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Urbanization without growth in historical perspective☆

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Abstract

The world is becoming more and more urbanized at every income level, and there has been a dramatic increase in the number of mega-cities in the developing world. This has led scholars to believe that development and urbanization are not always correlated, either across space or over time. In this paper, we use historical data at both the country level and city level over the five centuries between 1500–2010 to revisit the topic of "*urbanization without growth*" (Fay and Opal, 2000). In particular, we first establish that, although urbanization and income remain highly correlated within any given year, urbanization is 25–30 percentage points higher in 2010 than in 1500 at every level of income per capita. Second, while historically this shift in urbanization rates was more noticeable at the upper tail of the income distribution, i.e. for richer countries, it is now particularly visible at the lower tail, i.e. for poorer countries. Third, these patterns suggest that different factors may have explained the shift in different periods of time. We use the discussion of these factors as an opportunity to provide a survey of the literature and summarize our knowledge of what drives the urbanization process over time.

JEL classification: N9; R1; O1
Keywords: *Urbanization without growth*; Economic development; Megacities; Urban poverty; Urbanization

Contents

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1. Introduction

Urbanization is often considered a hallmark of economic development (Kuznets, 1968; Bairoch, 1988). Urbanization rates and city sizes have often been used as empirical proxies for the level of income per capita (De et al., 1993; Acemoglu et al., 2002; Dittmar, 2011). At a global level they have trended upward together from the Neolithic Revolution, when an appreciable agricultural surplus first allowed for towns and cities to form, to the current day when roughly half of all people live in urban areas (United Nations, 2014).

Recently Fay and Opal (2000) documented what they called *urbanization without growth* in developing countries of the late 20th century. In a similar vein, Glaeser (2013) shows that there is “poor country urbanization” at the bottom of the income distribution, and Jedwab and Vollrath (2015) document that mega-cities are increasingly located in poorer countries. These papers suggest the possibility that something fundamental has changed in the relationship of urbanization and development in the late 20th century compared to prior experience.[1]

In this paper we examine the relationship of urbanization and development levels from 1500 to 2010, with the goal of discovering whether in fact this relationship has changed appreciably in the late 20th century. We first establish that the world is becoming more urbanized at every level of income per capita over time, with the shift on the order of 25–30 percentage points for all countries. However, this occurred in different periods of time for different parts of the income distribution. From 1500 until the mid-20th century we find that urbanization rates rose dramatically for the *richest* countries, but remained roughly constant (i.e. close to zero) for countries at the lowest levels of income per capita. However, from the mid-20th century until today, urbanization has occurred primarily among the *poorest* countries in the income distribution. In this sense, *urbanization without growth* is not unique to developing countries in the 20th century. Rather, it appears to have been occurring for several centuries.

A consequence of this difference in the timing of urbanization is that the location of “mega-cities” – the largest urban agglomerations in a given time period – has changed demonstrably over time. From 1500 to the mid-20th century the largest mega-cities in the world tended to be in countries that were relatively rich and developing rapidly (e.g. London and New York). From that point until today increased urbanization rates, combined with large population bases, mean that the largest mega-cities now tend to be located in poor countries (e.g. Dhaka and Lagos). We document below how the location of mega-cities has changed over time along with the urbanization rate.

[1] The theme of urbanization without growth is not entirely new to economics and urban studies. (Hoselitz, 1953) explained that urbanization, industrialization, and economic development are not always correlated. (Hoselitz, 1955) suggested that many cities in the developing world were “parasitic” as opposed to “generative”. Similarly, (Bairoch, 1988) discusses the processes of “over-” or “hyper-” urbanization in the process of development. Lastly, (Davis, 2007) study the dramatic expansion of slums and the rise of an “informal urban proletariat” in the developing world. Davis thus also argues that urbanization has been disconnected from economic growth.

Last, we review the literature on urbanization and development for explanations of why this disconnect in the urbanization process occurred, and why it occurred starting in the mid-20th century. We note that there are both positive and negative types of *urbanization without growth*. Technologies such as clean water, sewers, public transportation and multi-story buildings increase the relative value of living in urban areas and generate larger cities, even if they may have no direct impact on productivity or output per worker. These positive forces seem to predominate in the earlier era leading up to the mid-20th century. On the other hand, urban bias in policies or rural poverty represents negative urbanization that appears to lower welfare even if it has no immediate impact on output per worker. While there certainly may be positive forces driving urbanization in the late 20th century in developing countries, their experience appears to be explained more by the negative sources of *urbanization without growth*.

To continue, we first review data on urbanization and development levels as well as data on the size and living standards of mega-cities over time. Once we have established the patterns in this data, we review theories of urbanization and growth and how they can be used to interpret those patterns.

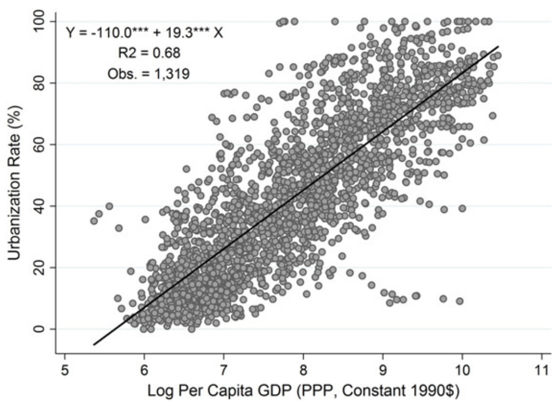

Fig. 1. Urbanization and economic development, 1500–2010. Notes: We use data for 2217 observations belonging to 159 countries for the following years: 1500 (24), 1700 (18), 1800 (25), 1850 (23), 1870 (46), 1910 (70), 1950 (159), 1970 (159), 1980 (159), 1990 (159), 2000 (159), and 2010 (159). The main sources for the urbanization rate (%) are Bairoch (1988); Acemoglu et al. (2002); Malanima and Volckart (2007); United Nations (2014); Jedwab and Moradi (Forthcoming). We use Maddison (2008); Bolt et al. (2014) to obtain log per capita GDP (PPP, constant 1990 dollars). Together, the 159 countries account for 99% of the world population in 2010.

2. Urbanization and development in the data

2.1. Urbanization and GDP per capita

Our first crude examination of the urbanization/development relationship is in Fig. 1. This plots urbanization rates against log GDP per capita for a total of 1319 observations that we collect. Data sources are available in the Appendix A. The positive correlation is clear and quite strong. Log GDP per capita explains about two-thirds of the variation in urbanization rates. The slope estimate indicates that tripling GDP per capita (equivalent to raising log GDP per capita by 1) raises the urbanization rate by about 20 percentage points. This represents an equilibrium relationship, and not a causal one. Economic development both drives urbanization and is driven by urbanization, a subject we will return to in the next section of the paper. But this figure shows how tight that equilibrium relationship is across the entire sample.

If the equilibrium relationship between development levels and urbanization was unchanging, then what we would see across time is that countries would “climb up” the line plotted in Fig. 1. As countries began the development process this would extend the distribution of points up the line, but the line itself would remain stable over time.

However, this is not what we see when we examine different time periods. Rather than a stable relationship, the link between urbanization and development has evolved over time. Fig. 2 plots the data from three years: 1500, 1950, and 2010. The relationship between urbanization and development is estimated and plotted separately for each of the three years. As can be seen, there are both level and slope differences across the years.

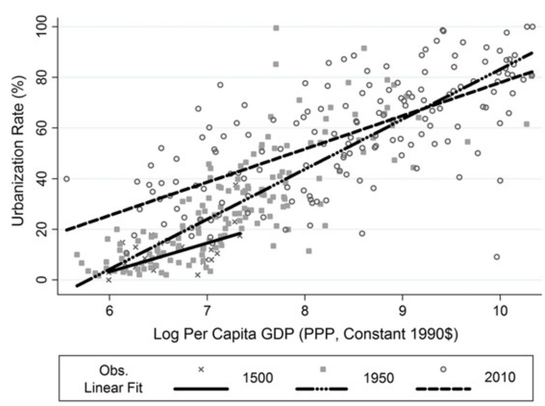

Fig. 2. Urbanization and economic development across time: 1500, 1950 and 2010. Notes: We use data for 342 observations belonging to 159 countries for the following years: 1500 (24), 1950 (159) and 2010 (159). See the notes of Fig. 1 for the list of sources used to reconstruct the data.

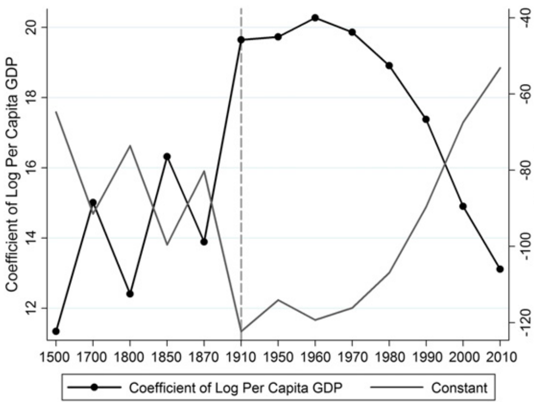

Fig. 3. Yearly correlation between urbanization and economic development, slope and constant, 1500–2010. Notes: For each year, we regress the urbanization rate (%) on log per capita GDP (PPP, constant $1990) and show the coefficient and the constant. The dashed vertical line represents the year 1910. See the notes of Fig. 1 for the list of sources used to reconstruct the data.

In 1500, development is low and related to urbanization, but the strength of that relationship is not as strong as in the overall sample. At log GDP per capita of 6 – roughly $400 in 1990 dollars, equivalent to Burundi in 2010 – the urbanization is close to zero. But even the most advanced countries in the 1500 data, Italy and the Netherlands both with roughly $1,800 per capita (7.5 in logs), had urbanization rates of only about 20%. In 1500 tripling GDP per capita was only associated with a difference in urbanization rates of about 12 percentage points.

By 1950, this relationship has changed substantially, with a higher slope. In this year, we have that tripling GDP per capita is associated with a 20 percentage point higher urbanization rate. This change is driven by high urbanization rates among the most developed nations. By 1950, a country with GDP per capita of about $1,800 (7.5 in logs) – Spain, for example – was more urbanized than its peers in 1500, reaching a 40% rate on average. At the highest end, with log GDP per capita of 9 (e.g. the United States with $8,100 per capita) urbanization rates were on the order of 60–80%. However, it was still the case that the poorest countries in 1950 (i.e. those with log GDP per capita of about 6, or $400) had urbanization rates close to zero. Hence the slope of urbanization with respect to GDP per capita was quite large.

But if we continue the analysis through 2010, we see another significant shift of the relationship. In the period after World War II it was the *poorest* countries that saw urbanization rates increase most rapidly. At GDP per capita of $400 (6.0 in logs), the urbanization rate was on the order of 25% in 2010, whereas it had been close to zero in 1950. At the same time, urbanization rates among the richest nations had only increased slightly by 2010. At GDP per capita of $8,100 (9.0 in logs) urbanization rates in 2010 were still around 60–80%, similar to their level in 1950.

Thus the *slope* of the income/urbanization relationship, while still positive, had a lower absolute value in 2010 than in 1950. It is now roughly the same as in 1500, with a tripling of GDP per capita associated with only a 13 percentage point increase in urbanization rates. Over the very long run, then, the urbanization rate has risen across the entire spectrum of development. The minimum level of urbanization appears to have risen from zero in 1500 to 20% in 2010.[2]

The changing relationship between urbanization and development over time can be most easily seen in Fig. 3. For each separate year, we regressed the urbanization rate against log GDP per capita. Against the left-axis is plotted the coefficient on log GDP per capita. From 1500 to 1910 the slope of the relationship tends to move upwards, although as one can see there is substantial variation from one year to the next, in part due to the limited sample sizes we have to work with for these years.[3]

However, there is clearly a distinct change after 1910. Here the relationship has a slope of 20, and remains there through 1960. The intercept terms of the regressions are also plotted in Fig. 3 against the right axis. The pattern seen in these tell us about *where* exactly the slope changes were taking place over time. In 1500 the constant term is relatively large, and despite the variation it drifts lower until dropping substantially in 1910. The drop in the constant along with the higher slope in 1910–1950 indicates that urbanization rates were becoming larger for *richer* countries between 1500 and the mid-20th century.

[2] Web Appendix Figs. 1 (1500 to 1950) and 2 (1950 to 2010) show the estimated relationship between urbanization and log income per capita for selected years in our sample in the indicated interval. The figures confirm that urbanization rates have been relatively increasing ceteris paribus for the richest countries between 1500 and 1950 and for the poorest countries between 1950 and 2010. An alternative way of seeing the evolution of urbanization over time is to look at average urbanization relative to average log GDP per capita for the world in a given year. Web Appendix Fig. 3 plots this ratio, which is clearly rising over time, indicating higher urbanization at the average of log GDP per capita over time.

[3] Figures showing the standard errors of estimates are available in the Web Appendix Fig. A.4. Given that we have only 18–25 observations in years prior to 1870, these confidence intervals are relatively large, narrowing as the sample roughly doubles in size in 1870 (46 countries), triples in 1910 (70) and increases sixfold in 1950–2010 (159).

After 1970, the slope drops, reaching 13 by 2010. Although urbanization remains an indicator of GDP per capita, this is becoming less reliable as we enter the 21st century. At the same time, the intercept term is becoming larger from 1970 to 2010. This indicates that urbanization rates are becoming larger for *poorer* countries since the mid-20th century, as shown in Fig. 2.[4]

For an alternative way of visualizing where the changes in urbanization have come from over time, Fig. 4 plots the predicted level of urbanization at different levels of GDP per capita for each year. For countries at $400 of GDP per capita, the predicted urbanization rate is essentially zero from 1500 to 1910, and very close to that level until 1970. By 1980, however, even countries with this very low level of GDP per capita begin to have appreciable urbanization and by 2010 are predicted to have urbanization rates of close to 25%. This level of urbanization is similar to that seen in countries with $3,000 of GDP per capita in 1500 or 1800. A similar dynamic is seen for countries at $1,100 (e.g. Nepal in 2010) in GDP per capita. Between 1500 and 1910, their urbanization rates were around 15%, and then after a small jump by 1950 the urbanization rate for these countries rises to nearly 40% in 2010. This is an urbanization rate as high as the most urbanized countries in 1500.

For countries with either $3,000 (e.g. the Philippines in 2010) or $8,100 (e.g. Turkey) in GDP per capita, Fig. 4 shows that the shift up in urbanization rates occurred earlier in time. Between 1870 and 1950 there are distinct jumps in the urbanization rates at these levels of GDP per capita, from 30% to almost 45% at $3,000 per capita and from 45% to 65% at $8,000. After this acceleration in urbanization rates, there have been more modest increases since 1950.

Figs. 3 and 4 show that overall, urbanization rates have been rising at all levels of GDP per capita over time. Roughly, urbanization rates are 25–30 percentage points higher in 2010 than in 1500 at any given level of income per capita. In this sense, there has been *urbanization without growth* at every level of development from 1500 to 2010. But this shift up in urbanization did not take place uniformly over time. From 1500 to the mid-20th century, urbanization was associated with the richest countries in the distribution. But since the mid-20th century the advance of urbanization has switched to the poorest countries.

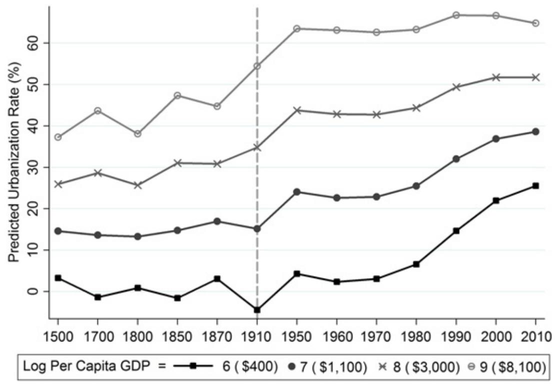

Fig. 4. Yearly predicted urbanization rate at different levels of economic development, 1500–2010. Notes: For each year, we plot the predicted level of urbanization at the indicated levels of log GDP per capita. The predictions are based on the regression of urbanization on log GDP per capita in the specified year. The dashed vertical line represents the year 1910. See the notes of Fig. 1 for the list of sources used to reconstruct the data.

2.2. Measurement issues and robustness checks

The changes in the relationship over time imply that one must be careful about using urbanization rates as a proxy for development. Comparisons *across* years are problematic. Given the shifts in the constant seen in Fig. 3, it is quite possible for urbanization rates to rise without any associated change in log GDP per capita. Fig. 4 lays this out most clearly. A country that remains at $400 in GDP per capita across time would still be expected to see its urbanization rate rise from 0% in 1500 to almost 25% by 2010. But even *within* any given year, although it is true in our data that urbanization and development are correlated and patterns are surprisingly consistent over time, one has to be careful.

2.2.1. Earlier years

Measurement errors are a particular issue for the earliest time periods, precisely the ones in which one would hope to use urbanization rates to proxy for non-existent GDP per capita data. In years such as 1500, the sources of data for both urbanization and GDP per capita are subject to much uncertainty, and thus the estimated correlation between them may be spurious. If measurement errors in GDP per capita are

[4] While the cross-country relationship between urbanization and development has been shifting over time, a separate question is whether the *within-country* relationship is similar to the cross-country one. Using our panel, we can perform regressions that include both country fixed effects as well as year fixed effects. The result of that regression is a slope estimate of 6.6, significant at 1%. This is half of the estimated effect in either 1500 (11.3) or 2010 (13.1), and one-third of the estimated slope in 1950 (19.7). Web Appendix Fig. A.5 then shows the slope and the constant for each year relative to the omitted year 1500 and confirms the patterns seen in the repeated cross-sectional regressions of Fig. 3.

simply noise, then we will be under-estimating the slope of the relationship. On the other hand, if the measurement errors are endogenous to the urbanization rate, then we are likely over-estimating the slope, which would be however less of an issue for our analysis.

We use the Bolt et al. (2014) update of Maddison (2008) to measure GDP per capita, but there are questions regarding the accuracy of Maddison's estimates of GDP per capita for not only the deep past, but through the 19th century (Clark, 2009). The main concern for our purposes is not whether Maddison gets the level of GDP per capita exactly right, but whether the relative values across countries is accurate. A possible explanation for the patterns we have seen is that Maddison's estimates are systematically biased. The biggest concern is that in generating the estimates of GDP per capita in very early years, Maddison used an *assumed* relationship between urbanization rates and development to infer GDP per capita. In this case, our regression for 1500 (or any year prior to the availability of quality GDP data) is simply reconstructing this assumed relationship. In this case, there is no evidence that urbanization is a good proxy for development in 1500, despite the fact that we may see a robust relationship in 1910, 1950, or later. However, this should only lead to an upward bias.

Regarding the urbanization data itself, this also is subject to issues with measurement. There are issues in defining what constitutes a city, and in making accurate estimates of the population of those cities. However, Bairoch (1988); Malanima and Volckart (2007) both use a threshold of 5000 inhabitants to define a city in their historical data. While we use several additional sources to supplement their data sets, it is fortunate for us that many of them also use the standard threshold of 5000 inhabitants, which should minimize exogenous measurement errors. But endogenous measurement errors could still create biases in the estimated relationship between urbanization and development. If, for example, it is in particularly poor countries that the population in cities of 5000 is *underestimated* then true urbanization rates would be higher, and the estimated slope of the relationship lower.[5] However, the pattern of *urbanization without growth* between 1500 and 1950 is particularly visible for the later years of the period (post-1870, see Web Appendix Fig. A.1), when many more observations are available and when urbanization rates are better documented for all countries.

2.2.2. Later years

Measurement errors are also an issue for the latest time periods, especially relative to the earliest time periods. We first check that our results are not entirely driven by rich countries, in particular since the continuous development of countries extends the distribution of points to the right along the x-axis of per capita income. We find similar patterns if we use only developing countries in any year as defined by the International Monetary Fund (Web Appendix Fig. A.6), or countries that have output per capita below the median in any year (Web Appendix Fig. A.7).

While the inconsistency in thresholds does not appear to be problematic for earlier years, there remains the question of whether the population counts are accurate for later years. This is actually less of an issue for those years as cities grew well beyond the 5000 person threshold, making inaccuracies in their population counts immaterial to whether a city was larger than 5000 inhabitants.

Additionally, we use data on the type of urban definition used by all countries for most of the 1950–2010 period. Among the 159 countries of the post-1950 sample, 81 countries use an explicit threshold to define a locality as a city, whereas 78 countries use a more administrative urban definition. Web Appendix Fig. A.8 shows the kernel distribution of the threshold used for the 81 countries using this type if definition. The median threshold is 2500 inhabitants but the mean threshold is 4362, not far from the 5000 threshold used by Bairoch (1988); Malanima and Volckart (2007). Controlling for the type of definition used (via a dummy equal to one if the country uses an urban definition based on a threshold, and the threshold itself) or restricting ourselves to countries using a threshold close to 5000 inhabitants (by restricting our sample to countries with a threshold between the 10th and 90th percentiles) does not change the results (see Web Appendix Figs. A.9 and A.10).

Definitional issues regarding urbanization rates have been raised for Sub-Saharan Africa in particular (Potts, 1995, 2012; World Bank, 2009). Web Appendix Fig. A.11 shows that if we exclude Sub-Saharan Africa, there is no change to the patterns in the data. Alternatively, we can include continent fixed-effects (Web Appendix Fig. A.12) or exclude countries that are outliers in general (Web Appendix Fig. A.13), and receive similar results. The six continents considered are North America, South America, Europe, Africa, Asia and Oceania. We then categorize as outliers countries for which the ratio of the

[5] Xu et al., (2015) provide revised measures of the urbanization rate in China from 1100 to 1900, and indicate that the rate is roughly 12% in 1500, rather than the 3.8% that we use from (Bairoch, 1988). If they are correct and errors such as these were replicated across other countries, this would likely reduce the estimated relationship of urbanization and log GDP per capita in 1500.

urbanization rate to log per capita GDP is below the 10th percentile or above the 90th percentile in 2010.

Lastly, an alternative measure of urbanization that is independent of the urbanization rate is the total employment share of industry and services. As shown by Gollin et al. (2013) using census and survey data for about 80 countries, agriculture is clearly a rural-based sector while industry and services are clearly urban-based sectors. Structural change out of agriculture and into industry and services thus reflect the urbanization of both the economy and the society. Data is rather unfortunately not available for the total employment share of these urban sectors before 1980. Yet we find the same patterns of *urbanization without growth* for the post-1980 period when urbanization is proxied by structural change out of agriculture (see Web Appendix Fig. A.14).

While there are measurement issues for urbanization rates, there are also measurement issues for countries' levels of economic development. As GDP is a flow concept, it tends to be more variable than the urbanization rate, which captures a stock concept. For example, many developing countries experienced a recession in the 1980s–1990s. If there are fixed costs in building cities, such as durable housing (Glaeser and Gyourko, 2005), an economic recession will reduce per capita GDP without necessarily affecting the urbanization rate. This may create *urbanization without growth*, but only because income temporarily decreases, and not because urbanization permanently increases.

Our results are first robust to excluding country/years experiencing a recession between two periods (Web Appendix Fig. 15). There are insufficient observations prior to 1800 to make any useful analysis. Results also hold when using a 20-year moving average of GDP (Web Appendix Fig. A.16). We focus on the 1960–2000 period because we cannot build 20-year moving averages for other years. It has been argued that human capital could be a better measure of long-run development than per capita GDP (Henderson et al., 2013b). We thus test that results are similar when using primary school completion in place of GDP (Web Appendix Fig. A.17), or average years of school in place of GDP (Web Appendix Fig. A.18). However, we only have data on education from 1960. Lastly, the literature has also shown how poorly measured per capita GDP is for many developing countries, particularly Sub-Saharan Africa (Young, 2012; Henderson et al., 2013b; Jerven, 2014). However, we have shown in Web Appendix Figs. A.11 and A.12 that results are unchanged when excluding Sub-Saharan Africa or including continent fixed-effects to do within-continent comparisons.

Finally, results are robust to using either population weights (Web Appendix Fig. A.19) or area weights (Web Appendix Fig. A.20) in the regressions. Results are thus not driven by the larger countries.

2.2.3. Comparisons across time

Our baseline results, as well as the robustness checks just described, all operate under the assumption that GDP is comparable over time. That is, a GDP per capita of $1,000 in 1500 is presumed to be an equivalent living standard to $1,000 in 2010. This assumption is almost certainly untrue, though, given the differences in products available in 1500, 1950, 2010, and years in between (Nordhaus, 1996; Hausman and Liu, 2014). This issue is analogous to issues in comparing living standards across countries with very different consumption baskets (Deaton and Heston, 2010). GDP per capita may be a poor measure of "true" living standards, even if it does not suffer from measurement error in the sense used in our prior robustness checks.

This means that "true" living standards and urbanization could have a stable relationship over time, but using GDP per capita mistakenly leads us to infer changes have occurred. Perhaps the increased urbanization rates in poor countries between 1950 and 2010 is associated with distinct improvements in living standards due to the introduction of new products (e.g. electricity, mobile phones), even though measured GDP per capita has not changed much. Thus "*urbanization without growth in GDP per capita*" may not imply that there is "*urbanization without growth in living standards*". With that caveat in mind, our results show that urbanization is higher at all standards of living as captured by GDP per capita.

2.3. The evolution of mega-cities

The rise of "mega-cities" over time mirrors the changes in urbanization just documented. By mega-cities we mean the largest urban agglomerations observed in a given time period. The absolute size of mega-cities has grown over time across countries at all levels of development, similar to the urbanization rate. But there was significant growth in mega-cities that occurred in the rapidly industrializing countries of the 19th and early-20th century before spreading across the rest of the developing world in the 20th century.

Fig. 5 shows two maps, first for 1900 (Panel A) and second for 2010 (Panel B). In each, the 100 largest cities in that year are plotted by location, with the size of the circles indicating absolute size. In 1900, it is clear that the vast majority of these mega-cities are concentrated within what would be considered the developed world

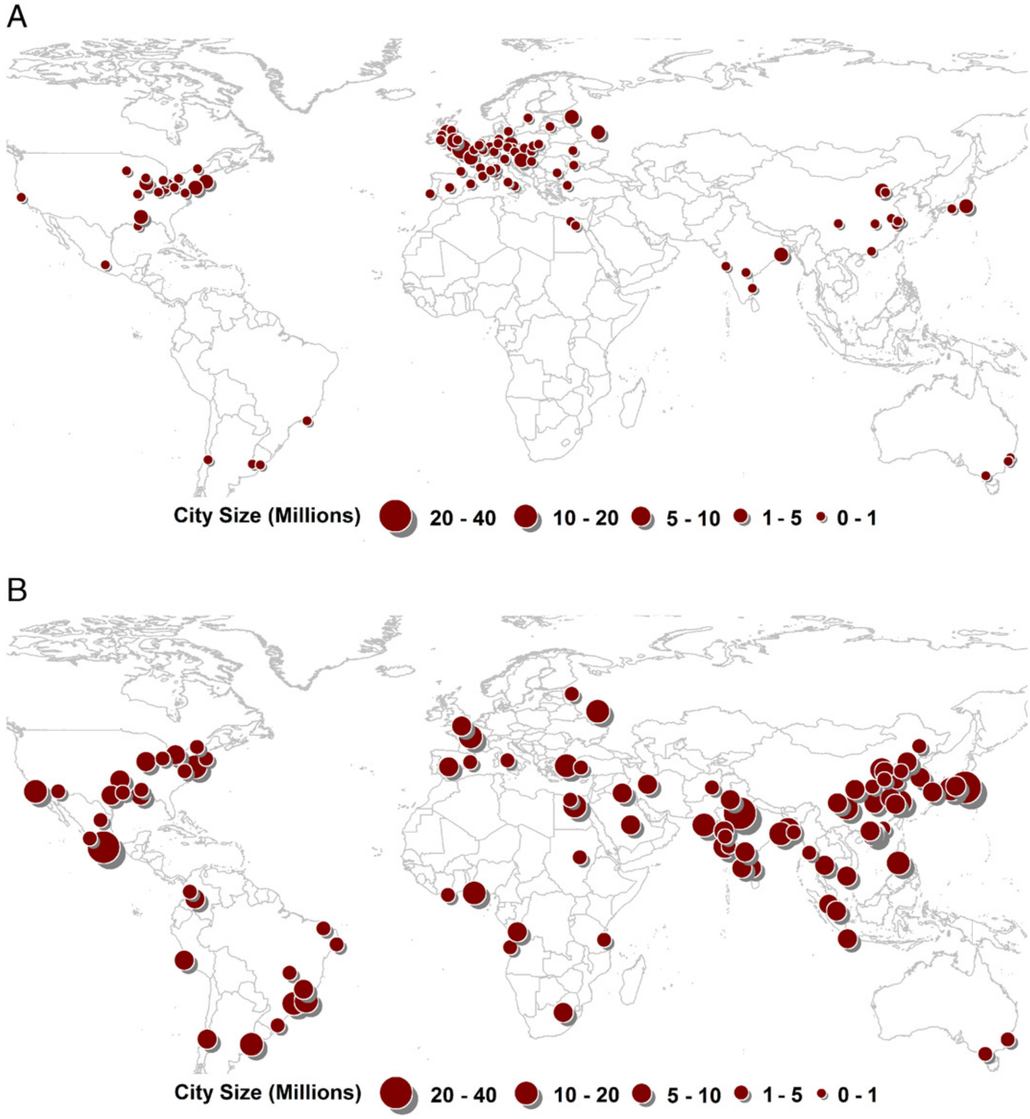

Fig. 5. Location of world's 100 largest mega-cities across time. Panel A: 1900 height 18 pt depth 10 pt width 0 pt. Panel B: 2010 height 18 pt depth 10 pt width 0 pt. Notes: Population sizes are in millions. The main sources of the data are Chandler (1987); United Nations (2014). We use the year 1900 instead of the year 1910 as in the analysis on urbanization rates, because Chandler only lists the 100 largest cities for the year 1900.

at that point. The largest cities in 1900 are London (6.5 million), New York (4.2), and Paris (3.3). Industrial centers such as Manchester (1.4) and Birmingham (1.2) are among the largest 15 cities in the world in 1900. Beijing (1.1) and Kolkata (1.1) are the only cities over 1 million inhabitants in 1900 that are located in non-industrializing countries of that period.

In contrast, in 2010 (Panel B) the geographic location of mega-cities has shifted away from the richest developed nations and towards less-developed ones. The map in Panel B shows a much wider geographic spread of the largest cities in the world. There are still several large cities in Europe and North America, but by 2010 mega-cities are located across Central and South America, Africa, and Asia. The largest city in 2010 is Tokyo (37 million), in a currently developed nation. But the next largest are Delhi (21.9), Mexico City (20.1), Shanghai (20.0), and Sao Paulo (19.7), all in what would be considered developing nations. Further, cities such as Dacca (14.7), Manila (11.9), Lagos (10.8), and Kinshasa (9.4) are among the largest cities in the world despite being in located in some of the poorest countries.

Table 1 lists the largest 30 cities in selected years from 1500 to 2010, and a few general patterns emerge.

Table 1
World's 30 largest megacities (millions), 1500–2010.

Rank	1500		1700		1825		1850		1875		1900		1950		2010	
1	Beijing	0.7	Istanbul	0.7	Beijing	1.4	London	2.3	London	4.2	London	6.5	New York	12.3	Tokyo	36.8
2	Vijayanagar	0.5	Tokyo	0.7	London	1.3	Beijing	1.6	Paris	2.3	New York	4.2	Tokyo	11.3	Delhi	21.9
3	Cairo	0.4	Beijing	0.7	Guangzhou	0.9	Paris	1.3	New York	1.9	Paris	3.3	London	8.4	Mexico	20.1
4	Hangzhou	0.3	London	0.6	Paris	0.9	Guangzhou	0.9	Berlin	1.0	Berlin	2.7	Paris	6.3	Shanghai	20.0
5	Tabriz	0.3	Paris	0.5	Tokyo	0.7	Istanbul	0.8	Vienna	1.0	Chicago	1.7	Moscow	5.4	Sao Paulo	19.7
6	Istanbul	0.2	Ahmedabad	0.4	Istanbul	0.7	Tokyo	0.8	Istanbul	0.9	Vienna	1.7	Buenos Aires	5.1	Osaka	19.5
7	Paris	0.2	Osaka	0.4	St. Petersburg	0.4	New York	0.6	Beijing	0.8	Tokyo	1.5	Chicago	5.0	Mumbai	19.4
8	Guangzhou	0.2	Isfahan	0.4	Hangzhou	0.4	Mumbai	0.6	Mumbai	0.8	St. Petersburg	1.4	Kolkata	4.5	New York	18.4
9	Nanking	0.1	Kyoto	0.4	Kyoto	0.4	St. Petersburg	0.5	Philadelphia	0.8	Manchester	1.4	Shanghai	4.3	Cairo	16.9
10	Cuttack	0.1	Hangzhou	0.3	Naples	0.4	Berlin	0.4	St. Petersburg	0.8	Philadelphia	1.4	Osaka	4.1	Beijing	16.2
11	Fez	0.1	Amsterdam	0.2	Osaka	0.4	Hangzhou	0.4	Tokyo	0.8	Birmingham	1.2	Los Angeles	4.0	Dacca	14.7
12	Adrianople	0.1	Naples	0.2	Suzhou	0.3	Philadelphia	0.4	Guangzhou	0.7	Moscow	1.1	Berlin	3.3	Kolkata	14.3
13	Xian	0.1	Guangzhou	0.2	Lucknow	0.3	Vienna	0.4	Kolkata	0.7	Beijing	1.1	Philadelphia	3.1	Buenos Aires	14.2
14	Ayutthaya	0.1	Aurangabad	0.2	Vienna	0.3	Liverpool	0.4	Liverpool	0.7	Kolkata	1.1	Rio de Janeiro	3.0	Karachi	14.1
15	Seoul	0.1	Lisbon	0.2	Xian	0.3	Kolkata	0.4	Glasgow	0.6	Boston	1.1	St. Petersburg	2.9	Istanbul	12.7
16	Suzhou	0.1	Cairo	0.2	Lisbon	0.3	Naples	0.4	Manchester	0.6	Glasgow	1.0	Mexico	2.9	Rio de Janeiro	12.4
17	Venice	0.1	Xian	0.2	Moscow	0.3	Manchester	0.4	Moscow	0.6	Osaka	1.0	Mumbai	2.9	Los Angeles	12.2
18	Naples	0.1	Seoul	0.2	Cairo	0.2	Moscow	0.4	Birmingham	0.5	Liverpool	0.9	Detroit	2.8	Manila	11.9
19	Ahmedabad	0.1	Dacca	0.2	Berlin	0.2	Glasgow	0.3	Boston	0.5	Istanbul	0.9	Boston	2.6	Moscow	11.5
20	Milan	0.1	Ayutthaya	0.2	Hyderabad	0.2	Suzhou	0.3	Naples	0.5	Hamburg	0.9	Cairo	2.5	Chongqing	11.2
21	Chengdu	0.1	Venice	0.1	Patna	0.2	Kyoto	0.3	Cairo	0.4	Buenos Aires	0.8	Tianjin	2.5	Lagos	10.8
22	Fuzhou	0.1	Suzhou	0.1	Madrid	0.2	Osaka	0.3	Chicago	0.4	Budapest	0.8	Manchester	2.4	Paris	10.5
23	Delhi	0.1	Nanking	0.1	Amsterdam	0.2	Madras	0.3	Hyderabad	0.4	Mumbay	0.8	Sao Paulo	2.3	Shenzhen	10.2
24	Gent	0.1	Rome	0.1	Dublin	0.2	Lucknow	0.3	Lyon	0.4	Ruhr	0.8	Birmingham	2.2	Seoul	9.8
25	Kaifeng	0.1	Smyrna	0.1	Seoul	0.2	Birmingham	0.3	Madras	0.4	Rio de Janeiro	0.7	Shenyang	2.1	London	9.7
26	Moscow	0.1	Srinagar	0.1	Kolkata	0.2	Xian	0.3	Madrid	0.4	Warsaw	0.7	Roma	1.9	Jakarta	9.6
27	Florence	0.1	Palermo	0.1	Benares	0.2	Dublin	0.3	Amsterdam	0.3	Tientsin	0.7	Milano	1.9	Guangzhou	9.6
28	Prague	0.1	Moscow	0.1	Manchester	0.2	Lisbon	0.3	Baltimore	0.3	Shanghai	0.6	San Francisco	1.9	Tientsin	9.5
29	Aleppo	0.1	Milan	0.1	Glasgow	0.2	Cairo	0.3	Brussels	0.3	Newcastle	0.6	Barcelona	1.8	Kinshasa	9.4
30	Tunis	0.1	Madrid	0.1	Madras	0.2	Patna	0.2	Budapest	0.3	St. Louis	0.6	Glasgow	1.8	Nagoya	9.2

Notes: The main sources of the data are Chandler (1987); United Nations (2014). We use the years 1825 and 1900 instead of the years 1800 and 1910 as in the analysis on urbanization rates, because Chandler (1987) only lists the 100 largest cities for the years 1825 and 1900.

The absolute size of the largest cities has grown dramatically over time, and in particular after 1950. Beijing, the largest city in 1500, had around 700,000 inhabitants, and even by 1825 had grown to only 1.4 million. There were only 8 cities that were significantly larger than 100,000 inhabitants in 1500, and in 1700 only 20.

Even through the 19th century, the largest city sizes remained small by contemporary standards. London in 1875 was 4.2 million people, and 6.2 million by 1900. If London had not grown after 1900, it still would have been among the largest 5 cities in 1950. But by 2010 a population of 6.2 million is smaller than Dacca, Manila, Lagos, and Kinshasa, and would not put a city in the top 30 cities in the world. Fig. 6 shows the shift in the scale of mega-cities over time. It plots the maximum city size by year from 100 to 1950. Extending the figure to further years makes the scale all but useless, demonstrating the massive growth of cities since 1950. From maximum city sizes of around 500–700,000 between 100 and 1700, this accelerates so that maximum city size is over 5 million by 1900 and is over 12 million by 1950. The right-hand axis of Fig. 6 measures the average size of a mega-city, defined here as cities over 300,000 inhabitants.[6] The average is around 500,000 until 1700, and then by 1950 is close to one million inhabitants. In 2010, the average size of mega-cities is approximately 1.3 million. This confirms that the increase in the absolute size of cities was not only driven by the largest cities on earth, but for all cities across the board.

The acceleration in the size of mega-cities means that absolute growth has risen over time. The fastest change in population ever experienced by London was 93,000 new residents per year during the 1890s. New York grew by 220,000 new residents per year during the 1920s, and Los Angeles by 248,000 per year during the 1950s. In comparison, mega-cities in developing countries of the late 20th century are growing at absolute rates unseen in history. During the 2000s, Delhi added 620,000 residents per year, Beijing 603,000 per year, and Dacca 445,000. The raw flow of people into developing mega-cities is two to three times the maximum flow seen by mega-cities in the past. Absolute growth in the size of mega-cities in developing countries is an analogue of the higher

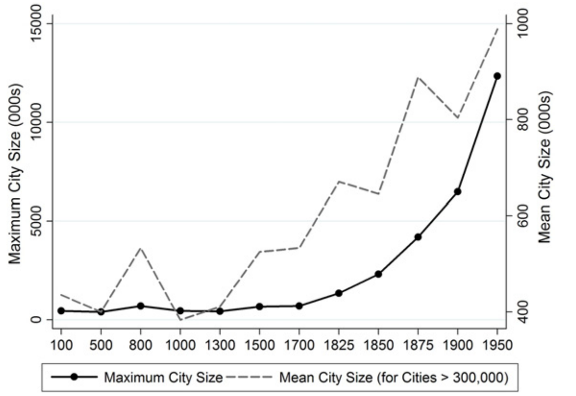

Fig. 6. Maximum and mean city size, 100–1950. Notes: The main sources of the data are Chandler (1987); United Nations (2014). The maximal city size is the size of the largest city in the world for different years. The mean city size is the mean size of all cities with at least 300,000 inhabitants for different years. We use 300,000 because it is the lowest population threshold for which we have data in 1950. Years beyond 1950 are not shown because the scale becomes unreadable.

urbanization rates among developing countries seen in the prior section.

This leads to the second general pattern observed from the location of mega-cities over time. For the period running from roughly 1500 until the mid-20th century, the largest cities in absolute size were typically located in the most advanced nations of their time. With the onset of the Industrial Revolution the association of mega-cities with economic development became even stronger. Looking at Table 1, in 1825 London and Paris are among the largest five cities in the world, but the top 30 cities range across Europe and Asia, with no North American cities on the list. As the Industrial Revolution begins to spread, however, by 1850 and 1875 the nature of the list has changed. By 1875 the top cities are London, Paris, New York, and Berlin. Beijing and Istanbul are still among the largest 10 cities in the world, but they have barely grown (or actually shrunk in size) between 1825–1875. As one moves down the list in 1875, industrializing cities such as Philadelphia, Liverpool, Glasgow, Manchester, Birmingham, and Boston have entered the list.

By 1900, as mentioned above, the list of largest cities is heavily concentrated in industrializing nations. Beijing and Istanbul have moved farther down the list, roughly stagnant in size while they are passed by cities such as Vienna, Tokyo, and Manchester. In 1950, the same pattern holds, with the majority of the largest cities located in the industrial countries of Europe and North America.

[6] The threshold of 300,000 is used because this is the lowest threshold for which we have city size data in 1950–2010, and for consistency we apply this threshold to previous years.

Fig. 7 plots the fraction of mega-cities, defined as those larger than 300,000 inhabitants, that are found in what are currently developing nations over time. To clarify, we take a contemporary threshold of "developing" countries (GDP p.c. less than $12,000 in 2000, as per the International Monetary Definition), and look backwards in time at their share of the largest cities in the world.[7] The black solid line shows this fraction, and as can be seen in 1700 this is about 45%. By 1850 this fraction is roughly the same, indicating that close to half of the largest cities in the world were in what are now considered developing countries. There was no distinct advantage to currently rich nations in the number of large cities prior to 1850.

However, the share of mega-cities in developing countries drops appreciably by 1900, to only about 30%, as the rich nations of today industrialized and experienced rapid urbanization. But following the rush of urbanization in currently rich nations, the developing world begins to catch up. By 1950, already, the fraction of largest cities in developing nations is back to 45%, and this fraction has climbed ever higher since then. It is currently close to 80%. The share of total population in large cities (the gray line) follows the share of cities themselves almost exactly. If we use 1 million as the cut-off for a large city, then the post-1900 pattern holds up as well. Finally, eliminating China and India from the calculation lowers the share of cities in developing nations across time, but we can again see the dip towards 1900 and then the catch-up by developing nations afterward. The rise of mega-cities in poor countries was thus not due to the fast urbanization of China and India in the modern period.[8]

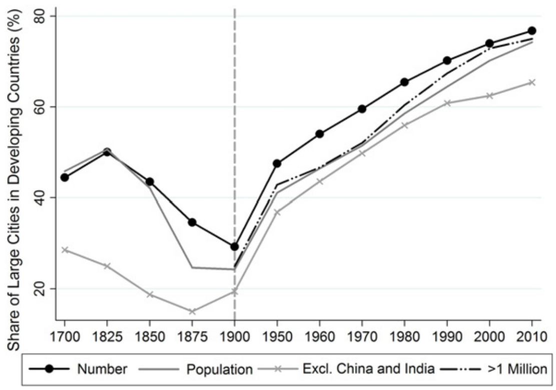

Fig. 7. Share of large cities in developing vs. developed countries, 1700–2010. Notes: The main sources of the data are Chandler (1987); Maddison (2008); Bolt et al. (2014); United Nations (2014). "Number" and "Population" show the relative shares of cities in developing countries in terms of number of cities above 300,000 inhabitants and total population of these cities, respectively. "Excl. China and India" and ">1 Million" show the relative share of cities in developing countries in terms of number of cities when excluding China and India or when restricting the sample to cities above 1 million inhabitants, respectively. We do not show the year for which we have fewer than 5 cities (1500 when using 300,000 as the threshold or 1500–1875 using one million). "Developing countries" are defined as those with log per capita GDP lower than 9.42 in 2010 (roughly $12,000), equivalent to the level in Slovakia in that year. Slovakia was the last country to graduate to the category of developed countries before the year 2010 according to International Monetary Fund (2009). The gray dashed line represents the year 1910.

This matches the pattern seen in urbanization rates in the prior section. Places that industrialized during this period saw the largest absolute growth in city sizes, and also tended to gain in both urbanization rate and measured GDP per capita. From the mid-20th century forward, however, we see the shift towards rapidly growing poor mega-cities in developing countries.

Further, there is evidence that city size in the past was a robust indicator of city-level living standards, while that relationship has broken down in more recent years. We do not have a consistent, comprehensive way to measure city-level living standards over time. But by combining several sources we believe we can show how the relationships have changed. For the pre-1910 period, our data are for welfare ratios calculated using nominal wages and price indices for minimal consumption baskets in different cities (Allen, 2007; Allen et al., 2011, 2012; Frankema and Van Waijenburg, 2012; Francis, 2013; Bassino et al., 2014). The 111 observations are at the city-year level, so that for many cities we have multiple observations over time. We rank all these observations based on their absolute city size. We then rank all these observations based on their real wage, and plot the rank of real wages against the rank of city size.[9]

[7] We use per capita income in 2010 rather than per capita income in each year to distinguish developed from developing countries. Indeed, all countries including today's developed countries were developing countries initially. Using income in 2010 thus allows us to distinguish cities in developing countries that industrialized and other developing countries that did not.

[8] This pattern is robust to using other thresholds for city size – 500,000, 2 million and 5 million inhabitants – see Web Appendix Fig. A.21.

[9] We use ranks rather than logs or levels for two reasons. First, we want a means of looking at the relationship that is comparable to later periods where we do not have the same welfare ratios. Second, city sizes have a skewed distribution and using ranks keeps the relationship from being driven by outliers. We use all cities that have data on a welfare ratio and that are greater than 100,000 inhabitants. This gives us 111 observations. We can restrict this to 61 cities over 300,000 inhabitants, and the results are similar (see Web Appendix Fig. A.22).

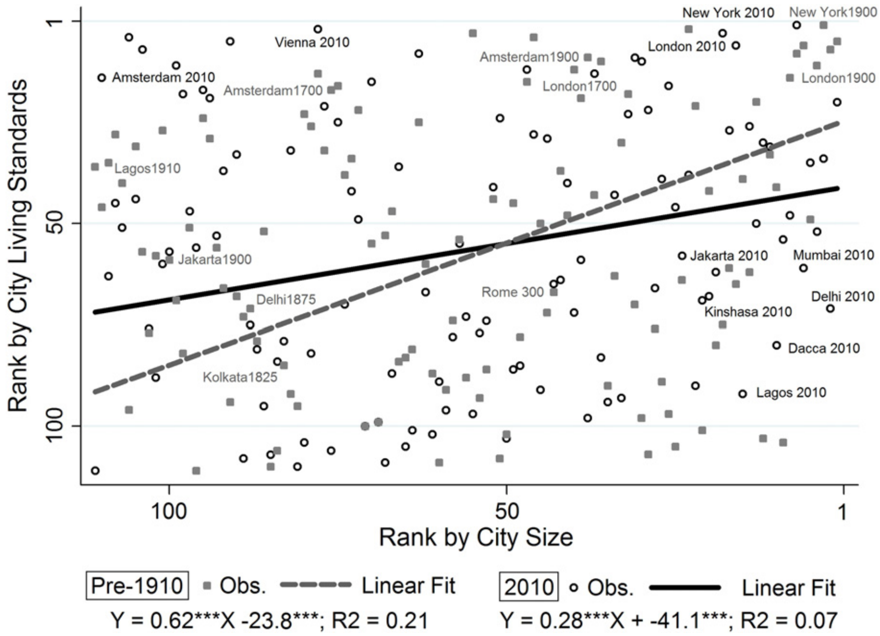

Fig. 8. City living standard rank versus city size rank, historically (pre-1910) and in 2010. Notes: This graph displays the relationship between city living standards and city size for 111 cities of more than 300,000 inhabitants in 2010 and 111 city-year observations of more than 100,000 inhabitants pre-1910 (we use multiple observations for a same city). For each period, we rank the cities by living standards and city size and show the correlation between the two (the linear fit is estimated using as weights the population of each city-year observation). City living standards are proxied by city product indexes in 2000–2010 and welfare ratios for the pre-1910 period. The two sources used to obtain the city product index in 2010 are United Nations Habitat (1998, 2012). The sources used to obtain the welfare ratios for the pre-1910 period (estimated for a "bare bones" consumption basket) are Allen (2007); Allen et al. (2011, 2012), Frankema and Van Waijenburg (2012); Francis (2013), Bassino et al. (2014). We obtain the size of each city from Chandler (1987); United Nations (2014).

Fig. 8 plots the rank of real wages against the rank of city size for these historical observations, and there is a positive relationship (the dashed line). This is not to say that the mega-cities of industrializing Europe or North America had high *absolute* living standards. These cities were congested and unhealthy. But city size did seem to indicate something regarding *relative* living standards at the time, and larger cities tended to have higher real wages. Likewise, Rome in 300 AD before the collapse of Roman Empire was not an exception to the rule, since its ranks in terms of real wages and size were relatively close. The correlation in rank between living standards and city size is approximately 0.6, where a correlation of 1.0 would indicate that city living standards lined up perfectly with size of city.

For the modern period, we do not have real wage measures comparable to historical data. However, we do have a city product index for a sample of 111 cities of at least 300,000 inhabitants in 2010 (United Nations Habitat, 1998; United Nations Habitat, 2012). The product index is measured using such inputs as capital investment, formal versus informal employment, trade, savings, exports and imports, and household income and consumption. Full details are available in the UN reports. For these observations we again rank them by size, and rank them by city product index, and then plot the rank of living standard against the rank of size. In Fig. 8 these are also plotted along with a linear fit (the solid line). The correlation in 2010 is only half the size, at 0.28, than in the historical data. The largest mega-cities today are thus twice less likely to be the richest cities than in the past.[10]

To highlight the differences over time, several individual cities are highlighted in the figure. Amsterdam, London, and New York all have relatively high ranked living standards, both before and after 1910. But note that their relative rankings in city size have changed over time. From 1700 to 1900 both Amsterdam and London shift to the right, indicating they are larger relative to other cities in the pre-1910 ear. We do not have living standard data for New York from 1700, but its growth in size from 1700 to 1900 is clear. London in

[10] We thus compare 111 cities larger than 300,000 inhabitants in 2010 with 111 cities larger than 100,000 inhabitants pre-1910. The results are robust to also using a threshold of 300,000 inhabitants for cities in the pre-1910 period. As we have only 61 cities above 300,000 inhabitants pre-1910, we only consider the 61 largest cities in 2010. See Web Appendix Fig. A.22.

1900 is the largest city in this pre-1910 data. New York in 1900 is also one of the largest cities of the time. All three are ranked among the richest cities in the world in 1900. From that point forward, however, they slip down the rankings in size while maintaining their position in living standards. By 2010 Amsterdam is no longer even in the top 100 cities by size, London has dropped to 25th, and New York to 8th.

In comparison are a number of currently poor mega-cities. Lagos in 1910, Jakarta in 1900, Delhi in 1875, and Kolkata in 1825 are all relatively small, and relatively poor. If we compare them to their contemporary positions, they have all moved up to become among the largest cities of the world in 2010. However, this has not been associated with a move up in the rankings in living standards. They have grown in absolute size, but this has not caught them up to places like Amsterdam, London, and New York in living standards. Other megacities in the developing world such as Dacca and Kinshasa are among the largest cities in the world while being also among the poorest.

The patterns in Fig. 8 are thus in line with the results for urbanization rates seen in the prior section. We have *urbanization without growth* across all cities of the world, so to speak, with absolute sizes growing everywhere. However, this occurred first in the richest cities, and only later in the 20th century was matched by growth among the poorest.

2.4. Summary of empirical analysis

Given our evidence regarding urbanization rates and mega-cities, several patterns stand out in the relationship of urbanization and development. If we compare urbanization and development in 1500 to 2010, there has been a distinct level shift in urbanization rates over time at all levels of income per capita. On average, urbanization rates are about 25–30 percentage points higher today than in 1500. Urbanization has diffused across all levels of development over the last 500 years, and one could term this shift *urbanization without growth*.

But this shift took place in two distinct phases. First, from the period 1500 to the mid-20th century, urbanization rose rapidly for the *richest* countries, while remaining stagnant for the poorest. The location of the largest cities was concentrated in the richest areas of the world in this period. In particular it is during the early 20th century, overlapping with the widespread industrialization of Europe and North America, when the correlation of urbanization and income per capita becomes the most pronounced.

Second, from the mid-20th century to the present we have seen a distinct change in this pattern. Urbanization rates have risen for the very poorest countries, and the location of mega-cities is shifting towards poor, developing countries and away from rich, developed ones. The correlation between urbanization and development has been falling demonstrably over the late 20th century when compared to the historical experience. While developing countries in the 20th century have experienced *urbanization without growth*, this is not unique to them, nor does it constitute an anomaly from the perspective of historical patterns of urbanization.

3. Urbanization and development in theory

How are we to understand the *urbanization without growth* at all income levels between 1500 and 2010? Further, what explains the fact that this shift occurred first in the richest countries between 1500 and the mid-20th century, and then took hold only in the latter half the 20th century among the poorest countries?

In this section we review theories of urbanization and development to explore the possible answers to these questions. We first present a simple framework for thinking about urbanization and development in order to provide a consistent means of comparing theories.

3.1. Conceptual framework

From an accounting perspective we can write

$$y = w_r + u(w_u - w_r), \tag{1}$$

where y is income per capita, w_r are rural earnings per (rural) worker, w_u are urban earnings per (urban) worker, and u is the urbanization rate. From this we can see that there is a relationship between urbanization and income per capita if $w_u \neq w_r$. Empirically, it may be the case that $w_u > w_r$ at a given time or in a given country, and hence increased urbanization would lead to higher average income per capita.

The urbanization rate, u, will depend on the relative utility of people in the two areas. Denote rural utility $U_r(w_r, X_r)$ and urban utility $U_u(w_u, X_u)$, where X_r and X_u capture all the ancillary characteristics of these areas (e.g. amenities or mortality rates). Utility in both sectors is increasing in earnings and the level of X. If $U_u(w_u, X_u) > U_r(w_r, X_r)$ then there is migration from rural to urban areas, and u is increasing. In the case where $U_u(w_u, X_u) < U_r(w_r, X_r)$, then u would be decreasing. The economy will tend towards an equilibrium where $U_u(w_u, X_u) = U_r(w_r, X_r)$, but this transition could take years or decades.

3.2. Urbanization with growth

The experience of the classical Industrial Revolution has informed much of the literature on urbanization and development, which often uses it as an example of how urbanization and structural transformation interact to produce higher levels of GDP per capita. These theories reflect *urbanization with growth*, in that urbanization is seen as either a consequence of productivity growth that causes structural change into predominantly urban sectors, or a cause of productivity growth in the economy due to agglomeration effects. To simplify greatly, these theories give explanations for why the *slope* of the relationship between urbanization and GDP per capita is positive, but do not necessarily explain why the level of urbanization rose over time at all levels of GDP per capita.

We discuss first theories where urbanization is a consequence (agricultural, industrial, and resource revolutions) of economic growth before turning to urbanization as a cause of economic growth.

3.2.1. Agricultural revolutions

In poor countries, large fractions of land and labor are devoted to producing food for subsistence needs (Schultz, 1953; Gollin et al., 2002, 2007). This "food problem" prevents the reallocation of productive resources to other sectors. An *agricultural revolution* provides an increase in food productivity that reduces the food problem and releases labor for the modern and/or urban sector (Matsuyama, 1992; Caselli and Wilbur John Coleman, 2001; Gollin et al., 2002, 2007; Nunn and Qian, 2011; Michaels et al., 2012; Motamed et al., 2014). This structural change could be the consequence of income effects: non-homothetic preferences and rising incomes mean a reallocation of expenditure shares towards non-food goods (Engel's law). Or it could be the consequence of price effects: assuming a low elasticity of substitution across consumption goods, any increase in the productivity of the food sector leads to a decrease in its employment share. In either case the non-food sectors are predominantly urban, which is consistent with data on residence and sector of employment (Gollin et al., 2013).[11]

3.2.2. Industrial revolutions

This approach describes how a rise in industrial productivity attracts underemployed labor from agriculture into the industrial sector (Lewis, 1954; Hansen and Prescott, 2002; Lucas, 2004; Alvarez-Cuadrado and Poschke, 2011), which is presumed to be more concentrated in urban areas than is agricultural production.[12] This approach either assumes that there is no food problem or that there is some other means of meeting subsistence food requirements. There could be surplus labor in the agricultural sector, as in the dual economy model of Lewis (1954), or the industrial could be preceded by an agricultural revolution, as in Asia where the Green Revolution occurred early (Evenson and Gollin, 2003). Alternatively, an industrial revolution could directly facilitate the modernization of agriculture through better agricultural intermediate inputs (Yi and Zhang, 2011). Lastly, a country could export manufactured goods (or services) to import food (Matsuyama, 1992; Teigner, 2011; Yi and Zhang, 2011). Regardless of the exact mechanism, in these models an industrial revolution draws labor into urban areas in response to a productivity improvement.

3.2.3. Resource revolutions

Revenue windfalls from resource extraction – oil, gold, and diamonds – may also drive urbanization. Gollin et al. (2013), Jedwab (2013), and Cavalcanti et al. (2014) show that resource revenues provide additional income, as well as having a significant effect on urbanization rates.[13] The resource revenues are spent disproportionately on urban goods and services, either because of income effects similar to an agricultural revolution or the concentration of revenues in the hands of an urban elite. These resource revolutions may not have the same long-run effects on growth as agricultural or industrial revolutions as they tend to produce "consumption cities" where the workforce is

[11] Bustos et al. (2013) suggest that the factor bias of agricultural technology matters for whether labor is released from that sector or not. Existing theories typically presume that productivity is labor-saving and so leads to urbanization. Further, with trade in food anything that lower the world price could lead to urbanization even in countries that do not experience a productivity improvement (Glaeser, 2013; Gollin et al., 2013).

[12] In the longer run, developed countries do eventually deindustrialize, and specialize in tradable services such as finance and business services, thus producing a rise and fall of manufacturing (Herrendorf et al., 2011; Buera and Kaboski, 2012). More recently, a country may directly specialize in tradable services (Ghani and Kharas, 2010; Gollin et al., 2013), as exemplified by Dubai, Macao, or Bangalore and Hyderabad in India. Other examples include merchant cities of the 15th–17th century (Acemoglu et al., 2005).

[13] More generally, any rent (e.g., international aid, remittances or illicit trafficking in arms and drug) could produce urbanization due to similar forces.

concentrated in non-tradable services as opposed to tradable industrial goods or services.

3.2.4. Agglomeration effects

Unlike the prior two theories, the economic geography literature suggests that causation runs from urbanization to productivity in both developed countries (Rosenthal and Strange, 2004; Henderson, 2005; Glaeser and Gottlieb, 2009; Combes et al., 2012; Duranton and Puga, 2013) and developing countries (Overman and Venables, 2005; Henderson, 2010; Felkner and Townsend, 2011; Duranton, 2014). Cities allow countries to save on the transportation costs of goods, people and ideas (see Glaeser and Gottlieb (2009) for a thorough survey of the literature). First, by agglomerating thousands or millions of people in a few locations, cities facilitate the distribution of goods. Firms are closer to suppliers. They are close to consumers, and vice versa. Second, cities create thick labor markets and are centers of human capital accumulation. In particular, returns-to-scale imply that universities and hospitals are located in large cities. Third, if there are agglomeration economies within sectors (localization economies) or across sectors (urbanization economies), firms directly benefit from being located close to firms of the same or different industries. As long as these agglomeration effects dominate congestion effects, cities increase productivity and wages in the long run. Empirical evidence suggest that these mechanisms are also at play in developing countries (Henderson et al., 2001; Lall et al., 2004; da Mata et al., 2007; Deichmann et al., 2008; Henderson, 2010) and many have argued that urbanization may promote growth in these countries (Duranton, 2008; World Bank, 2009; Venables, 2010; McKinsey,, 2011).

Retrospectively, the models described above appear to describe well the experience of European (and Neo-European) countries over the period from the late 19th century to 1950 (Bairoch and Goertz, 1986; Bairoch, 1988; Williamson, 1990; Kim and Margo, 2004; Kim, 2006; Allen, 2009). The agricultural revolution created a food surplus, which helped establish and consolidate urban networks across Europe. Whether the agricultural revolution directly preceded the original Industrial Revolution, or was necessary for it at all, is beyond the scope of this paper. What we know is that cities in Europe and the Neo-Europe grew as industrial centers, as seen in the pattern of mega-city growth in this period.

In our framework, the source of urbanization is fundamentally a change in productivity. This raises w_u relative to w_r either directly (as in an industrial revolution) or indirectly (through the low income elasticity for food), and *ceteris paribus*, raises $U_u(w_u, X_u) > U_r(w_r, X_r)$. Urbanization increases as workers migrate from rural to urban areas in search of higher urban earnings. If agglomeration effects are present, then w_u is itself a function of u (or absolute city size) and this creates a positive feedback where increased urbanization leads to higher wages and even more in-migration to urban areas. Thus, in each of these theories countries "climb up" the line relating urbanization and GDP per capita.

Further exaggerating the relationship between urbanization and development was, perversely, the low living standards in cities of this period. These were "killer cities" (Williamson, 1990; Clark and Cummins, 2009; Voigtlaender and Voth, 2009; Voigtlaender and Voth, 2013; Christiaensen et al., 2013; Jedwab and Vollrath, 2015) with high densities, industrial smoke, polluted water sources and unhygienic practices contributing to high urban mortality. As a result, industrial cities could not grow without massive inflows of migrants willing to move to unhealthy urban environments. Rural migration was thus the main driver of urban growth (Williamson, 1990; Kim, 2007; Christiaensen et al., 2013; Jedwab and Vollrath, 2015). The poor conditions in cities would imply that in terms of the non-pecuniary measures $X_u < X_r$. Hence equilibrium would require $w_u > w_r$ to ensure that $U_u(w_u, X_u) = U_r(w_r, X_r)$ in equilibrium. With $w_u > w_r$, any increase in urbanization would have mechanically raised measured income per capita, as noted in Eq. (1), even if this did not involve any improvement in welfare. Furthermore, in a Malthusian setting, this urbanization would have led to higher equilibrium w_u and w_r by raising mortality rates through warfare and plague (Voigtlaender and Voth, 2013).

The same theories are somewhat successful in explaining the urbanization processes of Latin America and Asia in the 20th century. The agricultural revolution and the industrial revolution first diffused to the Neo-European countries of Latin America in the late 19th century. Argentina, Chile and Uruguay were among the most urbanized countries in 1950 (their urbanization rates were respectively 65%, 58% and 78%). The revolutions then diffused to much of the rest of the Latin American region in the 20th century (Kingsley and Casis, 1946; Bairoch, 1988; Machicado et al., 2012). The urbanization rate of Latin American and the Caribbean region as a whole increased from about 20% in 1900 to 40% in 1950 and 80% in 2010.

More recently, agricultural and industrial revolutions have diffused to East Asia, and to a lesser extent, South-East Asia (Bairoch, 1988; Bosworth and Collins, 2008; Brandt et al., 2008). The urbanization rate of Asia has increased from about 10% in 1900 to 15% in 1950 and 45% in 2010. The following countries have developed and urbanized (or are in the process of doing so) over the course of the 20th century: Japan, South Korea, Hong Kong, Singapore, Taiwan, Malaysia, Thailand and China.

Over this same period, the revenues from resource extraction have led to significant increases in urbanization and income per capita in many countries (Gollin et al., 2013). Oil producers of the Middle-East (e.g. Kuwait, Saudi Arabia) are obvious examples, but countries such as Mongolia, Malaysia, and Indonesia have also urbanized rapidly while exporting resources. In Sub-Saharan Africa, the wealthiest and most urbanized countries are those with significant resource exports, such as Angola, Botswana, Nigeria, and South Africa. Resource extraction was historically a source of urbanization in the US South (cotton and tobacco), the Caribbean islands (sugar and cotton), and South America (silver, copper, and more recently oil).

3.3. Urbanization without growth

The theories just reviewed link urbanization to productivity improvements explicitly, but do not provide a way of understanding how urbanization may rise even in the absence of those productivity improvements. Our empirical work showed that urbanization has risen for *all* countries over time, not just those that were blessed with rich resource deposits or that experienced industrialization.

The *urbanization without growth* that we documented at every level of income per capita is not necessarily a bad thing, even though it is not linked to productivity explicitly. Positive sources of *urbanization without growth* include changes in urban amenities due to the diffusion of urban technologies that limit congestion and disease, or changes in preferences towards urban living. Of course, there are also negative sources that induce higher urban populations through distortions to prices or labor allocations without necessarily improving urban amenities. We discuss first positive sources of *urbanization without growth*, followed by negative sources.

3.3.1. Urban technologies

As noted previously, the largest cities of today's developing world are much larger than the largest cities of the previous centuries. The list of largest cities in the world in 2010 is dominated by developing country cities. The growth of these mega-cities was accelerated by specific kinds of (urban) technological progress (Bairoch, 1988; Glaeser, 2011) over the last one hundred years. Given a walking speed of 5 km per hour, the size of cities was traditionally limited to about 20 sq km. Obviously, cities are able to grow larger when people could use horse carriages. This all changed with the transportation (and architectural) revolutions of the 19th and 20th centuries. First, railways (trains, tramways and metro lines) and roads (cars, buses, motorbikes and bicycles) have reduced transportation costs for goods and people. Second, cities have also become denser, after the invention of cheap steel, and the elevator, which allowed the construction of taller buildings. Whether cities are becoming denser (building up) or sprawling (building out), it is relatively easier to be "urban" in the 21st century now that these technologies have diffused across countries.

3.3.2. Urban amenities and preferences

In the Rosen–Roback model (Rosen, 1979; Roback, 1982, 1988), rents and wages are higher in cities with a better quality of life, because people directly value it in their utility function. In other words, they are willing to "pay" for a better quality of life (by accepting a lower net income). This utility differential is often explained by urban amenities or the natural features of some cities (the diversity of restaurants and entertainment venues, the proximity to a river or the coast, etc.). Cities also have advantages in consumption (Glaeser et al., 2001; Rappaport et al., 2003). For example, Glaeser et al. (2001) show how the demand for living in cities has risen over time in the U.S. A historical amenity of cities may have been their role as safe havens from violent conflict (Glaeser and Shapiro, 2002; Dincecco and Gaetano Onorato, 2013) or from persecution by feudal lords (Pirenne, 1925, 1936).

3.3.3. Urban bias

Urbanization without growth is often attributed to the urban bias (Lipton, 1977; Bates, 1981; Bairoch, 1988), i.e. urban-biased policies such as agricultural overtaxation, public employment in the manufacturing and service sectors (e.g., the government sector), and food price subsidies for urban residents. Such distortions artificially increase the urban–rural income gap, which fuels migration.[14] If public employment is concentrated in the largest city, the urban bias may

[14] Symmetrically, rural-biased policies, or migration restrictions, should "artificially" reduce the urbanization rate. Au and Vernon Henderson (2006) show that a large fraction of cities in China are undersized due to strong migration restrictions.

also lead to urban primacy (Ades et al., 1995; Davis and Vernon Henderson, 2003). Urbanization here does not come from income growth but from sectoral distortions (a reallocation of income across areas, given a constant income level). From a historical perspective, this type of urban bias is perhaps evident in Rome, Tenochtitlan, Beijing, and Byzantium as they grew as administrative centers of large empires without necessarily being associated with sustained growth in income per capita.

3.3.4. Rural poverty

Rural poverty (whether it is due to agricultural overtaxation or another factor), land pressure (due to demographic growth, given land is inelastically supplied) and man-made or natural disasters (e.g., wars that destroy villages or climate change) constitute rural push factors feeding rural exodus (World Bank, 2000; Barrios et al., 2006; Poelhekke, 2011; Henderson et al., 2013a). These factors result in a lower rural wage, the urban–rural income gap increases, and poor migrants flock to the cities. These migrants find employment in the low-productivity urban sectors if urban labor markets have a limited absorption capacity.

3.3.5. Internal urban growth

Historical experience suggests that urbanization is primarily associated with in-migration. However, that no longer appears to be the case in many developing countries. With the onset of the mortality transition after World War II, urban mortality rates plummeted in most nations. This has led to rapid natural increase within cities (Rogers, 1978; Keyfitz, 1980; Rogers and Williamson, 1982; Potts, 1995; Christiaensen et al., 2013; Jedwab and Vollrath, 2015) as urban fertility remained high while mortality fell to low levels. Christiaensen et al. (2013) call these “mushroom cities” for these cities, which grow through “urban push” as opposed to the commonly used “rural push” (such as from an agricultural revolution) and “urban pull” (as from an industrial revolution). This implies that cities grow not as a result of income growth, but due to a shift in demographic behavior. The rapid natural increase of the urban population drives up absolute city sizes and tends to raise the urbanization rate, although there is not necessarily any change in development levels.

In terms of our framework, these various theories suggest several ways in which urbanization and development need not be closely related. Consider the positive theories of *urbanization without growth* — the diffusion of urban technologies and increasing urban amenities. In these theories $U_u(w_u, X_u)$ may rise due to factors influencing X_u, the inherent utility in urban area. Increased urban utility would draw migrants from rural areas and keep existing urban residents from leaving. Thus urbanization could increase without any change in earnings w_u or w_r.[15]

Negative theories of *urbanization without growth* work somewhat differently. These policies may use subsidies and/or taxes to raise w_u relative to w_r, inducing people to move from rural to urban areas. As this represents a distortion to the efficient allocation, this would lower the level of both w_u and w_r. Alternatively, if urban amenities X_u are increased by extracting rural resources, then this will induce a shift of population towards urban areas, but at the cost of lower rural wages relative to urban areas. In both cases, urbanization is associated with lower earnings per worker.

In the period from 1500 to 1950, there appear to be some clear features of positive *urbanization without growth* occurring. Without taking a stand on causality, industrialization and improvements in urban technologies occur within a similar time period. Otis’ elevator arrives in 1852. The first skyscraper (the 10-story Home Insurance Building in Chicago) was built in 1885, and the first all-steel framed skyscraper arrived in 1889. For public sanitation, John Snow demonstrated the correlation of cholera and water sources in London in 1854, and that city began regulating water supply standards in 1855. Chlorination of drinking water to eliminate germs begins in the 1890s. The availability of clean drinking water and sewage service meant that 20th century cities were no longer “killers”.

Transportation technologies like the steamboat and railroad, which arrived in the early 19th century, made supplying cities cheaper, allowing them to grow. Intra-city rail networks arrived in the mid-19th century (e.g. The Metropolitan Railway began service in 1863 in London). Automobiles arrived in the late 19th century, and by 1911 the first highway, the Long Island Motor Parkway, had opened. Taken all together, these technologies made cities more attractive places to live, allowing urbanization rates to rise without necessarily meaning that productivity increased. *Urbanization without growth* was a feature of the industrializing world, even if there as also significant *urbanization with growth* occurring at the same time.

For the post-1950 era, some combination of these positive and negative forces seems to be a plausible way

[15] Rural poverty would operate differently, by lowering X_r and making rural areas inherently less attractive. This would also drive more population into urban areas without an appreciable change in development levels.

of thinking about the shift up in the level of urbanization at low levels of GDP per capita. The mortality transition (Stolnitz, 1955; Davis, 1956; Preston, 1975; Acemoglu and Johnson, 2007) lowered urban mortality substantially in developing countries in this period and allowed for both “urban push” demographic growth as well as making cities more attractive locations for workers. Developing countries were able avoid the “killer cities” of the rich world’s history (Fogel, 2004), which create *urbanization without growth* by leaving more people alive in cities and making them more attractive destinations.

However, there also appears to have been significant *urbanization without growth* for negative reasons occurring in these developing countries. The poor mega-cities of the late 20th do not take advantage of innovations in city technology (e.g. public transportation, skyscrapers, sanitation) to an extent consistent with their size. Urban bias (Lipton, 1977; Bates, 1981; Bairoch, 1988; Ades et al., 1995) appears to be very strong with developing countries in the late 20th century, particularly in Africa. Rural poverty, driven either by increasing density, climate change, or wars, has driven more residents to mega-cities, again representing a negative source of *urbanization without growth*.

Urbanization without growth is not limited to the period from 1500–2010, of course. One could argue that the cities of Ancient Greece, the Roman Empire, the Aztecs, the European Renaissance, Ottoman Empire, Moghul India, China during the Qing dynasty all displayed *urbanization without growth* even if they may have been examples of commercial “efflorescences” (Braudel, 1973). These booms in urbanization (Rome may have reached 1 million residents at its peak) could have been for positive reasons of better amenities such as regular water supplies, or represented urban bias associated with empire-building. Regardless, it seems clear that *urbanization without growth* is not a process unique to the late 20th century.

4. Discussion and conclusion

By putting the relationship of urbanization and development in historical perspective, it is possible to see that *urbanization without growth* documented in the late 20th century is actually a continuation of a process running back to 1500. Over the last five centuries urbanization rates have risen at every level of GDP per capita, so that urbanization rates are now about 25–30 percentage points higher at all income levels than they were in 1500.

This *urbanization without growth* occurred it two distinct phases, however. From 1500 to roughly 1950 or 1960, urbanization rates increased dramatically in the richest countries in the world, and the growth of the largest cities was concentrated in those rich nations.

But at that point the relationship has changed. *Urbanization without growth* in the late 20th century has occurred in the poorest countries of the developing world. The absolute size of cities has increased rapidly in the poorest countries during the late 20th century, and city size is becoming less indicative of city living standards than in the past.

These historical comparisons provide several lessons for studying urbanization and growth. First, they caution us not to presume that urbanization and industrialization or development are synonymous. Urbanization has occurred throughout history without necessarily being associated with manufacturing expansion or with rapid economic development, as during an industrial revolution. This *urbanization without growth* may be good (e.g. due to lower urban mortality rates) or bad (e.g. rent-seeking in capital cities) for welfare. Second, theories that are built to explain the positive correlation of urbanization and income per capita, typically involving sectoral shifts following a productivity improvement, are not sufficient to understand all of the long-run shifts in urbanization rates seen in the world.

Appendix A. Data sources

Most of our analysis is at the country level, and so we require country-level data on urbanization rates and development levels. For development, we use log GDP per capita (PPP, constant 1990 dollars) from Bolt et al. (2014), who update Maddison (2008). We base our sample of the 159 countries available from these sources, which account for 99% of the world population in 2010.

To the information on GDP per capita we add observations on urbanization rates for a selection of years running from 1500 to 2010. We use primarily Bairoch (1988); Acemoglu et al. (2002); Malanima and Volckart (2007); United Nations (2014); Jedwab and Moradi (Forthcoming) to obtain the urbanization rates, supplemented by observations from several additional sources. The availability of urbanization and GDP data leaves us with 1319 total observations from the 159 countries. As one might expect, we have far more data from later rather than earlier years. The distribution of observations across time is for 1500 (24 observations), 1700 (18), 1800 (25), 1850 (23), 1870 (46), 1910 (70), 1950 (159), 1960 (159), 1970 (159), 1980 (159), 1990 (159), 2000 (159), and 2010 (159).

We also examine evidence on city size and city living standards, although this information is less widely available. For city size, we use Chandler (1987); United Nations (2014), and look at the top 100 cities by size or all cities larger than 300,000 inhabitants in several select years. We do not have comparable measures of city living standards across all time periods. For the pre-1910 period we use welfare ratios based on a “bare bones” consumption basket as reported in Allen (2007, 2011, 2012); Frankema and Van Waijenburg, 2012; Francis (2013); Bassino et al. (2014) and this yields 111 observations of city size and living standards in the pre-1910 period (which includes cities observed in more than one year) for cities larger than 100,000 inhabitants. For 2010, we use city product indexes from (United Nations Habitat, 1998, 2012). The data is available for 157 cities but we focus on the 111 largest cities to have a consistent sample size for both periods.

Appendix B. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.eeh.2015.09.002.

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