased the private demand for education.

those areas in modern-day Argentina, Brazil, and Paraguay.

Another active area for research focuses on the local impact of finance. An example of work in this vein is Heblich & Trew (2019) who use parish level data for England and Wales in 1817 and 1881 to study the effect of banking access on manufacturing growth and structural change. Similarly, Bodenhorn & Cuberes (2018) find that the entrance of a new bank had a positive effect on subsequent population growth in the Northeastern United States over the period 1830-1870. Another paper in this area is Atack *et al.* (2014), which looks at the relationship between banking and railroads in the U.S. before the Civil War. More recently, Feigenbaum *et al.* (2018) documents the long-run impact of the destruction caused by Sherman's March to the Sea during the U.S. Civil War. They argue that underdeveloped financial markets played an important role in the slow recovery of counties affected by the capital destruction that occurred during the March.

3.6 Structural transformation

A relatively new line of urban studies using historical data have focused on linking structural transformation and urban growth. For example, Michaels *et al.* (2012) study the impact of structural transformation on the population density distribution. They begin by using uniquely detailed data tracking population in the U.S. from 1880-2000 in a consistent way, including both urban and rural areas. Their data show that population growth is positively related to initial population density at intermediate population densities, a pattern that is inconsistent with Gibrat's Law. At higher population densities, however, this positive relationship disappears, a pattern that has been documented in numerous settings. To explain these patterns, they offer a model economy composed of agricultural and manufacturing sectors. In the model, agriculture concentrates in less dense areas and experiences mean reversion, while manufacturing employment growth is uncorrelated with initial density. These features, together with structural transformation from agriculture toward manufacturing across the study period in intermediate locations, can explain the stylized facts found in the data. This paper provides an important bridge between research on urban systems and work on structural transformation which has often been focused on patterns at the national level. A somewhat different approach is taken by Trew (2014), which calibrates a model based on Desmet & Rossi-Hansberg (2014) on occupational data for England in 1710 and uses it to predict changes in the spatial distribution of manufacturing and agricultural employment in the mid-19th century. In a follow-up paper, Trew (2020) investigates the interplay of infrastructure development and economic growth in England across 18th and 19th centuries. Herrendorf *et al.* (2012) perform a similar exercise for the U.S. and show that transport improvements determined where people lived and what industry they worked in and led to important welfare gains.

A second paper linking cities and structural change, Michaels *et al.* (2019), studies

the evolution of the types of tasks done in cities relative to less dense locations. To track tasks across locations and over the period 1880–2000, they classify the actions (verbs) associated with each occupation in the Dictionary of Occupational Titles compiled by the U.S. Department of Labor and then link these to locations using occupation data from the U.S. Census (via IPUMS). These data show a trend toward what they call "interactive" occupations – those that involve thought, communication, and inter-social activity – over time, and this trend is stronger in cities than in less dense areas. These patterns can be rationalized by a model in which dense locations have a comparative advantage in interactive tasks, a finding that is also documented in Bacolod *et al.* (2009).

3.7 Are cities too large or too small?

Historical data is also being used to improve our understanding of the distribution of city sizes and whether cities are too larger or too small. For example, two recent papers in this area look at the timing of the emergence of Zipf's law. Dittmar (2011a) provides evidence that in Europe, Zipf's Law emerged after 1500. Before that, big cities were too small, which he attributes to the constraint imposed by land entering as a fixed factor, a constraint that was relaxed after 1500 by innovations in transportation, technology and agricultural productivity improvements. In the U.S., Desmet & Rappaport (2017) show that large cities experienced a gradual transition toward Gibrat's Law (where growth rates are uncorrelated with initial size) across the 19th and early 20th centuries, which we know from Gabaix (1999) will lead to the emergence of Zipf's Law. They offer a model which rationalizes the observed patterns through the entry of new locations on the western frontier of the country. A useful take-away from this paper is that, because of the open frontier, the U.S. city system may behave quite differently than other locations until the middle of the 20th century. This study builds on earlier work tracing long-run city and regional development in the United States, including seminal work by Kim (1995).[23] Giesen & Südekum (2014) take an alternative approach to Zipf's law by focusing on city age. Using data on the founding date of 10,000 U.S. cities, they show that city age is positively correlated with city population, a feature that they explain by modeling an urban system with entry of new cities over time.

Historical studies can also help improve our understanding of the role of developers, which play an important role in determining city size in urban models such as Henderson (1974). As pointed out by Helsley & Strange (1997), one of the key challenges faced by developers is land assembly. This is an issue studied by several recent papers using historical data. Libecap & Lueck (2011) consider the impact of two different land demarcation systems in 19th century Ohio. One of these generated regular rectangular plots while the other allowed irregular plots that tracked terrain features. They find that rectangular plots had

[23] Other studies in this area include (Kim, 1998, 2006), and Beeson *et al.* (2001).

large long-run net benefits. Similarly, Bleakley & Ferrie (2014) uses exogenous variation in plot size allocations from land lotteries in Georgia to study the ease with which land can be assembled into optimal sizes. They find that misallocation initially depressed land values by 20% and that it took 150 years for these effects to disappear. Another study of the U.S. frontier, Smith (2020) finds instead that large landholdings resulted in depressed values. Overall, these studies suggest that there may be substantial barriers to the assembly of land into parcels of optimal size, as hypothesized by Helsley & Strange (1997).

The papers reviewed in this section show us that historical studies have a lot to tell us about why cities exist, how they interact, and how they grow. While many of the studies in this area address core urban economics questions – including the reasons that cities exist, agglomeration economies, and the causes of Zipf's Law – historical work is also creating bridges between urban economics and topics typically studied by other fields, including structural change, trade, education and migration. Given the continued growth of rich long-run historical data sources, we expect that this will continue to be a fertile research area for years to come.

4 Studies of city structure and neighborhood sorting

The previous section discussed historical reasons for the existence of cities and interactions between cities. This section shifts from a between-city perspective to a within-city perspective. Specifically, we are interested in what history can teach us about determinants of the equilibrium distribution of residents, workers and land rents across locations within a city, how major urban infrastructure investments, such as transport networks or sewer systems, affected the shape and size of cities, and how the organization and segregation of cities today is influenced by the past.

Papers that apply quantitative urban models in combination with historical data (see Ahlfeldt *et al.* , 2015; Heblich *et al.* , 2016) illustrate how a historical perspective can help us understand to what extent large shocks like the division of Berlin or historical pollution exposure changed the structure of the city in the long-run. Being able to account for these changes qualitatively and quantitatively provides a handle to evaluate future changes to e.g. the transport network. Additionally, a better understanding of path dependencies holds important policy implications, especially if initial conditions or shocks that determined a spatial equilibrium in the past are redundant today. Here, policies that promote a movement to better steady-state could be welfare enhancing (Donaldson & Allen, 2020).

4.1 Transport infrastructure

Before the industrial revolution, walking was the most common way to travel within cities and people lived close to where they worked (Voth, 2001). Cities were typically organized

around a center where the economic activity took place and they did not stretch out more than a few miles (this is why the City of London is also colloquially known as square mile). Urban development was constrained by distance (Duranton, 1999). While the introduction of horse omnibuses increased travel speed slightly, it was only the introduction of railways and subways that had a lasting effect on inner-city travel speeds.[24]

With the emergence of railways and subways, people started moving to suburbs and commuting to their place of work in city centers. As a result, employment and residence locations became increasingly segregated (Heblich *et al.* , 2020b).[25] Outside of metropolises that invested in the construction of railways and subways, street cars were a less costly but equally effective way to allow people to commute (Brooks & Lutz, 2019; Xie & Levinson, 2010). Early version of streetcars were horse drawn but this technology was not sustainable as growing numbers of workhorses lined the streets with piles of manure. The introduction of electricity in streetcars overcame this problem and was equally beneficial for subways, since steam driven engines in tunnels posed significant ventilation problems.

After the introduction of rail technology, cars and trucks were the next big technological shock, with lasting effects on the internal organization of cities around the world (see Glaeser & Kohlhase, 2004). The development occurred in two main waves. First, roads and the introduction of trucks freed up firms' location choice within cities, leading to an emergence of sub-centers (Moses & Williamson, 1967; Anas *et al.* , 1998; Glaeser & Kahn, 2001). The second wave of change was the result of newly built urban highways starting in the 1950s, which led to a significant reduction in commuting costs and with it a further increase in urban sprawl as people moved to suburbs. To identify the effects of decreased travel time on residential choice, Baum-Snow (2007) uses a 1947 highway system plan for the U.S. as a source of exogenous variation.[26] In subsequent research, the 1947-highway-map has been augmented by two more historical instruments–the 1898 railroad network and maps of historical routes of exploration–to assess the effect of transport infrastructure on road usage (Duranton & Turner, 2011), urban growth (Duranton & Turner, 2012), within and between city trade (Duranton *et al.* , 2014), driving speed in large U.S. cities (Couture *et al.* , 2018), and knowledge flows in support of innovative activities (Agrawal *et al.* , 2017).[27]

[24] see Bogart (2014) for a survey of the transportation revolution

[25] Ahlfeldt & Wendland (2011) and Ahlfeldt & Wendland (2013) use historical land values in Berlin, Germany, from 1890 to 1936 and show a similar impact of the rapid transport system on urban decentralization.

[26] Other research on suburbanization in the U.S. since the 1950s includes Glaeser & Gyourko (2005) and Glaeser & Kahn (2001). We also refer readers to *Crabgrass Frontier*, by Jackson (1985), which provides a comprehensive summary of the factors that promoted suburbanization over the course of history.

[27] Studies that use historical route instruments outside the U.S. include Garcia-López *et al.* (2015) who employ Roman roads and the 1760 Bourbon roads to instrument the Spanish road infrastructure today; Hsu & Zhang (2014) who exploit historical Japanese railroad networks; or Baum-Snow *et al.* (2017) who rely on the 1962 road and rail network in China. Somewhat related to this strand of research are papers which exploit the historical layout of the voice telephony infrastructure (Falck *et al.* , 2014) or cable-TV infrastructure (Czernich *et al.* , 2011) to explain the regional diffusion of high-speed internet.

Historical evidence tells us that the layout of road infrastructure can have long-lasting effects on city development. Existing layouts range from the iconic regular grid of midtown New York to the hub-and-spoke of Washington D.C. and the less regular patterns observed in the center of many older cities around the world. O'Grady (2014) presents one of the few quantitative studies on the coordinating effects of rectangular grids in cities.[28] The paper exploits the 1811 adoption of an iconic regular grid in midtown Manhattan while Lower Manhattan was built on a decentralized grid. These spatial differences in the street patterns continue to exist today, and it turns out that regular grids increase land values and land use because irregular property shapes are less common and connectivity is better (Barr & Ort, 2013). Related to this, using data on Indian cities, Harari (2020) shows that a more compact city shape due to favorable terrain facilitates transit accessibility. This is reflected in faster population growth.

Historical studies of the impact of transportation infrastructure on cities remains one of the most active areas of historical urban research. As we look ahead at further advances in transportation technology, whether in the form of self-driving cars, electric scooters for hire, or package delivery drones, historical studies can offer insights into how we might expect urban environments to change in response.

4.2 Urban health amenities

Transport infrastructure is an important factor if we think about the internal organization of cities. An equally important though less visible part of the urban infrastructure is the network of water and sewer pipes. Its importance for the (healthy) rise of densely populated cities cannot be overestimated. During the industrialization, more and more people cramped into cities hoping to earn higher wages. The price they paid was a lower life expectancy.[29]. Water-borne illnesses, like cholera and typhoid, were a main factor underlying urban mortality before the oral-fecal method of disease transmission was understood and cities started investing in water and sewerage infrastructure to improve public health.[30] An important line of research, including work such as Cutler & Miller (2005), Ferrie & Troesken (2008), Troesken (2008), and Kesztenbaum & Rosenthal (2011), documents the importance of sanitation improvements for urban health and development. This literature has played an influential role in policy responses in modern developing countries, where cities continue to struggle with high mortality rates. More recently Alsan & Goldin (2019) highlight the

[28] Ellickson (2012) discusses the economic benefits of a grid pattern but he does not present quantitative evidence.

[29] Cities were already deadly places before that as discussed in Voigtländer & Voth (2013b) and Jedwab *et al.* (2020) but the population growth during the Industrial Revolution brought this to a new level

[30] The epidemiologist John Snow provided important evidence on the oral-fecal transmission mechanisms when he detected that one contaminated well in a London parish caused a cholera epidemic Ambrus *et al.* (2020).

importance of combining water and sewer infrastructure, while work by Clay *et al.* (2014) and Feigenbaum & Muller (2016) on lead pipes shows that mistakes in the provision of health infrastructure can be costly. Yet despite a substantial body of research on this topic, reviewed in more detail in Brian Beach's article in this volume, debate remains over the true effect of public health efforts on urban mortality (Anderson *et al.* , Forthcoming).

Another factor underlying urban mortality was air pollution. While coal smoke from small workshops and heating existed prior to the industrial use of coal, the amount of air pollution in emerging manufacturing towns was unprecedented. Coal was fueling rising incomes but workers had to breath its smoke in the notoriously polluted centers of the industrialization which came at the cost of a lower productivity and poor health (Bailey *et al.* , 2018; Barreca *et al.* , 2014; Beach & Hanlon, 2018). Even more insights into the health effects of air pollution come from Hanlon (2019) who combines a long time series of mortality data for London with London fog events where pollution got trapped in the city. That paper highlights the substantial contribution that pollution made to overall mortality in the past, as well as documenting interactions between pollution exposure and the presence of infectious diseases. Clay & Troesken (2011) study the Spanish Influenza Pandemic and find a similar interaction with pollution. These results indicate that pollution is likely to be more costly in cities, such as those in modern developing countries, that also struggle with high infections disease burdens.

Unlike the case of water supply, cities were less influential in regulating urban air pollution. One potential explanation is that managing air pollution would directly affect the competitiveness of one location compared to others within the same country. Only a nationwide regulation could have prevented this, but nothing substantial had been done before the lethal London Fog in 1954 led to the 1956 Clean Air Act in England. Subsequently, other countries followed.

Despite the fact that cities in modern developed countries are remarkably healthy by historical standards, the results reviewed in this subsection suggest that urban economists should not lose sight of the important role that health plays in cities, a role that has been starkly illustrated by the Covid-19 pandemic. Even after that passes, health concerns will remain important, particularly in developing cities, though urban health challenges remain even in developed countries, as the recent experience of Flint, Michigan can attest.[31]

[31] The 2014 *Flint Water Crisis* emerged when the city of Flint decided to disconnect from Detroit's drinking water system that drew water from Lake Huron and set up their own water supply that drew from the Flint river. Tragically, officials failed to apply corrosion inhibitors to the more corrosive river water, thus causing lead to leach into the drinking water. Residents noticed health effects but local officials denied anything wrong for over a year. After that, Flint switched back to Detroit's water system and the state of Michigan has agreed to compensate the victims.

4.3 Residential amenities

The public sewers and pollution regulations that we have just discussed represent just two of the many factors that influence the amenity value of neighborhoods and cities. Other important influences on city amenities that have been studied with historical evidence include those related to public safety, natural amenities, as well as the many beneficial pieces of urban infrastructure, ranging from opera houses to iconic buildings, bequeathed to cities by past generations of residents.

As protests in U.S. urban cities following the death of George Floyd remind us, how cities invest in public safety continue to be an important topic for discussion and study. This is a topic where historical evidence has much to offer, though one where existing work remains limited. One recent example in this vein is Bindler & Hjalmarsson (2019), which studies the formation of the world's first professional police force, the London Metropolitan Police, in 1829, as well as the subsequent role-out of a professional police forces across Britain. They show that this led to an overall reduction in crime, contributing to the declining crime rates in England and Wales in the second half of the nineteenth century despite a growing population. That paper highlights two important features that influenced the effectiveness of the new police force. First, there was a new focus on crime prevention and deterrence rather than ex-post punishment. Second, there was an emphasis on police quality, a topic that clearly remains relevant.

Other *historical amenities*, to use the term offered by Brueckner *et al.* (1999), continue to influence patterns of urban development today.[32] Examples of historical investments that have lasting effects on the attractiveness of neighborhood include park designations in expensive downtown locations; opera houses (Falck *et al.* , 2011); and historical buildings and cultural landmarks (Koster & Rouwendal, 2017; Ahlfeldt & Holman, 2018). However, it is worth noting that these amenities can also come with costs, in addition to benefits. For example, in England, Hilber *et al.* (2019) highlight the costs of preserving historic buildings in terms of lost energy efficiency. Another cost are building height restrictions meant to preserve skylines with the silhouette of historical buildings, that may limit beneficial development.

In addition to historical amenities, exogenous natural amenities can have lasting effects on the attractiveness of neighborhoods. Looking at the period 1880–2010 in the U.S., Lee & Lin (2018) uncover an interesting heterogeneity in the spatial distribution of income within cities; those cities with natural amenities like oceans, mountains, and lakes show a more persistent spatial distribution of income, while the spatial distribution of income in cities with few natural amenities churns quickly. This result nicely complements Rosenthal (2008) who shows that neighborhoods cycle through periods of decline and renewal. As

[32]The value of amenities is often assessed with the help of the hedonic pricing. This approach runs up against a natural limitation in historical studies.

their housing stock deteriorates, so does the average income until old dwellings are replaced with newer dwellings which attracts higher income families. Rosenthal argues that local externalities may amplify these cycles while Lee & Lin point out a countervailing force, natural amenities.

economic status follows long-running cycles of decline and renewal in the core areas of thirty-five U.S. cities between 1950 and 2000. Villarreal (2014) is another paper which explores how exogenous environmental amenities–undesirable historical marshes–shaped initial settlement patterns in New York City, as well as the channels through which these initial conditions influence the long-run distribution of housing prices and household income.

Historical amenities can have long-run effects on the sorting of population within cities. These effects are shown in recent work by Heblich *et al.* (2016), which examines the long-run effects of historical air pollution as an example of an endogenous man-made disamenity. They show that coal pollution from industrial chimneys in England had a disproportionately stronger effect on cities' east side due to the prevailing wind patterns. Interestingly, these effects persist to this day, even though the initial pollution sources have waned. In a related paper, Ambrus *et al.* (2020) show that the cholera epidemic in 19th century London affected the spatial distribution of poverty within the city until today. One implication of these results is that the nature and distribution of urban amenities, even those that existed in the past but disappeared long ago, can continue to exert influence on the urban segregation.

4.4 Segregation

The lasting pollution effects on the east sides of cities is an example of historically inherited *income segregation*. A much larger body of research focuses on the origins and lasting effects of *racial segregation*, predominantly in the U.S. Using a new next-door-neighbor measure, Logan & Parman (2017) show that segregation doubled nationally from 1880 to 1940 and this was a general trend for rural and urban areas as well as the North and South. This corroborates earlier work by Cutler *et al.* (1999) who employ a less disaggregate segregation index to document the rise (since the 1890s) and decline (since the 1970s) of black ghettos in urban centers.[33] Boustan (2010) focuses on the period between 1940–1970 where segregation increased faster. An important driver of this trend was the white flight from city centers to suburbs as black migrants left the rural South to find jobs in the booming industrial centers in the North, results that are reinforced in recent work by Shertzer & Walsh (2019). These patterns had important consequences, such as on the provision of (locally financed) public goods such as education (Boustan, 2013).

Historical transportation infrastructure has had an important role to play in segregation within cities. Ananat (2011) shows that historical railroad tracks physically separate neigh-

[33]Part of the decline might be related to the longer-run success of urban renewal programs (Collins & Shester, 2013).

borhoods, thereby contributing to segregation and black-white income disparities. In the case of white flight in the U.S., the availability of highways facilitated suburbanization by white residents. A different aspect of the interplay between transportation infrastructure and segregation is highlighted by Brinkman & Lin (2017). They show that freeways have disproportionately negative effects on the predominantly black homeowners in central locations,[34] because accessibility improved relatively little in those areas, which were already well-connected, while the city freeway network meant increased pollution and noise.

Another historical factor that fostered racial segregation patterns which continue to exist today was a practice known as *redlining*. Redlining prevented African Americans access to home loans backed by the federal government (Aaronson *et al.* , 2017). A similar practice were racial covenants that prohibited the sale or renting of a property to specific races or religious minorities (Sood *et al.* , 2020). While these practices have been officially banned since the middle of the nineteenth century, their influence remains. Moreover, not only did such practices generate segregated neighborhoods, they also had other impacts, such as contributing to racial wealth disparities (Akbar *et al.* , 2020). While redlining is no longer legal, other less obviously discriminatory policies continue to be in place. For example, wealthy neighborhoods may deter poorer residents by minimum lot size requirements or limiting mixed-use or multifamily zoning (Shertzer *et al.* , 2016).

Segregation remains one of the most active research topics at the intersection of history and urban economics (as well as real estate). Given the prominence of this issue, and the long reach of history in urban environments, we expect this to continue. While much of the focus in recent work has been on the U.S., this is a topic where there is ample need, and opportunity, for evidence from other settings.

4.5 Zoning and other urban policies

Today, how cities are organized depends crucially on urban regulations, which include a wide range of policies such as zoning, historical designations, etc. In many cases, these regulations represent historical institutional arrangements that restricted location choices in the past and, to the extent that they did not adjust to changes in local demand over time, have grown to be a significant obstacle for urban economic growth today. Understanding the origin and persistence of these regulatory forces, and the extent to which they influence modern cities, is important for helping design more effective urban policies.

One of the most prominent urban policies is zoning (see Fischel (2004) for a comprehensive historical review). A first wave of zoning laws, which originated in the early twentieth century, were designed to protected home-owners from industrial developments and lower income apartment when trucks and buses improved mobility across town. A second wave

[34]The white flight to suburbs led to a reduction of house prices in the center which benefited black homeownership (Boustan & Margo, 2013).

of zoning restrictions in suburbs was a reaction to the rising demand for suburbanization. Historical studies have a natural advantage in investigating the impact of zoning because they can look before and after the introduction of zoning laws. In contrast, modern studies are often constrained by the fact that most modern zoning laws were enacted many decades ago and change slowly over time. Two examples of historical work on zoning are McMillen & McDonald (2002) and Shertzer *et al.* (2018), both of which study zoning in Chicago going back to the 1920s.

While economists agree that zoning laws restrict urban growth, it is important to note that land development is not necessarily optimal in the absence of regulations. This point is made by Hornbeck & Keniston (2017), who exploit the 1873 Boston fire as exogenous shock and test whether the opportunity to simultaneously reconstruct a wide area came with economic gains. The findings suggest that the simultaneous reconstruction efforts after the fire helped developers overcome redevelopment frictions and translated into higher land values. This shows that the durable building stock is a redevelopment burden in itself. Two other studies, Siodla (2015, 2017), examines similar topics using the effect of the San Francisco fire of 1906. These studies show the potential for harnessing historical natural experiments to study urban topics that are often difficult to tackle using modern data.

Looking beyond the zoning of land for particular uses, other recent work examines topics such as the impact of historic designations (Waights, 2019). Another class of regulations have to do with building heights. As urban areas grew in the nineteenth and early twentieth centuries, land prices in the center increased, giving developers an incentive to increasing building heights. This led to the emergence of skyscrapers at the end of the nineteenth century, first in Chicago, then in New York, and then around the world. With an increasing number of skyscrapers and competition over the prize of being tallest Helsley & Strange (2008), there were rising concerns about negative externalities on surrounding buildings as a result of sunlight blockage and increased traffic congestion. To address this, U.S. zoning laws were extended to regulate the vertical expansion of buildings from the early twentieth century on. Research by Barr (2013) provides an interesting perspective on the effect of these regulations. Comparing the skyscraper developments in Chicago and New York City, he shows changing zoning regulations did reduce the height of each city's own skyline while triggering increased building activity in the other city. Ahlfeldt & McMillen (2018) study the vertical evolution of Chicago and find evidence that the footprint of taller buildings cover a smaller fraction of the plot to comply with restrictions on the floor area ratio. To assess the costs of height restrictions, Koster & Dericks (2020) exploit the Blitz bombings of London during the Second World War as an exogenous shock to local density restrictions and show that bombed areas host taller buildings today.

Zoning and other policies that restrict urban development are sure to remain a core concern for urban economists for many years. This is because they drive up land prices

and Knoll *et al.* (2017) have shown that rising land prices are a significant driver of the global house price boom that has taken place since the Second World War. As the studies cited above illustrate, history offers numerous natural experiments that can be harnessed to help us understand the effects of these policies. Just as important, by looking back in history we can observe a world in which such regulations were largely absent. While much has changed since zoning laws were introduced, doing so still offers the potential for helping us understand the consequences of rolling back existing restrictions.

5 Cities and growth

There has been a growing interest in the historical urbanization process from different subfields within economics. Part of the growing popularity relates to the insight that urbanization can proxy for economic prosperity. While it is comparatively hard to compile reliable data on countries' GDP growth going back in time, data on historical city sizes are easier to access. Under assumptions that we discuss below, the urbanization rate or population density can provide suitable proxies for countries' economic growth and development over long periods of time. It is worth noting however, that the exact nature of the relationship between urbanization and development may have changed over time, a point argued by Jedwab & Vollrath (2015).

5.1 Urbanization as an indicator of economic growth

Economists in different fields have approached the relationship between urbanization and economic growth from different perspectives. Economic historians often focus on the impact of economic growth on the level of population in a location. In contrast, urban economists are often more interested in how a given population is spread across space, i.e., the extent to which a given population agglomerates in urban areas. Below, we briefly describe the foundations of these two views, discuss the extent to which they complement each other, and seek to highlight areas where further work is needed to bring them into agreement.

Urbanization or population density in the past is widely used as a proxy for technological progress and economic growth. One motivation for this approach emphasizes the impact of technological progress on population (Kremer, 1993; Galor & Weil, 2000). In particular, the link between economic growth and population is a key prediction of the Malthusian model, which is the dominant framework for thinking about economies prior to the Industrial Revolution, as well as modern developing countries that have not yet passed through the demographic transition. The basic intuition behind the Malthusian model is that, given sufficient time, changes in per capita income due, for example, to a technological discovery or natural fluctuations, will ultimately result in population growth. This will erode the increase in per capita income. The result is a long-run equilibrium in which per capita

income is determined only by fertility and mortality parameters and technological progress appears in the form of rising population density.[35] While extremely simple, the Malthusian model has held up well in recent empirical studies (e.g., Ashraf & Galor, 2011). This is a useful fact for urban economists to consider, because it suggests that city growth can provide a useful proxy for technological progress before the demographic transition. Note, however, that in this framework individual income does not provide insight into productivity changes.

An alternative view of the relationship between urbanization and technological progress focuses on the distribution of a given population across space, rather than the sources of population growth. This view, which is more associated with urban economics than economic history, emphasizes the key role that local agricultural productivity and the costs of transporting agricultural goods played in constraining city size in the past (Bairoch, 1988; Duranton, 1998, 1999; Dittmar, 2011a). The costs of supplying food to cities represent the key congestion force that balances agglomeration forces in order to determine city size. In this framework, technological progress, either in the form of improved agricultural productivity or a fall in transport costs, allows cities to grow in size. Urbanization, therefore, is a direct reflection of technological progress.

Thus, both of the approaches described above draw a link between technological progress and urban growth. On one hand, urban growth is a byproduct of population growth, while on the other it is the result of the release of constraints on city size, which causes a reallocation of population from the countryside to the city. Both frameworks thus provide a theoretical foundation for the large set of papers using population density or urbanization to measure the impact of new technologies (Dittmar, 2011b), new crops (Nunn & Qian, 2011; Chen & Kung, 2016), improved institutions (Acemoglu *et al.* , 2002), better education (Cantoni & Yuchtman, 2014), improved trading links (Acemoglu *et al.* , 2005), etc.

It seems likely that the two views described above both contribute to the historical relationship between technology, rising population, and urbanization. Thus, we view these approaches as complementary, and in particular, we note that it may be beneficial for urban economists to consider the relationship between urbanization and population growth, not just how a given population is spread across space.

However, there are also important difference between these views. For example, in models of the spatial distribution of population, such as Duranton (1998), the transition from pre-industry to modern cities is characterized by a shift in the main constraint on city growth from the ability to access food supplies to the shortage of land and commuting costs. In contrast, unified growth theories, which model the transition between the Malthusian world and modern economic growth (Galor & Weil (1999)), emphasize the role of rising productivity growth coupled with the demographic transition. These differences will matter

[35] See Voigtländer & Voth (2013a) for a useful description of this theoretical framework.

when urbanization is used as a proxy for technological progress during the transition from pre-industrial to modern economic growth. Given this, integrating these views into a unified framework that explains both the source of population growth and its distribution over space seems like a useful direction for future work.

5.2 The contribution of cities to growth

Up to now, this section has focused on the impact of productivity growth on population growth and urbanization. However, it is also likely that cities are central contributors to the development of new technologies, a view argued forcefully by Jacobs (1969). This possibility raises both theoretical and empirical considerations. On the empirical side, it means that we have to worry about the direction of causality when relating urbanization and productivity growth. On the theoretical side, it calls for the integration of the causal effect of cities on technological progress into models of urban growth. Progress has already been made on this front in a series of papers by (Rossi-Hansberg, 2005; Desmet & Rossi-Hansberg, 2014; Desmet *et al.* , 2018) but work in this direction is sure to continue.

There is also an interesting line of work in this vein that considers the trade-offs between achieving optimal city size in the short-run and reducing technological progress in the long-run. For example, Duranton (1998) argues that cities may be too large in equilibrium, but that "large actors" may be able to reduce the city to an optimal size. He suggests that guilds may have played this role in historical European cities. By limiting entry into specific crafts within a city, guilds acted as a constraint on city size. In addition, guilds may have provided other functions, such as acting as an enforcement mechanism that constrained local rulers and thereby fostered trade (Greif *et al.* , 1994). However, while guilds may have helped achieve a more optimal city size in a static sense, there is also evidence that they slowed down the development and adoption of new technologies (Mokyr, 1990; Desmet & Parente, 2014). This highlights a trade-off that cities may face between static and dynamic gains. This is a valuable direction for future research, with potentially important implications for modern policies, such as zoning, that constrain city size.

6 Summary

In our review of research applying historical data to the understanding of urban economics, four broad themes have emerged. The first is the drastic increase in the quality and richness of available data over the past decade or so, driven by methodological advances in computing and digitization. This is an important force behind the large and rapidly growing set of historical urban papers that we have reviewed. We see no evidence that this trend is likely to slow in the near future. Rather, technological advances in machine reading and learning

are likely to allow the collection of even more detailed and comprehensive historical data, at lower cost, in the near future.

A second broad theme that emerges from our review is the advances made in bringing the increasingly rich historical data into closer contact with economic theory. This trend is particularly notable among papers focused on the role of trade and market access, the spatial allocation of people and firms within cities, and in recent work on cities and growth. Combining historical data with theory offers a number of advantages, including guiding the structure of the empirical analysis, making it easier to interpret reduced-form parameter estimates, and facilitating the construction of counterfactuals. Perhaps most important for urban economics, theory offers a useful tool for accounting for general equilibrium effects and spatial spillovers. The increasing use of theory together with historical data is a trend that we expect to continue, particularly as more detailed historical data become available.

A third broad theme of our review has to do with the depth and breath of urban topics being addressed using historical data. Historical settings have played a key role in our understanding of some core urban questions, such as the nature of agglomeration economies and congestion forces and the long-run impact of urban infrastructure investments. At the same time, a number of papers have used historical data to form connections between urban economics and other topics, including finance, education, health, and structural change. Both of these trends seem likely to continue. Beyond that, one area where we believe historical studies have the potential to make additional contributions is in connection to factors that affect contemporary city structure, including zoning laws, local resource endowments, city shape, and the impact of these factors on long-run city performance.

Finally, our review suggests that urban economists have been largely successful in integrating the insights and techniques of economic history into their work. The papers we have reviewed generally show an impressive understanding of the historical context in which they are embedded as well as care in the use of historical data, two hallmarks of high quality economic history research. However, there is still scope to bring urban economics into closer contact with work in economic history. In Section 5, we provide an example focused on city growth, showing how urban economists and economic historians take differing views on similar issues. Integrating the lessons of economic history more fully into work on urban economics, and vice versa, seems like another fruitful direction for future work.

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