

Analyzing Urban Systems

Have Megacities Become Too Large?

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Abstract

The trend toward ever greater urbanization continues unabated across the globe. According to the United Nations, by 2025 close to 5 billion people will live in urban areas. Many cities, especially in the developing world, are set to explode in size. Over the next decade and a half, Lagos is expected to increase its population 50 percent, to nearly 16 million. Naturally, there is an active debate on whether restricting the growth of megacities is desirable and whether doing so can make residents of those cities and their countries better off. When analyzing whether megacities have become too large, policy makers often analyze a single city in depth. But no city is an island: improving urban infrastructure in one city might attract migrants, and a negative shock in one location

can be mitigated because people can move to another. Considering the general equilibrium effects of any such urban policy is thus key. That is, when deciding whether to make medium-size cities more attractive, policy makers need to understand how cities of all sizes will be affected. The second section briefly summarizes the theoretical framework and discusses which data are needed. The third section implements the methodology for the benchmark case of the United States. The fourth section does the same for China and Mexico and compares the findings. And the last section concludes. A technical online appendix guides the reader through a practical, step-by-step, discussion of how to do the analysis.

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Analyzing Urban Systems: Have Megacities Become Too Large?

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The trend toward ever greater urbanization continues unabated across the globe. According to the United Nations, by 2025 close to 5 billion people will live in urban areas. Many cities, especially in the developing world, are set to explode in size. Over the next decade and a half, Lagos is expected to increase its population 50 percent, to nearly 16 million.¹ Naturally, there is an active debate on whether restricting the growth of megacities is desirable and whether doing so can make residents of those cities and their countries better off.

This debate is not so much about urbanization per se—whether people should move to cities or stay in the countryside—but about whether (some of the world’s) megacities are creating megaproblems that could be avoided with suitable policies. People flock to cities in search of higher paying jobs and better amenities. Many of the world’s large metropolises, such as Los Angeles and Mumbai, are highly productive and located on large bodies of water. As cities grow, however, they start suffering from congestion, higher crime rates, and air pollution. How fast the benefits of efficiency and amenities erode with increasing congestion depends on the quality of governance, responsible for providing road infrastructure, sewerage systems, clean water, and security. Cities differ in their efficiency, amenities, and quality of governance, so they have no single optimal size. We need analytical tools that can help us evaluate the desirability of policies that hinder or promote the growth of cities of different sizes. This will allow us to assess urban policies that depend on the size of the cities where they are implemented (scale-dependent policies).

When analyzing whether megacities have become too large, policy makers often analyze a single city in depth. But no city is an island:² improving urban infrastructure in one city might attract migrants, and a negative shock in one location can be mitigated because people can move to another. Considering the general equilibrium effects of any such urban policy is thus key. That is, when deciding whether to make medium-size cities more attractive, policy makers need to understand how cities of all sizes will be affected.³

There is thus a need for quantitative models of systems of cities that are complex enough to account for the general equilibrium but simple enough in structure and data requirements to make them usable for policy makers. In Desmet and Rossi-Hansberg (2012), we develop such a framework. And in this paper, we start by briefly sketching the main forces in that model and later discuss which data are needed for policy analysis. (For the interested policy maker, an online technical appendix provides a more detailed, step-by-step, practical guide on how to implement the methodology.)⁴ It then shows how the framework can be used to quantitatively analyze some important questions. Would there be any welfare gains from shrinking megacities and expanding medium-size cities? Is there any sense to implementing policies that make cities more equal in efficiency and amenities? How will growth in developing countries affect their city-size distributions? Are cities in developing countries really too large? Should policy favor smaller cities or medium-large cities? The answers to

these questions will be country-specific. Countries are at different levels of development and have different geographies and histories. We will therefore compare the urban systems of three countries: the United States, which as the world's most advanced economy will serve as a benchmark; China, Asia's largest economy and one of the world's fastest growing; and Mexico, one of Latin America's most important middle-income economies.

A first policy question is how reducing spatial differences in city characteristics affects the city-size distribution. Many countries favor balanced spatial growth and try to reduce uneven development. Spatial concentration is often viewed with suspicious eyes, and many countries implement policies aimed at mitigating spatial differences, with the goal of creating a less dispersed city-size distribution. When reducing productivity differences across cities, our quantitative analysis shows that responses vary by country. In the United States, the city-size distribution would become slightly less dispersed, with the larger cities shrinking and the smaller cities growing. In Mexico, something similar happens: Mexico City declines, but no city takes its place. By contrast, China's city-size distribution becomes more dispersed, implying larger megacities. Although one would intuit that reducing spatial differences would lead to a less dispersed city-size distribution, the opposite result in China illustrates the importance of model-based analysis. Without this analysis, policies might have unintended consequences: a policy aimed at reducing the dispersion in city sizes might actually increase it.

When mitigating spatial differences in city characteristics, we find limited welfare effects in Mexico and the United States but very large effects in China. Reflecting China's important spatial disparities in productivity and the mobility restrictions under the *hukou* system, this suggests that as China develops further, it will reap huge benefits from the spatial reallocation of people and economic activity. We do not find the same effects in Mexico, probably because it has much more history as a developing market economy and thus suffers from fewer spatial distortions.

A second policy question is whether policies that target lagging cities are more effective than policies that target cities of different sizes. Governments may choose to improve road infrastructure in remote areas or give firms incentives to move to particular locations. The U.S. federal policy of the 1960s to assist the declining Appalachia region is a good example.⁵ The European Union structural funds that subsidize investments in infrastructure and human capital in regions with an income per capita below a certain threshold are another. Other policies favor cities of particular sizes. For example, China's urbanization policies in the 1980s and 1990s had a strong small-city bias based on "controlling the big cities, moderating the development of medium-size cities, and encouraging growth of small cities."⁶ Our results suggest that policies targeting small cities are less effective than those targeting lagging cities. Encouraging the growth of small cities, as China once did, might

thus be unwarranted. Of course, to target lagging cities, a methodology is needed to rank cities by different characteristics. Our model provides a framework to do so.

We also analyze the spatial impact of countrywide shocks. As an example, we evaluate the effect of Mexico's 1994 economic crisis. Our results show that productivity differences across cities increased during this episode, suggesting that the country's largest cities, like Mexico City, suffered less than smaller cities. So, larger cities seem better at absorbing economywide shocks.

The next section briefly summarizes the theoretical framework and discusses which data are needed. The third section implements the methodology for the benchmark case of the United States. The fourth section does the same for China and Mexico and compares the findings. And the last section concludes. A technical online appendix guides the reader through a practical, step-by-step, discussion of how to do the analysis.⁷

A simple framework for a system of cities

To analyze how policies affect a country's city-size distribution, we need a framework recognizing that each city is part of a system—and that a shock to one city will affect the others. For example, a national policy that improves the amenities in medium-size cities will not only make those cities more attractive but also affect its larger cities. The framework should capture that a city's size depends on multiple determinants, such as efficiency, amenities, and governance. These determinants are interrelated, so improving one might not have the expected effect if the others are ignored. In Desmet and Rossi-Hansberg (2012), we develop such a model of a system of cities. In what follows, we provide a brief overview of the forces at work in the model.

In Desmet and Rossi-Hansberg's (2012) framework, a country has a given number of cities. So the model is not suited to study city creation or destruction. Each city has three characteristics that affect its size:

- *Efficiency.* Productivity is the efficiency with which a city can produce. One can consider a city's productivity to be exogenous or can assume that it depends, at least partly, on its size, because of agglomeration economies. In other words, larger cities may be larger because they are more productive, but they may also be more productive because they are larger.
- *Amenities.* Amenities are anything (positive or negative) that affects a city's attractiveness as a place to reside, without directly affecting its productivity or distorting its labor market. This includes weather, geography (being close to water), pollution, crime, cultural and sports activities, and anything else that influences a city's quality of life.

- *Excessive frictions.* Excessive frictions are the distortions over and above what we would expect given the city's actual size. As cities become larger, they become more congested, limiting a city's population. But even among cities of the same size, not all are equal. Some cities are less efficient than others in dealing with congestion, perhaps reflecting that some city governments do not provide congestion-alleviating infrastructure as well as others. This would translate into higher local tax rates or other distortions.

Cities will be larger if they are more efficient, provide better amenities, or have lower excessive frictions. Of course, what matters for an individual city is not just its own characteristics; it is also how its characteristics compare with those of other cities. A highly productive city will have a smaller population if there are many others like it. A system of cities is in equilibrium if no one wants to (or can) move. This is not to suggest that wages should be equal across cities. Even if people can move at no cost, an individual might be willing to accept a lower wage in a city with better amenities. Many countries, like China, have internal migration restrictions. In our model, a city that restricts entry will be seen as having worse amenities. We will return to the mobility question when we discuss our findings for China.

An important advantage of the Desmet and Rossi-Hansberg (2012) framework is that it can be implemented and used for policy analysis with few data requirements. To identify efficiency, we use information on income, hours worked, and possibly (but not necessarily) capital. By using data on income, consumption, and hours worked, we can estimate a city's distortions. By comparing a city's actual distortions with those it would be expected to have given its size, we can identify a city's excessive frictions. Finally, by using data on population and matching a city's actual size to the one generated by the model, we can identify a city's amenities.

The bottom line is that having data on population, income, consumption, hours worked, and possibly capital at the city level is enough to identify the determinants of the city-size distribution. Collecting such data is fairly straightforward. Table 1 briefly summarizes how we did this for the United States, China, and Mexico. Some metropolitan data, such as GDP for the United States and population for China and Mexico, are provided directly by national statistical offices. Other metropolitan data, such as hours worked in the United States and Mexico, need to be constructed from microdata. Even when not using microsurveys, we often need to aggregate data up to the metropolitan level. In the United States, for example, a large amount of data are provided at the county level (metropolitan statistical areas are a collection of counties), and in Mexico most variables are available at the municipal level (metropolitan areas are a collection of municipalities).

Table 1. Variables and sources

Variable	Source
<i>United States</i>	
Unit of observations	Metropolitan statistical areas, 2005–08
Population	Bureau of Economic Analysis
Income	Bureau of Economic Analysis
Consumption	Bureau of Economic Analysis, American Community Survey (constructed, Desmet and Rossi-Hansberg, 2012)
Hours worked	Current Population Survey (constructed, Desmet and Rossi-Hansberg, 2012)
Capital	Bureau of Economic Analysis, American Community Survey (constructed, Desmet and Rossi-Hansberg, 2012)
<i>China</i>	
Unit of observations	Districts under prefecture-level cities 2005
Population	China city statistics
Income	China city statistics
Consumption	China city statistics (constructed, Desmet and Rossi-Hansberg, 2012)
Hours worked	2005 1 Percent Population Survey (constructed, Desmet and Rossi-Hansberg, 2012)
<i>Mexico</i>	
Unit of observations	Metropolitan areas, 1989, 1994, 2000, and 2005
Population	Mexican census
Income	Encuesta Nacional de Ingresos y Gastos de los Hogares (microdata, constructed)
Consumption	Encuesta Nacional de Ingresos y Gastos de los Hogares (microdata, constructed)
Hours worked	Encuesta Nacional de Ingresos y Gastos de los Hogares (microdata, constructed)

Source: Authors.

To make reasonable cross-country comparisons, another relevant point is to use comparable geographic units. In the United States, metropolitan statistical areas should capture meaningful economic geographies, making them preferable to using counties or other localities. In China, prefecture-level cities cover the entire country and should thus be understood as metropolitan areas with their rural hinterlands, making them hard to compare with metropolitan statistical areas in the United States. That is why we rely instead on the districts under prefecture-level cities, which capture the urban part of the country and thus make them comparable to metropolitan statistical areas. In Mexico, we also use metropolitan areas, as defined by the country's national statistical institute.

Once we have measures of these three determinants for each city in a country, we can do counterfactual policy exercises. For example, we ask what would happen if efficiency differences across Chinese cities fell to the U.S. level. Would this shrink China's megacities or expand them? Would this improve the well-being of Chinese citizens? Which cities would gain and which would lose? Given that technology diffusion is likely to mitigate

spatial differences in China's productivity over the next decades, these are relevant questions for policy makers.

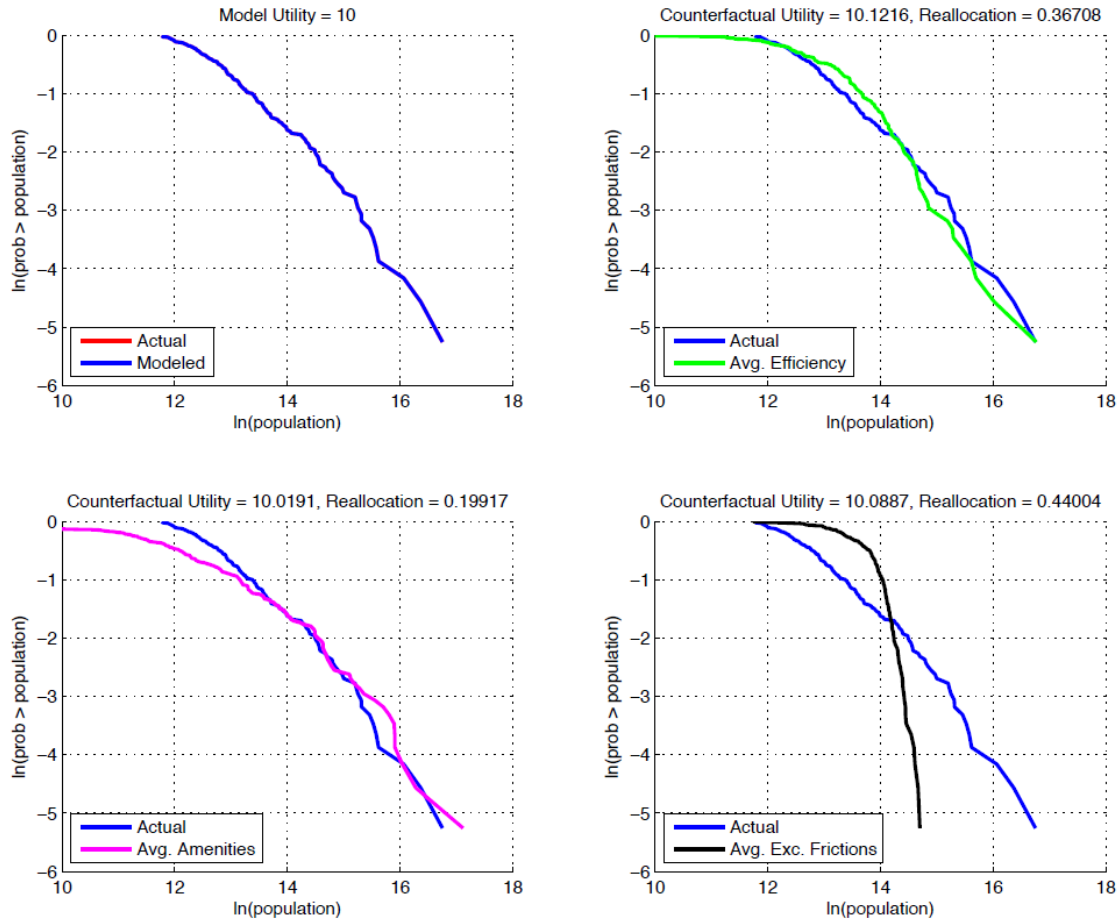
The United States as benchmark

Large cities must be highly productive, have attractive amenities, or be governed well. Otherwise, they would never have grown as large as they are. But because congestion costs accompany city growth, policy often aims to reduce heterogeneity across cities by revamping backward locations. Backward locations can be revamped by making productive investments (increasing efficiency), improving attractiveness as a place to live (improving amenities), or strengthening local governance (lowering excessive frictions). Like business cycle policies, which aim to smooth shocks over time, regional policies aim to smooth differences across space.

To analyze the impacts of regional policies, we start by presenting results for the United States. This example will also provide a useful benchmark for comparing against China and Mexico. To present an upper bound of the potential effects of spatial smoothing, our counterfactual policy analysis consists of completely shutting down spatial differences in the city characteristics (efficiency, amenities, and excessive frictions) by setting their values to the population-weighted average. That is, we want to see what happens to the city-size distribution, to the fate of individual cities, and to overall welfare when we completely eliminate spatial differences in each dimension. While it is unlikely that any policy can completely smooth differences across space, this analysis provides a useful upper bound to what policy could actually achieve.

Figure 1 shows the results. The upper-left panel shows the actual city-size distribution. Each of the other three panels presents the actual and the counterfactual distributions of city sizes when we shut down the spatial variation in one of the city characteristics. In each panel, the horizontal axis shows the log of population size and the vertical axis the log of the probability of cities being larger than that size. For a given city size on the horizontal axis, the vertical axis shows the share of cities that are larger than that size. A steeper slope implies a less dispersed city-size distribution, with the smaller cities growing and the larger cities shrinking. This is a common way of depicting city-size distributions, because it emphasizes the upper tail of the distribution and, perhaps more important, because a distribution exhibiting Zipf's law would show up as a straight line with a slope of -1 (similar to the one for the United States in the upper-left corner of figure 1).

Figure 1. Counterfactuals without differences in one city characteristic (United States)



Source: Authors.

By comparing the actual distribution with the counterfactual distributions, we notice that efficiency and amenity differences have a limited effect on the city-size distribution, whereas differences in excessive frictions play a much larger role. Indeed, the counterfactual distributions when differences in efficiency or amenities are eliminated hardly change the city-size distribution. That is, if all cities had the same level of efficiency or amenities, the city-size distribution would not change much (except for some cities becoming extremely small). By contrast, if all cities had the same level of excessive frictions, the dispersion in city sizes would become much smaller, making cities much more similar in size than in reality. In the same way that growth accounting decomposes the relative role played by different growth determinants, this exercise of urban accounting can be interpreted as decomposing the relative role played by different city characteristics. This decomposition shows that the U.S. city-size distribution is due mostly to differences in excessive frictions.

Eliminating differences in city characteristics amounts to smoothing differences across space. In the same way that the business cycle literature analyzes the welfare benefits of smoothing temporal shocks, we can analyze the welfare effects of smoothing spatial shocks. As the numbers at the top of the panels in figure 1 indicate, the welfare effects are modest, with increases of 1.2 percent if all cities had the same efficiency, 0.2 percent if all cities had the same amenities, and 0.9 percent if all cities had the same excessive frictions. In terms of consumption equivalence, the corresponding figures would be 12 percent, 2 percent, and 9 percent. Finding positive welfare effects, though modest, is not surprising. Eliminating spatial differences tends to spread people more equally across locations. Congestion costs rise with size in a convex way, leading to welfare gains. As mentioned, the modest welfare gains are, if anything, upper bounds. Indeed, completely eliminating differences is probably impossible, given that some of a city's characteristics might be given by nature or geography and thus difficult to change. In addition, our counterfactual exercises assume that people can move across locations at no cost.

Because city characteristics can be correlated with size, spatial smoothing can often be reinterpreted as a size-dependent policy, affecting megacities differently from small and medium-size cities. For example, figure 1 shows that equalizing efficiency makes the city-size distribution slightly less dispersed: the larger cities become smaller and the smaller cities larger. Los Angeles would lose 29 percent of its population, Chicago would lose 46 percent, and New York 77 percent. In this sense, a policy that smooths efficiency differences amounts to a size-dependent policy that favors smaller cities over larger cities. The same size-dependency is present when equalizing differences in excessive frictions. But, by contrast, amenities are correlated less strongly with size. When equalizing amenities across locations, some larger cities would lose some of their populations—for example, Los Angeles (8 percent) and San Diego (42 percent)—whereas others would add to their populations—for example, New York (44 percent) and Philadelphia (39 percent).

Although smoothing differences in efficiency and amenities has a limited effect on the city-size distribution—the counterfactual distribution and the actual distribution do not look all that different—the individual cities mentioned above illustrate that the ordering of cities changes substantially. For instance, when equalizing efficiency across all cities, New York is no longer the country's largest city, overtaken by Riverside (California), Los Angeles, Chicago, and Phoenix. The country's largest city would be Riverside, with a population similar to New York's actual population. This reordering implies that behind the veil of an apparently stable city-size distribution, there would be a substantial reallocation of population. When calculating reallocation following the methodology of Davis and Haltiwanger (1992)—adding the number of new workers in expanding cities as a proportion of total population—we find reallocations of 37 percent when eliminating differences in

efficiency, 20 percent when eliminating differences in amenities, and 44 percent when eliminating differences in excessive frictions.

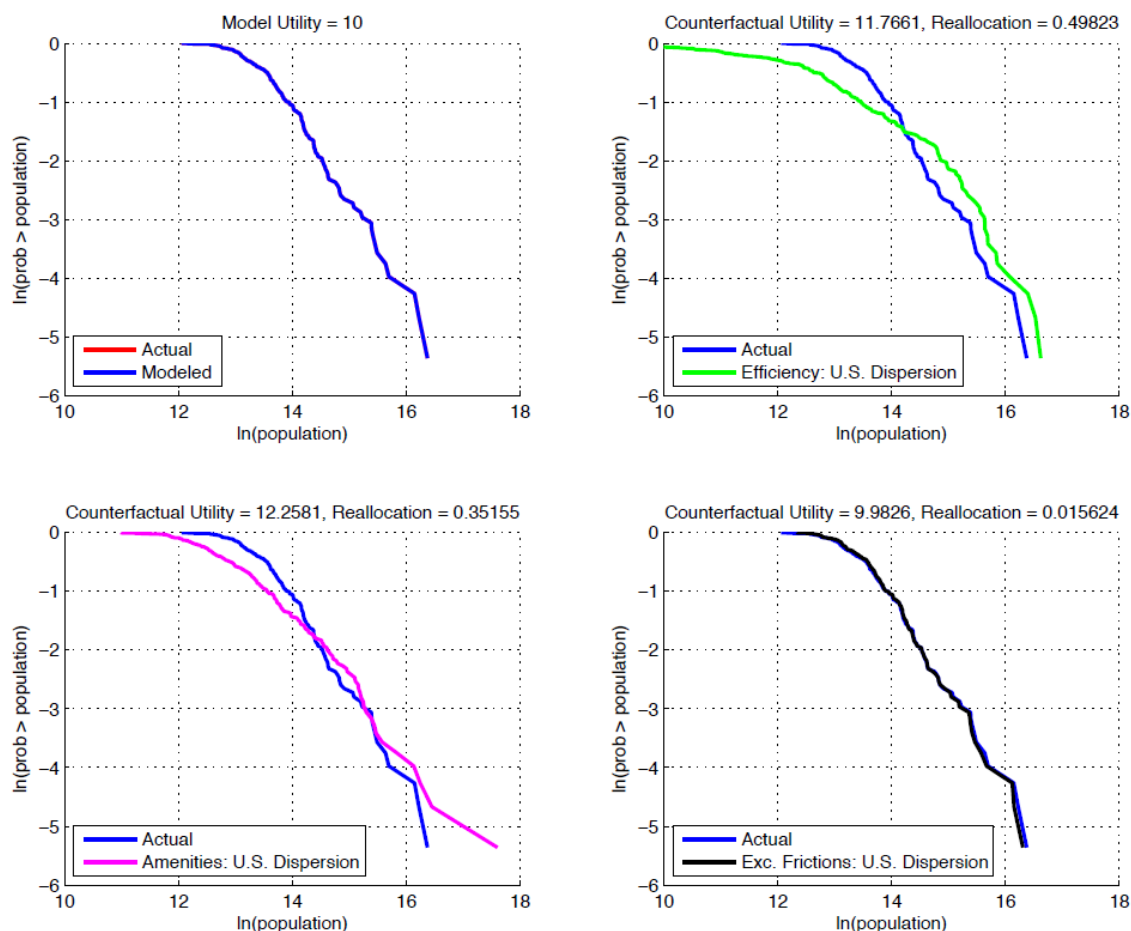
Once again, the welfare differences from smoothing are computed under the assumption of free mobility. If one were to consider the costs of moving and the magnitude of reallocation, any modest positive welfare gain from smoothing would likely vanish and become negative. Indeed, many cities would undergo large shocks, giving people an incentive to move, despite the costs. This could easily turn the small welfare gains into large welfare losses. From that point of view, regional policies aimed at reducing spatial differences might be counterproductive. They would force many people to move, perhaps with important welfare costs.

Comparing with China and Mexico

China

Reducing spatial dispersion to the U.S. level. In the United States, we found that even if we were able to eliminate all spatial differences in efficiency (or any other determinant of city sizes), the gains in well-being would be limited. We now turn to China, a country rapidly urbanizing over the last couple of decades. China has much larger spatial differences than the United States. In China, city productivity at the 80th percentile is 71 percent higher than at the 20th percentile; for the United States, that figure drops to 32 percent. As China continues to grow and develop, these spatial differences will likely converge to those in more mature economies, such as the United States. For policy makers that need to make long-term decisions about, for instance, how much to invest in infrastructure and where, understanding how China's future growth will affect the spatial distribution of its people and economy is essential. Therefore, instead of analyzing what would happen if we completely smoothed China's spatial differences, it might be more relevant to ask how the Chinese city-size distribution would change if it had the same dispersion in the city characteristics as the United States.

Figure 2. Counterfactuals changing dispersion in characteristics to U.S. levels (China)



Source: Authors.

Figure 2 shows the results. In the top-right panel, we lower the dispersion in efficiency across Chinese cities to the U.S. level without changing the population-weighted average efficiency. In the bottom panels, we follow the same procedure for amenities and excessive frictions. The welfare effects from reducing spatial differences are huge. If the dispersion in efficiency across Chinese cities were reduced to that in the United States, welfare would increase 17.7 percent, and similarly, if the dispersion in amenities dropped to that in the United States, welfare would increase 22.6 percent. of the numbers would be large for consumption equivalence. In contrast with the United States, these figures suggest that reducing spatial differences could have enormous positive effects on China's well-being. This is all the more striking given that for the United States we completely eliminated spatial differences, whereas for China we only reduced spatial differences to the U.S. level. If we had completely smoothed spatial differences in China, as we did in our counterfactual exercise for the United States, the welfare effects would have been even larger. In the case

of efficiency, for example, welfare would increase an astounding 55 percent in China but a meager 1.2 percent in the United States.

Looking at how reducing spatial differences in efficiency to the U.S. level affects China's largest cities, we find that Beijing would lose 87 percent of its population and Shanghai a similar 88 percent. Most of China's other large cities would also lose people, except for Chongqing, whose population would grow 46 percent. Does this imply that the future will bring the demise of China's megacities as technology spreads more equally across the country? Not necessarily. In fact, figure 2 suggests the contrary: reducing differences in efficiency would make the city-size distribution more dispersed, implying that China's largest cities would become larger and China's smallest cities would become smaller. Hence, in contrast with the United States, where smoothing efficiency made cities more equal in size, the opposite happened in China. This unexpected result illustrates the need to analyze policies in a model of a system of cities with multiple determinants of city sizes. Not doing so could lead to unintended consequences: a policy aimed at reducing dispersion across cities might actually increase it.

Given the huge decline in Beijing and Shanghai, an increasing dispersion in city size seems counter-intuitive. Some of the medium-size cities with attractive amenities and low efficiency now become the new megacities, and they become larger than Beijing and Shanghai today. The country's three largest cities become Liuan in Anhui Province (predicted population 16 million) and Chongqing (15 million) and Bazhong (13 million) in Sichuan Province. Chongqing is already a megacity, and Liuan and Bazhong are medium-large cities with populations of 1–2 million. But because they have above-average amenities and below-average productivity, improving their efficiency transforms them into huge cities.

Reducing the spatial differences in amenities to the U.S. level also leads to greater dispersion in China's city-size distribution, because many larger cities in China have poor amenities. Formal and informal mobility restrictions are one possible reason for this. Indeed, if large cities are kept artificially small through mobility restrictions, our model will show them as having low amenities. Consider a highly efficient city with a predicted city size larger than in reality. In that case, some other force in our model must keep it from reaching that larger size. That counteracting force will be poorer amenities. As a result, many of the highly efficient eastern coastal cities have low amenities. Giving them better amenities would grow them tremendously. This is the case, for example, of several cities in Guangdong Province, which included some of the first special economic zones under Deng Xiaoping's Open Door Policy. Shenzhen would grow to a population of 27 million, and Guangzhou would increase its population 64 percent. This finding is in line with Au and Henderson (2006), who argue that China's megacities are too small. Mobility restrictions are not applied always and everywhere in China. Chongqing and Chengdu are pursuing "an

unabashedly urbanization-based growth strategy.”⁸ If those cities are benefiting from government policies promoting rural-urban migration, it should be reflected in our model as high amenities. Consistent with this, reducing the dispersion in amenities across cities would reduce Chongqing’s population 83 percent and Chengdu a more modest but still high 46 percent.

Although mobility restrictions often stem from government policy through the *hukou* system, not all such restrictions are based on policy. Cities need time to grow, and housing and other urban infrastructure needs to be built. This “time to build” implies that Chinese cities can converge only gradually to their steady-state population level. Shenzhen is telling in this context. While the model predicts that it might be too small, it is unclear which part is due to policy restrictions and which part to the “time to build” constraint. As Shenzhen has been China’s fastest growing city since 1979,⁹ it probably could not have grown much faster, even if people had been free to move. Other urban problems that afflict megacities, but more so in China than in the United States, include severe air pollution. Again, in our model air pollution will show up as a negative amenity, making cities like Beijing less desirable. In that sense, the low amenities of the larger Chinese cities might also be due to environmental problems.

Overall, we find that lowering the spatial dispersion of amenities or efficiency would lead to larger cities and huge welfare gains. Greater mobility would surely narrow the dispersion in amenities, allowing the larger cities to grow even more. Differences in efficiency are also bound to narrow over time, as technology and efficient management practices diffuse spatially. Therefore, as China continues to develop and mature, it will likely see larger megacities—and more of them.

Urban policies. While the previous section focused on the likely spatial evolution of the Chinese economy as it further matures, we now analyze the effects of specific urban policies. One common policy is to improve lagging locations. Cities are selected by their low productivity, bad amenities, or poor governance. Examples include the European Union’s structural funds, which subsidize local infrastructure and human capital formation in regions with an income per capita below a certain threshold, and China’s attempts to spread development from the highly productive coast to the less productive inland. Another common policy is to favor growth in cities of certain sizes. In that case, cities get selected by their size. For example, China’s urbanization policy in the 1980s and 1990s was based on “controlling the big cities, moderating the development of medium-size cities, and encouraging growth of small cities,” though in more recent years this policy has gradually been phased out.¹⁰

Table 2. Urban policies in China

Urban policies	Welfare differences (percent)		
	Efficiency	Amenities	Excessive frictions
Improve in worst cities by 20 percent	4.9	13.7	0.2
Improve in smallest cities by 20 percent	2.0	4.5	0.1
Improve in medium-large cities by 20 percent	5.2	8.9	0.1
Improve in largest cities by 20 percent	12.1	22.0	0.4

Source: Authors.

In what follows, we analyze the effects of the two types of policies mentioned above—those that benefit lagging cities and those that benefit cities of different sizes. Table 2 reports the results. The first row estimates the effect of a policy that improves conditions in backward cities. If we increase efficiency 20 percent in the bottom quartile of cities ranked by efficiency, the model predicts a 4.9 percent increase in welfare. Corresponding policies that increase amenities and lower excessive frictions would also have positive welfare effects, of 13.7 percent and 0.2 percent, respectively. The next rows estimate the effects of size-based policies that improve conditions in the smallest cities (bottom quartile), the medium-large cities (second quartile), and the largest cities (top quartile). Two results stand out. First, targeting the worst cities is more effective than targeting the smallest cities. For example, improving amenities 20 percent in the smallest cities increases welfare 4.5 percent, less than a third the 13.7 percent if the policy focuses on the cities with worst amenities. Second, when comparing the size-based policies, the welfare effects are greater, the larger the cities that are targeted. This is of course not surprising. Improving efficiency (or any of the other characteristics) in the largest cities benefits many more people than the same policy applied to the smallest cities. For example, when increasing efficiency 20 percent in the largest cities, with populations above 1.4 million, welfare rises 12.1 percent, more than six times the 2.0 percent when applying the same policy in the smallest cities (populations of less than 500,000).

From the point of view of expected benefits, this suggests that policy makers should concentrate their efforts on the country's largest cities. But there is of course also a cost of implementing these policies, and this cost may well differ by city. Therefore, only with a cost constant across cities can we conclude that targeting the largest cities is better. For example, if we had to choose one of two isolated cities to connect by highway to the rest of the country, we would connect the larger one. But many other policies will likely have a cost increasing in the number of people. For example, building urban infrastructure or

improving local schools will cost more the larger a city's population. Enhancing efficiency in the largest cities will therefore require more resources than in the smallest cities.

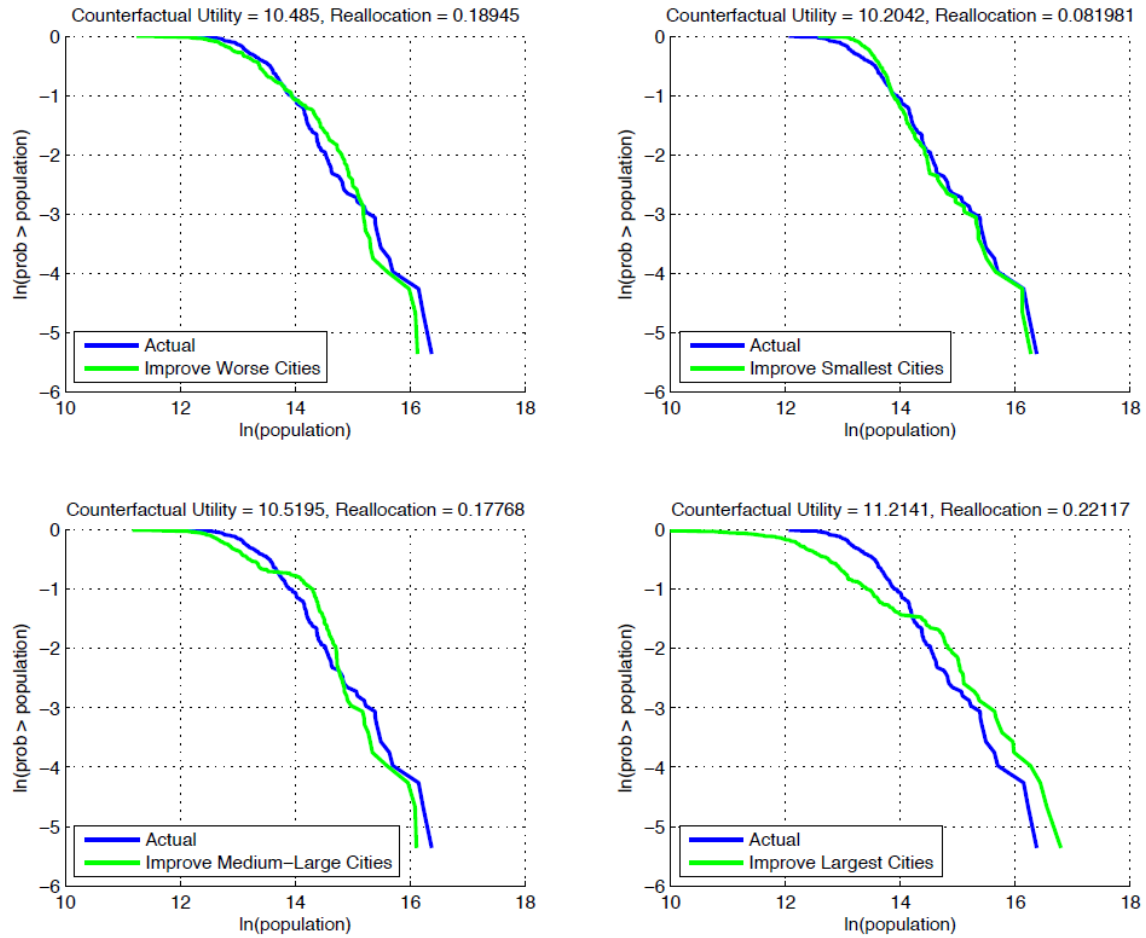
Table 3. Urban policies in China for constant population-weighted characteristics

Urban policies	Welfare differences (percent)		
	Efficiency	Amenities	Excessive frictions
Improve in worst cities by 20 percent	2.7	8.2	0.0
Improve in smallest cities by 20 percent	0.8	2.2	0.0
Improve in medium-large cities by 20 percent	1.9	1.3	0.0
Improve in largest cities by 20 percent	0.0	2.0	0.1

Source: Authors.

To remove the effect that certain policies benefit more people than others (and are therefore likely to cost more than others to implement), table 3 analyzes the same urban policies as before, but now keeps the ex-ante population-weighted characteristics constant. In other words, we leave ex-ante aggregate efficiency unchanged but change the distribution of efficiency across cities, benefiting some cities at the cost of others.¹¹ We apply the same methodology to amenities and excessive frictions. Policies that target cities by their characteristics rather than their size seem much more effective. Implementing such policies requires a methodology to rank cities by their characteristics. Our model provides a framework to do so. Note that within the class of size-based policies, no clear picture emerges of which size should be targeted. For example, focusing on the smallest cities is more effective for amenities, whereas improving conditions in medium-size cities has a greater impact for efficiency. Which type of city benefits the most depends on the distribution of the different characteristics across cities of different sizes.

Figure 3. Counterfactuals different urban policies (China)



Source: Authors.

Beyond their effects on welfare, these policies also affect city-size distributions. Figure 3 shows the counterfactual city size distributions when improving efficiency. These correspond to the urban policies in table 2. All policies, except for the one that targets the largest cities, tend to shrink the largest cities. For example, when increasing efficiency 20 percent in the bottom quartile of efficient cities (top-right panel), the country's largest city remains Shanghai, but its population drops 21 percent. The next two largest cities, Beijing and Chongqing, would also see their populations fall, by 22 percent and 6 percent, respectively.

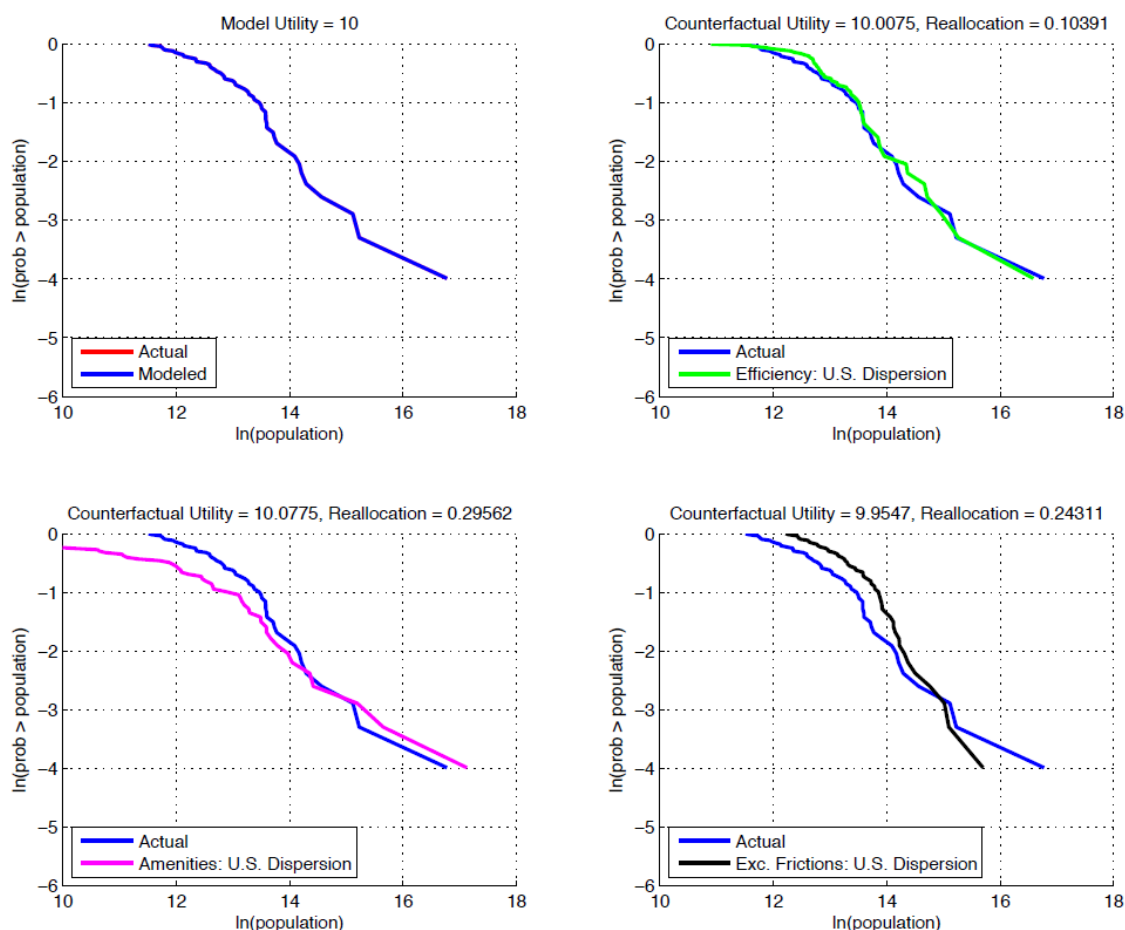
Mexico

Reducing spatial dispersion to the U.S. level. After analyzing the United States and China, we now look at Mexico, Latin America's second-largest economy. How would Mexico's city-size distribution look like if it had the same dispersion in city characteristics as the United States? Figure 4 shows the results. The welfare effects for Mexico are far smaller than for China. If the dispersion in efficiency across Mexican cities were the same as in the United States, welfare would increase a mere 0.1 percent, compared with 17.7 percent in China. For amenities, the effect would be a larger 0.8 percent but still much smaller than China's 22.6 percent.

The main reason for the smaller effect is that Mexico looks more like the United States than China, especially in efficiency. In Mexico, the productivity of the city at the 80th percentile is 43 percent higher than the city at the 20th percentile. For China, that figure is 71 percent; for the United States, 32 percent. This suggests that the diffusion of technology has been greater in Mexico, reducing spatial differences. For amenities, the smaller welfare effects suggest that Mexico suffers less from mobility restrictions than China. The finding that Mexico's spatial structure is closer to the United States's than to China's is further reinforced when we compare the effects of completely smoothing spatial differences in the city characteristics. In efficiency, for example, this would lead to a welfare increase of 0.7 percent in Mexico, 1.2 percent in the United States, and 55 percent in China.

Another relevant question is how reducing spatial differences affects megacities relative to medium-size and smaller cities. In efficiency, we found that reducing differences to the U.S. level made the city-size distribution in China more disperse. This is not the case in Mexico: the country's megacity, Mexico City, loses 17 percent of its population, dropping from 19.2 million to 16.0 million. The situation is similar in the United States, where spatial smoothing also reduced the size of the country's largest city, New York. However, despite some of the country's medium-size cities becoming much larger, none reaches the dimensions of Mexico City. In Leon, for example, the population increases from 1.4 million to 2.3 million. Other cases of medium-size cities gaining population include Puebla (16.5 percent), Aguascalientes (34.2 percent), and Acapulco (115.6 percent). Acapulco's staggering growth can be explained by its having one of the country's highest levels of amenities, so that once it improves its efficiency, it grows tremendously.

Figure 4. Counterfactuals changing dispersion in characteristics to U.S. levels (Mexico)



Source: Authors.

When reducing the dispersion in amenities across cities, the effect is quite different. Many of the larger cities lose population, such as Guadalajara (56 percent), but Mexico City, which grows from 19.2 million to 27.4 million, and Tijuana, which grows from 1.5 million to 6.3 million, do not. This reflects Mexico City and Tijuana having bad amenities. Once again, what we call amenities should be interpreted broadly. Any feature that holds back city growth but that does not distort the labor supply is a bad amenity in our model. For example, if pollution and a complex geography stunt Mexico City's growth, our model will show it as a negative amenity.

Urban policies. As in China, we now analyze the effect of two types of policies—those that benefit lagging cities and those that benefit cities of different sizes. Table 4 shows the results. If we improve efficiency 20 percent in the bottom quartile of efficient cities, the model predicts that welfare in Mexico will increase 0.4 percent. Similar policies that improve amenities would have a positive welfare effect of 0.7 percent, whereas policies that

lower excessive frictions would have no noticeable effect. As for the scale-dependent policies, improving conditions 20 percent in the smallest cities would have a very small effect, in no case improving welfare more than 0.1 percent. Doing the same in larger cities has, as expected, a greater effect. One important difference with China is that the welfare effects of any of these policies are much smaller.

Table 4. Urban policies in Mexico

Urban policies	Welfare differences (percent)		
	Efficiency	Amenities	Excessive frictions
Improve in worst cities by 20 percent	0.4	0.7	0.0
Improve in smallest cities by 20 percent	0.1	0.1	0.0
Improve in medium-large cities by 20 percent	0.5	0.3	0.1
Improve in largest cities by 20 percent	2.1	1.1	0.5

Source: Authors.

Once again, the finding that targeting the largest cities has a greater impact is not surprising. As in China, if we were to control for the fact that improving conditions in larger cities benefits more people, we would find that the best policy targets the most lagging cities. Table 5 reports the results. Improving efficiency in the most backward cities improves welfare 0.2 percent, compared with 0.1 percent or less when targeting cities of different sizes.

Table 5. Urban policies in Mexico for constant population-weighted characteristics

Urban policies	Welfare differences (percent)		
	Efficiency	Amenities	Excessive frictions
Improve in worst cities by 20 percent	0.2	0.1	0.0
Improve in smallest cities by 20 percent	0.0	0.0	0.0
Improve in medium-large cities by 20 percent	0.1	0.1	0.1
Improve in largest cities by 20 percent	0.1	0.1	0.2

Source: Authors.

Mexico's changing city-size distribution. Until now we have compared urban systems across countries, but our methodology can also compare urban systems over time. When reducing spatial efficiency differences to the U.S. level, welfare gains in Mexico rise, from 0.2 percent in 1989 to 0.6 percent in 1994, and then drop again, to 0.3 percent in 2000 and 0.0 percent in 2005.¹²

We now interpret this finding in light of the severe economic crisis that hit Mexico in 1994, which had profound effects on efficiency.¹³ As argued, equalizing efficiency across locations tends to help medium-size cities at the expense of larger ones. We would therefore expect the positive effect on welfare to be larger, the greater the dispersion in efficiency. If so, the temporal pattern suggests that the dispersion in efficiency must have widened during the economic crisis—that is, the smaller cities are likely to have been hit harder than the larger ones. The data bear out these intuitions. The standard deviation of the log of efficiency increased from 0.27 in 1989 to 0.32 in 1994 and then declined to 0.23 in 2000 and 0.16 in 2005. Further, the correlation between changes in efficiency over time and city size in Mexico is always negative, except for 1989–94 when it was positive, indicating that larger cities suffered less than smaller cities. This is reflected by the counterfactual predictions for Mexico City. We know that reducing spatial differences in efficiency to the U.S. level will have a negative effect on the country's capital, but the effect was much larger in 1994. While the predicted change in Mexico City's population is –11 percent in 1989 and 4 percent in 2005, the predicted change is a much larger –53 percent in 1994, the crisis year.

In addition to analyzing the spatial impact of the crisis, our results shed light on the long-run spatial development of Mexico's urban system. The drop in the dispersion of efficiency suggests a tendency toward the spatial convergence of efficiency over time. In fact, by 2005 Mexico's spatial dispersion of efficiency had converged to the United States's. Another long-term trend is the worsening in Mexico City's amenities. If the country's capital had the country's average level of amenities, its population would have dropped 41.7 percent in 1989. By 2005, the situation was completely reversed: with average amenities, the city's population would rise 40.0 percent.

Some policy conclusions

We have applied a simple model of a system of cities to do policy analysis. Our focus has been on the United States and two large emerging economies, China and Mexico. Our findings allow us to state six relevant policy conclusions:

- *Reducing spatial differences across cities does not necessarily imply larger cities becoming smaller.* If efficiency were spread more equally across space, megacities would lose people in Mexico but gain in China. The finding that megacity populations may not always decline has to do with the multiple determinants of the city-size distribution and how they relate to each other. Many medium-size cities in China have great amenities but low efficiency. Improving their efficiency gives them a huge boost, allowing them to become larger than the country's megacities today. In other words, Shanghai and Beijing would lose people, but other cities would take their place and

outpace them. By contrast, Mexico City would lose people but remain Mexico's largest city.

- *In a mature economy like the United States, the welfare effects of completely smoothing out spatial differences are small.* Because policy is unlikely to completely eliminate differences across cities, these already-small effects should be interpreted as upper bounds. If, in addition, one were to account for the reallocation costs of people implied by policies that reduce spatial differences, these small positive welfare effects would likely become negative, suggesting there is little room for policies that focus on lowering differences across U.S. cities.
- *Emerging economies are typically characterized by larger spatial differences than are developed economies, so the welfare effects of smoothing out spatial differences are likely to be larger.* As China and Mexico continue to grow and develop, their spatial differences will likely converge to those in more mature economies, such as the United States. Reducing spatial differences in efficiency to the U.S. level would improve China's welfare 17.7 percent and Mexico's a much smaller 0.1 percent. The huge welfare effects in China can be explained by the large spatial dispersion in efficiency across its cities, a situation virtually absent in Mexico. A similar policy that lowers spatial differences in amenities would increase China's welfare 22.6 percent and Mexico's 0.8 percent. China's much larger effect is likely related to its mobility restrictions under the *hukou* system. Taken together, our findings suggest that China stands much to gain from the spatial reallocation of people and economic activity, as technologies diffuse across space and mobility restrictions are lifted. The effects in Mexico are substantially lower, probably reflecting the country's longer history as a developing market economy and its lack of formal mobility restrictions.
- *Urban policies that target lagging cities are more effective than those that target cities of different sizes.* Urban policies often focus on either improving conditions in lagging cities or favoring cities of particular sizes. Our results suggest that targeting lagging cities tends to be more effective, except when the cost of implementing such policies does not increase with city size. In that case, targeting the largest cities is better, because the benefits are shared by more people. The often observed policy in developing countries of favoring smaller cities is in general unwarranted. To implement policies based on city characteristics, a methodology is needed to rank cities by their different characteristics. Our model provides a framework to do so.
- *Countrywide shocks are likely to have important spatial effects.* We find that Mexico's 1994 economic crisis increased the dispersion of efficiency across cities. This implies that the country's largest cities, such as Mexico City, were spared more than the country's smaller cities. It suggests that large cities are more resilient to countrywide shocks than small cities.

- *From a methodological point of view, there is much to learn from a quantitative analysis of urban systems.* Analyzing policy interventions for just one city, without accounting for its effects on others, is likely to be misleading. Given that the data requirements to implement this framework are minimal, we hope that policy makers in many countries will find it useful.

Notes

¹ UN-Habitat 2010.

² As in John Dunne: No man is an island entire of itself; every man is a piece of the continent, a part of the main.

³ The literature on firm dynamics and industrial policy has also focused on this problem. For example, is it more desirable to subsidize small firms or large firms? See Restuccia and Rogerson (2008).

⁴ The online appendix is available at www.princeton.edu/~erossi/RethinkingCitiesCh14Appendix.pdf.

⁵ Glaeser and Gottlieb 2008.

⁶ Kamal-Chaoui and others 2009, 9.

⁷ See www.princeton.edu/~erossi/RethinkingCitiesCh14Appendix.pdf

⁸ World Bank 2009, 221.

⁹ World Bank 2009.

¹⁰ Kamal-Chaoui and others 2009.

¹¹ Of course, given that people will move as a result of the policy, the ex-post aggregate efficiency may be different.

¹² The numbers for 2005 are slightly different than those for figure 3. Because we want to use a constant sample of cities across all years, the number of cities analyzed here is a bit lower.

¹³ Meza and Quintin 2007.

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