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Growing through cities in developing countries

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ABSTRACT: This paper examines the effects of urbanisation on development and growth. It starts with a labour market perspective and emphasises the importance of agglomeration economies, both static and dynamic. It then argues that more productive jobs in cities do not come in a void and underscores the importance of job and firm dynamics. In turn, these dynamics are shaped by the broader characteristics of urban systems. A number of conclusions are drawn. First, agglomeration effects are quantitatively important and pervasive. Second, the productive advantage of large cities is constantly eroded and needs to be sustained by new job creations and innovations. Third, this process of creative destruction in cities, which is fundamental for aggregate growth, is determined in part by the characteristics of urban systems and broader institutional features. We highlight important differences between developing countries and more advanced economies. A major challenge for developing countries is to make sure their urban systems acts as drivers of economic growth.

Key words: cities and development, local labour markets, jobs and firm dynamics, urban systems

JEL classification: J24, O18, R23

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1. Introduction

Urbanisation and development are tightly linked. The strong positive correlation between the rate of urbanisation of a country and its per capita income has been repeatedly documented. See for instance World Bank (2009), Henderson (2010), or Henderson (2002) among many others. There is no doubt that much of the causation goes from economic growth to increased urbanisation. As countries grow, they undergo structural change and labour is reallocated from rural agriculture to urban manufacturing and services (Michaels, Rauch, and Redding, 2012).¹ The traditional policy focus is then to make sure that this reallocation occurs at the ‘right time’ and that the distribution of population across cities is ‘balanced’. Urbanisation without industrialisation (Fay and Opal, 1999, Gollin, Jedwab, and Vollrath, 2013, Jedwab, 2013) and increased population concentrations in primate cities (Duranton, 2008) are often viewed as serious urban and development problems.

This paper takes a different perspective and seeks to examine to which extent growth and economic development are affected by urbanisation. In this case, urbanisation is no longer a change that follows from growth and needs to be accommodated but it is viewed instead as an integral part of the growth process. To evaluate how cities affect growth, it may seem natural to take a macroeconomic perspective and assess the effects of urbanization and its characteristics. Doing so involves taking a cross-country perspective and regressing growth on urbanisation. Unfortunately, there is extremely little work doing this and cross-country growth regressions have come under heavy criticisms.²

Instead, it is useful to reframe the question about the effects of urbanisation on growth as a question about the effects of cities on worker productivity over different time horizons. Are workers more productive when they move to cities? Do they become more productive in cities? If yes, how and to what extent? The general answer is that workers in cities benefit from agglomeration economies. These take place through a variety of channels: resource sharing, quicker and better matching, and more learning. Section 2 provides a discussion of these issues. The bottom line is straightforward, cities have a positive effect on productivity and wages. There is a short-run effect by which workers are on average more productive in a large city than in a small city and in a small

¹Closely related to this is the issue of how the overall concentration of economic activity may increase and then decrease during the process of development as first conjectured by Williamson (1965). See Henderson (2005) or Kim (2008) for further discussions.

²The main exception is Henderson (2003) who finds negative effects of urban primacy on economic growth. See also Brülhart and Sbergami (2009) for a perspective closer to Williamson (1965). For a critical review of cross-country growth regressions, see Durlauf, Johnson, and Temple (2005).

city than in rural areas. There is also a medium-run effect where workers learn more in cities and gradually become more productive.

This greater productivity of labour in cities does not come in a void. Urban workers hold jobs that allow them to be more productive. Section 3 broadens the discussion to job creation and firm dynamics in cities. More productive jobs in cities need to be created. Innovation, entrepreneurial activity, and firm growth all play a crucial role in this respect. Adding to this, more productive jobs do not remain more productive forever. This productivity advantage is constantly eroded and needs to be constantly re-created. The creative destruction process, i.e., more firm entry and exit and higher portion of innovative young firms, is also fundamental.

In turn, the dynamics of firms and jobs in cities is shaped by the broader characteristics of urban systems in the long-run. In section 4, we highlight major differences between cities in developing countries and more advanced economies. In short, too often the urban system of many developing countries acts as a brake on economic growth. A major challenge for these countries is to make sure their urban systems acts as drivers of economic growth. More specifically, cities in developing countries appear to be far less functionally specialised than cities in more advanced economies. This hampers the dynamism of the largest cities, which, in developing countries, are burdened by many ancillary activities. These activities add to urban crowding without adding to agglomeration benefits. Better infrastructure, in particular better transportation infrastructure, and a reduction in favouritism towards large cities may be a way to remedy these problems. Policies to foster job creations directly may be tempting but their record in more advanced economies is unsatisfactory.

In addition, developing cities also function less efficiently and face challenges that differ from those of cities in more advanced economies. An appropriate management of the transition to full urbanisation, a strengthening of urban governance, a reduction in labour market duality, and a reduction or the full elimination of land market duality are key challenges that must be tackled for developing cities to take the full advantage of agglomeration effects and foster aggregate growth.

Because the literature on the issues discussed here is often extremely thin for developing cities, the exposition proceeds as follow. It first discusses the most recent findings about cities and various aspects of economic growth. Although much of the evidence is comes from developed economies, this allows us to develop a rich vision of how cities can affect growth. After this, the evidence that relates more specifically to developing cities is discussed. Sometimes, it is difficult to do more than highlight existing gaps in our knowledge and conjecture about how far the evidence can be

extrapolated to developing cities.

2. Cities, productivity, and wages

The most immediate way by which cities can foster economic growth and development is by making urban labour more productive. More specifically, we are interested in knowing whether households are more productive in cities than in rural areas and in larger cities than in smaller cities. Ideally we would like to be able to compare the same households across locations and assess their income, consumption, human capital acquisition, quality of life, etc. For lack of data on many aspects of urban life, much of the literature focuses on wages and productivity.

The link between city scale and labour productivity

Cities enjoy a productive advantage over rural areas and this advantage is larger for larger cities. This conjecture dates back to at least Adam Smith (1776) and was more fully articulated by Alfred Marshall (1890). The positive association between various measures of productivity and urban scale has been repeatedly documented since Shefer (1973) and Sveikauskas (1975). That larger cities obtain higher scores on many productivity metrics from wages to output per worker or the total factor productivity of firms is now beyond doubt. Most of the studies reviewed by Rosenthal and Strange (2004), Melo, Graham, and Noland (2009), or Puga (2010) measure an elasticity of wages or firm productivity with respect to city employment or urban density between 0.02 and 0.10.

This type of work involves regressing an outcome variable by location on a measure of agglomeration. In the early literature, the typical regression of choice involved using output per worker as dependent variable and city population as explanatory variable. In the early 1990s, authors often employed more indirect strategies and started to use variables such as employment growth or firm creation as outcome measures (e.g. Glaeser, Kallal, Scheinkman, and Shleifer, 1992, Henderson, Kuncoro, and Turner, 1995). More recently, the literature has moved to microdata and returned to more direct outcome measures, namely the total factor productivity of firms and wages. Importantly, the focus is on differences in *nominal* wages between cities which reflect differences in productivity not on differences in real wages which would measure differences in the 'standard of living'. We return to this distinction below but for now examine productivity studies which

typically estimate a regression like

$$\log w_{ic(i)} = \alpha \log Pop_{c(i)} + \eta_{c(i)} + u_i + \varepsilon_{ic(i)}, \quad (1)$$

where c denotes cities and i denotes individuals or groups of individuals. The dependent variable is w the wage and the explanatory variables are $\log Pop$ the log of population as a measure of urban scale, η a city effect (usually proxied through a number of control variables at the city level), and u an individual effect (often proxied through observable individual characteristics). Finally, ε is an error. The estimated value of the coefficient of interest, α , is usually positive and significant. Similar regressions can be proposed for firms data using measures of firm level productivity and firm characteristics.

In a standard framework with competitive wage setting, we expect a higher coefficient when wages are used as dependent variable rather than total factor productivity. This is because higher productivity implies a more intensive use of capital which further raises the marginal product of labour and thus wages. Confirming this, there is mild evidence of higher agglomeration coefficients when wage is used as dependent variable instead of firm productivity (Melo *et al.*, 2009). Using a population- or employment-based measure of agglomeration as dependent variable makes little difference to the results given the high correlation between the two. After Ciccone and Hall (1996), density has often been favoured relative to population since it appears to yield more reliable results. The reason is probably that density-based measures of agglomeration are more robust to zoning idiosyncracies. For instance treating Washington and Baltimore as one big consolidated metropolitan area or two separate cities makes a big difference to their employment count but only little difference to density.³

While most of the studies on this subject use data from more developed economies, the association between urban scale and productivity has been documented in a number of developing countries including Korea, Indonesia, India, and Brazil. Importantly, the association between urban scale and productivity appears to be of similar magnitude if not stronger in many developing countries than that in more developed economies. A detailed discussion of these studies can be found in Duranton (2008), Overman and Venables (2005), or Henderson (2005). These three reviews lament the paucity of work estimating agglomeration effects in developing countries and

³On the other hand, one must be careful not to use employment density with small sub-city units. In some countries, the densest parts of cities are also those that host the least skilled jobs and pay the lowest wages. That would certainly include parts of Washington DC and downtown Baltimore.

call for more work on the topic. Six years after the last of these surveys was written, this call is yet to be heard. There are only a handful of recent studies not reviewed in these surveys. They largely confirm earlier findings for Turkey (Coulibaly, Deichmann, and Lall, 2007), China (Bosker, Brackman, Gerresten, and Schramm, 2012, Combes, Démurger, and Shi, 2013), India (Chauvin, Glaeser, and Tobio, 2013), and Colombia (Duranton, 2013a).

Is the relationship between city scale and productivity causal?

Recall that the question raised above involves comparing the same households or workers in different locations. The regression described by equation (1) is comparing the outcomes across different workers who chose to be where they are. That is potentially a very different matter. Put differently, there is a robust statistical association between productivity outcomes and agglomeration, but it is unclear whether the estimated coefficient α in regression (1) reflects a causal effect of agglomeration on wages. A closer examination of equation (1) reveals three possible sources of bias (Combes, Duranton, Gobillon, and Roux, 2010). They all stem from the fact that the measure of urban scale such as $\log Pop_{c(i)}$ is indexed by $c(i)$, that is the city c is *chosen* by worker i . Again, one would like to compare the same workers across the cities that they have chosen and those that they have not chosen. In absence of randomised experiments, this is not possible. Greenstone, Hornbeck, and Moretti's (2010) quasi experiment on 'million dollar plants' is what comes closest to this ideal for firms' location choices.

The first source bias is the possible link between city effects (which are not observed directly) and the variable of interest, city population or density. Put differently, the 'quantity of labour' may be endogenous and it is reasonable to expect workers to go to more productive cities. A possible solution to this problem is to use instruments for city population or density (Ciccone and Hall, 1996, Combes *et al.*, 2010). These instruments need to predict current population patterns but must be otherwise uncorrelated with city productivity. Deep historical lags such as population from 200 years ago or soil characteristics can do the job (at least under some circumstances — see Combes *et al.*, 2010, for a discussion). Studies using these type of approach typically find that correcting for the endogeneity of population has only a mild downward effect on the estimation of the coefficient of interest α .

The second main identification problem in the estimation of equation (1) regards a possible correlation between the measure of city population and individual effects. That is, the quality

of labour may be endogenous and we expect more productive workers to reside in larger cities (Glaeser, 1999, Behrens, Duranton, and Robert-Nicoud, 2012). A first possible solution to this problem is to control for an extensive set of individual characteristics (Bacolod, Blum, and Strange, 2009, Glaeser and Resseger, 2010). A more drastic solution is to use (whenever possible) the longitudinal dimension of the data and impose worker fixed effects as Combes, Duranton, and Gobillon (2008). The endogenous quality of labour seems to be an important source of bias in the estimation of equation (1). The estimated value of α is typically reduced by 30 to 50% using extensive individual controls or worker effects. This said, one needs to be careful. Imposing worker effects improves the quality of the estimation but it is not a perfect solution since it assumes that mobility is exogenous.

Related to this last issue, the third source of bias in the estimation of equation (1) is the possibility of a correlation between the error term and the measure of city population of interest. If, for instance, workers move more easily from large cities to small cities than the opposite in case of a good external wage offer, this will create another source of bias, which, in this particular situation, leads to an underestimate of agglomeration economies. No satisfactory solution to this problem has been proposed so far.⁴

At this point, the conclusion of the agglomeration literature is that there is a causal static effect of cities and urbanisation on wages in more advanced economies but that this effect represents only about half the measured association between city population or density and wages (or alternative measures of productivity). The rest of the association between population or density and wages reflects the sorting of more productive workers in larger and denser cities, and to a lesser extent, reverse causality and workers moving to more productive places. Recent investigations that tackle the concerns mentioned above find agglomeration elasticities around 2 to 4%. They thus suggest rather modest static effects of cities on productivity.

Unfortunately, the literature from developing countries is often less advanced and identification concerns have not been taken as seriously. In the rare cases where they have been (such as Combes *et al.*, 2013, Chauvin *et al.*, 2013, Duranton, 2013a, for China, India, and Colombia, respectively), three interesting features occur. First, just like in developed economies, better controls for individ-

⁴Considering mobility explicitly in this type of work is extremely challenging. First individuals have a large number of discrete locations to choose from. This raises serious computational problems. Second, one requires an instrument that would explain location choices but not wages. It is unclear whether there is any variable that explains location but is otherwise uncorrelated with wages. The only attempt so far to tackle this problem has taken place within the structural estimation of a pre-imposed model (Baum-Snow and Pavan, 2012).

ual effects lower the estimates of the agglomeration elasticities. This is unsurprising since larger cities in developing countries tend to be populated by more educated workers. Second, in China and India instrumenting for city size tends to raise the estimates for agglomeration effects instead of lowering them if we expect workers to move to high-wage cities. This is perhaps because policy in these two countries has sought to limit the migration of workers to larger and more productive cities. Hence, this perverse finding may not be as perverse as it seems and may only reflect a different policy context for these two countries. Third, after doing their best to deal with estimation issues, estimated agglomeration effects in China and India remain much higher than the corresponding coefficients for developed economies. For instance, Combes *et al.* (2013) suggest agglomeration externalities of 10 to 12% for China. In Colombia, by contrast, the findings are much closer to those of developed economies. A deeper understanding of how the policy context can impact the estimate of agglomeration effects is obviously an important priority.

What are the sources of agglomeration benefits?

After questioning its causal aspect, the second key question about the estimation of agglomeration effects regards their sources. When asking about the 'sources' of agglomeration, the literature frequently confuses two separate questions. The first is about which markets are affected by these agglomeration effects and the second is about which mechanisms actually occur. Regarding the 'where' question, it is customary after Marshall (1890) to distinguish the markets for (intermediate) goods, the market for labour, and the (absent) market for ideas and knowledge. In terms of mechanisms, Duranton and Puga (2004) distinguish between sharing, matching, and learning mechanisms. 'Sharing' is about the many possible benefits from the mutualisation of specialised input providers, the diversity of local goods, the division of labour, or risks. 'Matching' is about the greater probability of finding another party such as a worker, an employer, a supplier, or an investor and the greater quality of the match with that party. Finally, 'learning' is about the better generation, diffusion, and accumulation of knowledge. The latter set of mechanisms is regularly referred to as knowledge spill-overs.

Because of the wide variety of possible mechanisms and the markets where they can take place, the literature that investigates the sources of agglomeration benefits is much more heterogeneous than the literature that attempts to measure the overall benefits from agglomeration which naturally coalesces around the estimation of equation (1) or some variant of it.

First, there is a diversity of work which provides evidence of an association between some aspect of agglomeration such as a particular mechanism or market and measures of agglomeration such as city size. Let us take only a few recent examples (see Puga, 2010, for a more exhaustive discussion). Holmes (1999) provides evidence of a strong association between urban scale and greater outsourcing to other firms, consistent with the importance of input-output linkages. Overman and Puga (2010) show that sectors where establishments face more idiosyncratic risks tend to cluster more, consistent with the standard argument of better risk sharing in labour market pooling. Charlot and Duranton (2004) show that workplace communication, particularly communication with other workers outside the firm, is greater in larger cities and brings higher wages, consistent with standard spillover arguments. Also consistent with spillover arguments, Jaffe, Trajtenberg, and Henderson (1993) show that innovators are more likely to cite patents invented nearby than remote patents.

Taken together, these studies are suggestive that many of the agglomeration mechanisms described by the theoretical literature are at work in a variety of markets. This conclusion must be taken cautiously however. Establishing the direction of causality in this type of work is even harder here than when attempting to measure the overall effects of agglomeration.

To show that a given factor, say communication spillovers, is a key channel through which agglomeration benefits percolate, one must establish two different causal relationships. First, one must show that urban scale has a positive causal effect on this factor. This is basically the same regression as described by equation (1), except that the dependent variable is now the factor under consideration instead of wages. The identification problems are thus the same as when trying to establish a causal effect of urban scale on wages. Then, one must also show that the factor under consideration, spillovers in our example, affects the final outcome of interest such as wages. This is extremely difficult because other agglomeration channels may also be at play and affect wages.

Given the difficulty of measuring many aspects of agglomeration and given also that the list of possible agglomeration sources is fairly open, considering all sources of agglomeration in one regression is not a feasible option. A more reasonable path forward is, following Ellison, Glaeser, and Kerr (2010), to consider several classes of agglomeration sources in the same approach. Ellison *et al.* (2010) assess how much labour pooling, input-output linkages, and spillovers account for co-agglomeration between industries in the US. They use a measure of industry co-agglomeration and find more co-agglomeration among (i) industries that buy from each other, (ii) industries that use a

similar workforce, and (iii) industries that share a common scientific base. To reduce the possibility that co-agglomerated industries end up buying from each other or using similar workers because of their physical proximity, they instrument their US measures of input-output linkages and labour pooling using corresponding UK data. Of course, if the biases are the same in the UK as in the US, these instruments are of limited value.⁵ Another caveat is that input-output linkages are possibly more easily measured using input-output matrices than spillovers using patent citations. This can also lead to biased estimates since a positive correlation with both linkages and spillovers is likely to be picked up mainly by the better-measured variable, i.e., linkages. This said, Ellison *et al.* (2010) confirm that the three motives for agglomeration they consider are at play with input-output linkages playing a more important role.

There has been close to no work about the sources of agglomeration effects in developing countries. The main exception is Amiti and Cameron (2007) who use an empirical strategy that resembles that of Ellison *et al.* (2010) to look at the determinants of the productivity of firms in Indonesia. Their results strongly underscore the importance of input-output linkages. This result and the sometimes larger agglomeration effects for developing countries discussed above lead to an interesting conjecture. In many developing countries, trade costs with other cities or with foreign countries are particularly high. This would then imply that the proximity to suppliers of intermediate goods becomes all the more important and explains stronger agglomeration benefits. This is only a conjecture of course, and we discuss transportation issues below.

Even if we abstract from the uncertainty around those results, the notion that several mechanisms, each operating in several markets, contribute to agglomeration benefits is problematic for policy. At their heart, agglomeration benefits rely on market failures associated with the existence of small indivisibilities with sharing mechanisms, thick market effects with matching mechanisms, and uncompensated knowledge transfers with learning mechanisms. That is, there are possibly many market failures at play in many markets. In turn, this implies that there may be no hope of fostering agglomeration economies through a small number of simple policy prescriptions.

⁵To make this discussion more concrete consider for instance shipbuilding and fishing. These two industries co-agglomerate along the coasts in the US and the UK. The fishing industry also buys a lot from shipbuilding. It would nonetheless be far-fetched to interpret this link solely as evidence for the importance of local input-output linkages since the co-location of these two industries is also largely explained by their need to be on a coast.

Heterogeneity in agglomeration benefits

Before going further it is also important to note that agglomeration benefits are not ‘monoliths’ that apply equally to all workers in all cities depending only on their overall size. The literature has provided evidence about three sources of heterogeneity.

The first regards the sectoral scope of agglomeration benefits. Agglomeration effects within sectors are referred to as localisation economies and between sectors as urbanisation economies. When estimating a more general version of regression (1) that accounts for both city size or density and the degree of same sector specialisation, extant research has found evidence of both localisation and urbanisation effects. There is also evidence of significant heterogeneity across industries. This heterogeneity follows an interesting pattern. Following Henderson *et al.* (1995) for the us, it appears that more technologically advanced industries benefit more from urbanisation economies whereas more mature industries benefit more from localisation economies. Interestingly, Henderson, Lee, and Lee (2001) obtained very similar results for Korea.

However, the calculations of Combes *et al.* (2008) also indicate that in France the benefits from localisation economies are smaller than those of urbanisation economies and mostly uncorrelated with local wages. Put differently, increased local specialisation has only small benefits and does not contribute to making workers richer.⁶

The second key form of heterogeneity in agglomeration effects is that not all workers benefit equally from urban scale. Equation (1) estimates an ‘average’ agglomeration effect. As highlighted by Wheeler (2001) and Glaeser and Resseger (2010) agglomeration effects appear stronger for more educated workers in the us. Bacolod *et al.* (2009) also find that individuals with better cognitive and people skills benefit more from being in larger cities. Higher returns in larger cities should in turn provide stronger incentives to more skilled workers to locate there. Hence, these results are consistent with the well documented fact that workers in larger cities in more advanced economies tend to be more educated and better skilled (Berry and Glaeser, 2005, Combes *et al.*, 2008, Bacolod *et al.*, 2009). The general tendency of an over-representation of more skilled workers in larger cities is clear but somewhat modest in advanced economies. Behrens *et al.* (2012) estimate the elasticity of college graduates with respect to city population to be around 7%.

Very little is known about differences in agglomeration benefits across skill groups in developing cities. For Colombia, Duranton (2013a) provides evidence of, if anything, lower returns for

⁶This is due to a strong negative correlation between city effects and specialisation.

university-educated workers in large cities. This occurs despite a strong sorting of these workers in large cities. This could be the outcome of better amenities in large cities leading more skilled workers to sort into these cities and depress the returns to education there. More evidence is obviously needed here.

Next, while not all workers benefit equally to agglomeration effects, it also appears that not all workers contribute equally to these effects either. There is a large literature on human capital externalities suggesting that workers enjoy higher wages when surrounded by more educated workers. Estimates of external returns to education are typically between 50 and 100% the corresponding estimates of private returns to education, in particular for university graduates. These findings are robust to a number of estimation concerns and suggestive of large effects.⁷ It is beyond the scope of this paper to review this literature extensively. See instead Moretti (2004) and Duranton (2006) for more in-depth surveys and discussions. Early findings in the literature were generated from us data but they have been confirmed for most large developed economies. For transition and developing countries these findings have been replicated for Malaysia (Conley, Flyer, and Tsiang, 2003), China (Liu, 2007), Russia (Muravyev, 2008), Chile (Saito and Gopinath, 2011), and in some further unpublished work for a number of other countries including Colombia, India, and Turkey.

Worker learning and dynamic agglomeration effects

There is also emerging evidence from us and European data that wage growth also depends on city size/density. To show this, one can estimate a regression along the lines of regression (1) but use wages in first difference instead of in levels as dependent variable:

$$\Delta_{t+1,t} \log w_{ic(i)} = \alpha \log Pop_{c(i)t} + \eta_{c(i)} + u_i + \varepsilon_{ic(i)t}, \quad (2)$$

where Δ is used to note time differences between t and $t + 1$. Among a number of papers, Peri (2002) and Wheeler (2006) confirm that wage growth is stronger in larger cities. While this result appears robust in many advanced countries, evidence from developing countries is still lacking.

Because the structure of regression (2) is the same as that of regression (1) for the static estimation of agglomeration economies, it suffers from the same identification problems. First, the

⁷There are some unresolved tensions between the ‘agglomeration’ literature and the ‘human capital externality’ literature. The key variable of interest (city size or average education) of each literature is typically ignored (missing) in the other. In addition, the city size literature argues that agglomeration economies are higher for more educated workers whereas the human capital externality literature finds that less educated workers benefit more from being surrounded by more highly educated workers. Given the positive correlation between city population size and average education, it would be desirable to reconcile these two findings within in a consistent framework.

association between wage growth and agglomeration could be explained by the sorting of workers with faster wage growth in larger cities. This could occur because ‘fast learner’ tend to locate in larger cities or because the wage of workers who are predominantly located in larger cities (such as more educated workers) tend to increase faster. Following the same sort of fixed effect strategy described above and applying that to a regression like (2), Freedman (2008) nonetheless shows that this type of result holds even after controlling for the fact that some workers may experience higher wage growth independently of their location.⁸

Although the result that wages grow faster in cities is frequently interpreted as evidence about faster learning in cities and knowledge spillovers, the mechanisms that drive it are unclear. Just like regressing wages in levels on a measure of urban scale in equation (1) does not tell us anything about the sources of static agglomeration economies, regressing wage growth on urban scale in equation (2) is equally uninformative about the mechanisms driving agglomeration dynamics. Interestingly, Wheeler (2008) shows that young workers tend to change job more often in larger cities while the opposite holds for old workers. This type of evolution is consistent with a matching model where workers can find their ‘ideal match’ faster in larger cities and then stick to it. Such mechanism could explain both faster wage growth and eventually higher wages in larger cities.

As proposed by Glaeser and Maré (2001), evidence about learning in cities can come from the fact that workers retain some benefits from agglomeration after they leave their city. Consistent with this, Combes, Duranton, Gobillon, and Roux (2012c) find that ‘worker skills’ as measured by their fixed effect in a wage regression do not differ much between less dense and denser areas in France for young workers. On the other hand, older workers, when they come from denser areas, can command much higher wages than similar workers from less dense areas. This effect seems to be driven by labour market experience in denser areas rather than by increased sorting of intrinsically more skilled workers.

De la Roca and Puga (2012) provide the most comprehensive treatment of these issues to-date using Spanish data. They assess agglomeration benefits both in terms of wage levels and wage growth. Their findings suggest the existence of both a level effect of cities on wages (of the same magnitude as those discussed above) and a dynamic effect. Over the long-run, workers in large cities seem to gain about as much from each of these two effects. Confirming these findings for developing cities is of course a priority.

⁸Again, the fact that mobility is endogenous limits the validity of this strategy.

To sum up, this discussion of agglomeration economies which focuses mainly on workers and jobs reaches a number of interesting conclusions. First, larger cities make workers more productive. There is both a static and a dynamic component to these gains. A static elasticity of wages with respect to city population of 0.03 — as typically found in developed economies — implies that a worker receives a 23% higher wage when moving from a tiny city with population 5,000 to a large metropolis with a population of 5 million. Taking an elasticity of 10% as found by Combes *et al.* (2013) for China leads to a much more significant gain of 100%. Over time, dynamic effects make this urban premium larger. Assuming an extra 3% from learning in the medium of 3 to 10 years like De la Roca and Puga (2012) find for Spain, yields another 23% from the same move. While long run gains of 50% to 125% are not miraculous, there are nonetheless sizeable.

Of course, these numbers are only an illustration of the magnitudes at stake. They do not constitute a welfare pronouncement. Cities offer pecuniary benefits such as higher wages in both the short- and medium run as discussed above. They also offer non-pecuniary benefits such as a greater diversity of goods and services (Handbury and Weinstein, 2010, Couture, 2013). On the opposite side, cities also have pecuniary costs such as higher prices for housing and longer commutes and non-pecuniary costs such as, often, worse pollution and more crime. Although the balance between costs and benefits is not precisely known, three elements are worth keeping in mind.⁹ First, mobile labour is expected to go where it welfare is highest. Even in countries where mobility is restricted, household vote with their feet and move to cities in large numbers.¹⁰ Second, some urban costs such as higher land costs are only transfers. Although they do not benefit newcomers who do not own the land, higher land costs in larger cities are benefits that accrue to land owners. Actually, a reasonable case can be made that restrictive practices on the land market and the failure to redistribute these rents properly is inefficient and constitutes an obstacle to urban growth. Third, urban costs are typically only paid when households reside in cities whereas urban benefits that arise from learning are retained by households after they leave a city. Hence, the choice to reside in cities should be viewed as an investment made by households.

Where does that leave us in terms of policy implications? The key conclusion is that the

⁹Looking at the pecuniary costs of French cities depending on their size, Combes, Duranton, and Gobillon (2012a) find a cost elasticity slightly larger than the agglomeration elasticity suggesting that the net benefits from city size are close to being flat. Conducting a similar exercise for Colombian cities, Duranton (2013a) obtains comparable results.

¹⁰Of course, there could be some inefficiency inducing household to inefficiently move to cities as suggested a long time ago by Harris and Todaro (1970). However, the literature has never found much to support this type of behaviour (see Lall, Selod, and Shalizi, 2006, Duranton, 2008, for reviews and discussions).

economic gains from urbanisation are significant and urbanisation should be embraced rather than resisted. One may then be tempted to go further and attempt to ‘foster agglomeration effects’. This temptation should be resisted. We are too far from knowing enough about the sources of agglomeration to implement any meaningful policy in that direction.

3. Job and firm dynamics within cities

As noted in the introduction, the greater productivity of labour in cities does not come in a void. Urban workers hold jobs in cities that allow them to be more productive. Jobs are usually viewed as a veil when we model production in theoretical models. In practice, jobs matter. Higher labour productivity in larger cities is not about doing the same thing as in smaller cities only more efficiently. Instead, this higher productivity is associated with doing different things and doing them differently. That is, to receive higher wages, workers need ‘better jobs’. Firm dynamics is often the vector of these changes. More specifically, let us examine several aspects of firm dynamics in cities: innovation, firm creation and growth, and factor allocation and reallocation across firms.

Innovation

Starting with innovation, the first salient feature of the geography of innovative activity is that research and innovation is much more concentrated than production in most industries (Audretsch and Feldman, 1996). Interestingly, this tendency seems particularly strong for industries that are more intensive in skilled labour and for research and development. It is also the case that the strong concentration of research and development often takes place in large metropolitan areas.

These location patterns for innovative activity are consistent with the notion that cities have a positive effect on innovation just like they have on wages. More direct evidence can be found in Feldman and Audretsch (1999) and Carlino, Chatterjee, and Hunt (2007). To measure innovation, Feldman and Audretsch (1999) make a count of all new product innovations in US metropolitan areas for a broad set of technologies and sectors in 1982. They find no evidence of urban scale effects but find that same sector specialisation is strongly negatively associated with innovation whereas a diversity of employment in technologically related industries is strongly positively associated with innovation, as originally suggested by Jacobs (1969). They also find strong positive innovation effects associated with the presence of smaller establishments.

Using the number of patents per capita as dependent variable, Carlino *et al.* (2007) find evidence of strong agglomeration effects for innovative activity. Their estimate of the elasticity of patenting per capita with respect to employment density is around 0.2. This is several times the estimates reported above for the corresponding elasticity of wages.¹¹ Although patenting may be argued to be a poor proxy for innovation, Carlino and Hunt (2009) confirm these results when patents are weighted by their number of citations. Thus, larger cities innovate more on a per capita basis and these innovations are no less influential than those developed in smaller cities.

While this evidence is highly suggestive that cities affect innovation, there is, to the best of my knowledge, no work which focuses on the effects of innovative activity in cities such as its effects on urban population growth. Regressing urban population growth on innovative activity would raise some obvious identification concerns. In addition, simple theoretical argument suggest that the effect of innovation on urban growth need not be positive. Obviously, product innovation in the form of either an entirely new product or the capture of an established product from another location is expected to add to a city's employment (Duranton, 2007).¹² However process innovation within a city can cut both ways. Employment will increase with process innovation only if greater productive efficiency and lower prices lead to a more than proportional increase in demand. In the opposite case, process innovation will imply a contraction of local employment. Remarkably, Carlino *et al.* (2007) show that Rochester, Buffalo, Cleveland, St Louis, and Detroit, which are all in demographic decline, are also highly innovative cities. This suggests that, to some extent, the demise of these cities may be attributed to the fact that labour productivity increased much faster than demand in their industries.

Finally, innovative activity appears to change the nature of jobs in the cities where it takes place. As shown by Lin (2011), cities that patent more tend to have a greater proportion of what he labels 'new work', that is jobs that did not exist a few years before. New work is also fostered by a greater proportion of educated workers and a diversity of industries, two other attributes of large cities.

To draw lessons for developing cities from these results about cities in developed economies some caution is needed. Acemoglu, Aghion, and Zilibotti (2006) make a useful distinction between

¹¹Interestingly, Carlino *et al.* (2007) also find that this elasticity of innovation with respect to employment density or population size is not constant across the urban hierarchy. Patenting per capita appears to peak at around 5,700 jobs per square kilometre or a city population size slightly below a million.

¹²Strong evidence linking product innovation to subsequent employment growth is nonetheless still missing. Kerr (2010) documents that a 'breakthrough' innovation in a city leads to a wave of subsequent innovations. This increase in innovative activity is particularly strong in research fields where foreign-born scientists are more numerous. This is arguably linked to the greater mobility of foreign-born vs. native scientists.

developed economies which are located at the technological frontier and developing countries which are within this frontier. The growth problem for developed economies is to push the frontier. For them, formal innovations and research and development play a crucial role. For developing countries, the problem is one of catch-up where scientific advances and patenting play much less of a role. However, this does not mean that innovative activity broadly construed is irrelevant for those countries. To some extent economic growth in developing countries is about firms being able to produce new and better products and produce them more efficiently. That is, firms in developing countries require product and process innovation, albeit in a way that is different from firms at the frontier. Being able to understand, adapt, and use knowledge developed in other countries is fundamental. In Colombia for instance, the number of new patents is minimal but a significant proportion of firms claims to be engaged in product and process innovation (Nieto Galindo, 2007). Interestingly, innovation is also geographically concentrated. The departments of the 3 main cities in Colombia generate more than 70% of the innovations of the country whereas they host less than 40% of the population. Hence even though the issue for developing countries is more about absorbing existing knowledge than generating completely new knowledge, large cities in developing countries should still have an important role to play in innovative activities through absorbing foreign knowledge and making sure it diffuses to the rest of the country.

To conclude on the links between innovation and cities, extant literature supports the notion that cities affect the propensity to innovate either because of their sheer population size or because of the (diverse) structure of their production activities. The evidence about the effect that these innovations have on the cities where they were developed is more complex. In particular, for a given city, being more innovative does not appear to mean higher growth in income per capita or even growth in population.

Entrepreneurship

Entrepreneurship is also closely associated with cities in several ways. First, cities affect entrepreneurship just like they affect wages and innovation. In a comprehensive analysis of the determinants of employment in new manufacturing start-ups across sectors in US cities, Glaeser

and Kerr (2009) generate a rich harvest of facts.¹³ The first is the existence of scale economies. As a city grows larger, employment in new start-ups in this city increases more than proportionately. Depending on their specification, Glaeser and Kerr (2009) find an elasticity of employment in new start-ups per capita with respect to city scale between 0.07 and 0.22.¹⁴ City population, city-industry employment, and sector effects explain around 80% of the variation in start-up employment across cities and sectors.

Consistent with a conjecture made initially by Chinitz (1961), Glaeser and Kerr (2009) also find that the presence of many small suppliers is strongly associated with employment growth in start-ups. In addition, they also find evidence of mild Marshallian effects associated with labour market pooling and spillovers. Finally, city demographics only have a limited explanatory power just like their measure of 'entrepreneurial culture'.¹⁵ The 'Chinitz' finding about the importance of many small establishments is confirmed by Rosenthal and Strange (2010) who suggest that small establishments matter because they provide a greater diversity of specialised suppliers to local firms.

The analysis of Glaeser and Kerr (2009) has been recently replicated by Ghani, Kerr, and O'Connell (2011) for startups in formal manufacturing, informal manufacturing, and services in Indian districts. They find evidence of urban scale effects whereby the number of start-ups increases more than proportionately with city population in services though not in manufacturing. Like Glaeser and Kerr (2009) for the US, their Indian evidence also underscores the importance of small firms and broader measures of input-output linkages. Unlike in the US, they also find that, in India, district demographics (education in particular) matter. They also consider a number of variables not present in Glaeser and Kerr (2009). Importantly, their measure of district accessibility plays an important role just like the stringency of labour laws, which, in India, varies across districts.

The other key feature about the supply of entrepreneurs is that there is a strong local bias in entrepreneurship. Entrepreneurs tend to create their start-up in the place where they were born

¹³It is well-known that the analysis of entrepreneurship is plagued by fundamental measurement problems. Self-employment will capture most entrepreneurs but unfortunately it will also capture many other workers who are not 'true' entrepreneurs. Using small firms is problematic for similar reasons. The entry of new establishments is also a highly imperfect measure but for different reasons since it often measures establishments affiliated with an already established firm. To avoid these problems, one can focus on the more restrictive notion of new (independent) start-ups, which may be weighted by their employment.

¹⁴Glaeser and Kerr (2009) perform their analysis at the level of sectors in cities. The above elasticities were computed under the assumption that city population growth was accompanied by parallel growth in all sectors.

¹⁵Capturing the notion of 'entrepreneurial culture' is extremely difficult. For each sector, Glaeser and Kerr (2009) use the number of start-ups in other sectors. They find no association between start-ups in a sector and start-ups in other sectors of the same city after conditioning out other city variables.

and/or where they have lived and worked before becoming entrepreneurs. This important fact has been first documented by Figueiredo, Guimarães, and Woodward (2002) for Portugal and Michelacci and Silva (2007) for Italy and the us. This finding has been further confirmed by several other studies in developed economies. Figueiredo *et al.* (2002) also show that when entrepreneurs chose a new location, this choice is strongly governed by agglomeration economies and a proximity to large cities.

After looking at the urban determinants of entrepreneurship, we now turn to the effects of entrepreneurship on their cities. It has been shown repeatedly that entrepreneurship plays a key role in urban evolutions. The key fact here is that growth in a city and sector over a period of time is strongly correlated with the presence of small establishments in that city and sector at the beginning of the period. This fact was first documented by Glaeser *et al.* (1992) and has been confirmed for other countries and time periods by many other studies. In an interesting extension of this type of research, Faberman (2011) documents that the majority of the variation employment growth across us cities can be accounted for by the birth and expansion of young firms. Employment growth in us cities is also positively correlated with greater job churning.

Just like with many of the correlations discussed above, the strong link between small firms and employment growth raises a key identification concern about the direction of causality. However, this issue has been neglected by the literature until quite recently. This is perhaps because the standard regression in this literature uses growth over a period as dependent variable and establishment size *at the beginning of the period* as explanatory variable. However, using a pre-determined variable as explanatory variable in a regression does not guarantee its exogeneity. Local entrepreneurs could enter in large numbers in a city and sector if they foresee strong future demand. That expectations of future growth should trigger entry today is only natural. That is the nature of business.

As a first step towards the resolution of this identification problem, Glaeser, Kerr, and Ponzetto (2010) examine whether the presence of many small firms in a city and sector is driven by the demand for entrepreneurship or by its supply. To the extent that they can be captured by higher sales per worker, demand factors do not appear to matter. Their findings point instead at the importance of the supply of entrepreneurship. This indirect approach, however, does not entirely solve the causality issue. To tackle it head on, Glaeser, Kerr, and Kerr (2012) take an instrumental variable approach. Returning to Chinitz's (1961) initial comparison of Pittsburgh and New York,

they use the idea that cities closer to mines have been influenced by large mining firms. In turn, large firms are expected to reduce entrepreneurship by providing attractive employment opportunities for highly skilled workers. Large firms may also breed a local culture of ‘company men’ which also reduces entrepreneurship. In the data, proximity to historical mines is associated with larger establishments today even in completely unrelated sectors. Using this instrument, they estimate an even larger effect of entrepreneurship on city growth than the one measured directly from the data. Because a mining past can be associated with a general decline in manufacturing, Glaeser, Kerr, and Kerr (2012) replicate their main findings for cities outside the rust-belt. These findings also hold when, instead of focusing on overall employment, they only look at service sectors only remotely tied to mining. Although these results require further confirmation and need to be replicated for developing countries, they are supportive of the notion that entrepreneurship is an important engine of city growth

Factor allocation and reallocation

Turning finally to factor allocation and reallocation, the literature that examines these issues makes two important claims. The first is that a large fraction of productivity growth at the country level can be accounted for by the reallocation of factors from less productive to more productive firms. Foster, Haltiwanger, and Krizan (2001) for US manufacturing and Foster, Haltiwanger, and Krizan (2006) for US services show that exiting firms are less productive than continuing ones and that, conditional on survival, start-ups have higher productivity than more mature firms. Put differently, a large share of productivity growth can be accounted for by a churning process where low productivity firms are replaced by new and more productive start-ups. As shown by Foster, Haltiwanger, and Syverson (2008), taking into account the fact that start-ups have lower margins (and thus a lower apparent productivity when using standard approaches to the estimation of productivity) only strengthens these results. These important findings have been confirmed for many countries (Bartelsman, Haltiwanger, and Scarpetta, 2004) including by detailed studies using high quality data from developing countries such as Colombia (Eslava, Haltiwanger, Kugler, and Kugler, 2004).

The second important claim made by the reallocation literature is that ‘misallocation’ can account for a large share of existing productivity differences across countries. To understand this point better, consider the influential work of Hsieh and Klenow (2009). They first note

that, in equilibrium, marginal products should be equalised across firms. If the demand for the varieties produced by firms has a constant elasticity of substitution, this implies an equalisation of the product of their price by their ‘true productivity’ (which is the ability of firms to produce output from inputs). This – price times true productivity – product is what is estimated as ‘total factor productivity’ in most productivity exercises. We may call this second quantity ‘apparent productivity’.¹⁶ Obviously, the firms’ apparent productivities are never equalised in real data. Hsieh and Klenow (2009) interpret this as evidence of factor misallocation. Taking the highly dispersed distribution of manufacturing productivity in China and India, they calculate extremely large potential costs from such misallocation. Acknowledging that a perfectly efficient allocation may be impossible, they compute that the productivity gains for manufacturing in China and India would still be of about 50% if their level of misallocation could be reduced to that observed in the US. Using a different approach which makes use of the covariance between size and productivity at the firm level to measure misallocation, Bartelsman, Haltiwanger, and Scarpetta (2013) find substantial differences between countries.¹⁷ These differences in misallocation are correlated with the large existing differences in aggregate performance between countries and are predicted to explain a sizeable fraction of them.

To the best of my knowledge there is no study in the spirit of the cross-country work Foster *et al.* (2001) that would attempt to relate greater churning/reallocation at the firm level and higher productivity growth at the urban level. However, there is a strong suspicion that larger cities should exhibit more churning. This is because, as already argued, larger cities are more innovative, experience more entry and exit, and have a greater fraction of their workforce in ‘new work’. At the same time, there is no indication that this greater amount of churning in larger cities is associated with higher productivity growth in those cities unlike what occurs at the country level.

We actually know little about productivity growth in cities. According to Lin (2011), the greater proportion of workers employed in new work in larger cities is not associated with faster productivity growth. In a rare study of the broader determinants of productivity growth in Italian cities, Cingano and Schivardi (2004) highlight the importance of both specialisation and employment

¹⁶To be more specific, true productivity is typically unobserved because one cannot easily condition out prices. Firm productivity studies do not measure the true ability of firms to generate output from inputs but their ability to generate value added.

¹⁷Most models of market structure predict that more productive firms should be larger. The strength of the correlation between firm size and firm productivity should thus be indicative of how efficiently labour and capital are allocated. This exercise is known as the Olley-Pakes productivity decomposition (Olley and Pakes, 1996).

size. But given that specialisation and employment size are negatively correlated, their positive effects arguably cancel out. Hence more churning does not appear to lead to faster productivity growth in cities.

To confirm this conclusion, note that workers are somewhat mobile across cities. Then more churning associated with faster productivity growth in larger cities should imply a divergence in population growth rates. There is no evidence of such divergence.¹⁸ This lack of result regarding the link between churning and productivity should not be taken as negative evidence against the reallocation literature. As argued in the next section, it is possible that reallocation does not take place within cities but also across cities.

Turning to the second claim about misallocation, Combes, Duranton, Gobillon, Puga, and Roux (2012*b*) show that the distribution of firm productivity is unambiguously more dispersed in larger cities in France. In the framework of Hsieh and Klenow (2009), that would be interpreted as greater misallocation in larger cities. This seems hard to believe. The evidence about static agglomeration effects discussed above is instead best interpreted as agglomeration economies leading to a better allocation of resources (in a broad sense) in larger cities. When performing the same productivity decomposition as Bartelsman *et al.* (2013), Combes *et al.* (2012*b*) find a similar covariance between establishment size and productivity in large and small cities which suggest a similar level of efficiency in the allocation of factors to firms.

To sum up, the evidence about firm dynamics and cities presented in this section suggests an interesting tension. Larger cities are more innovative, more entrepreneurial, experience more churning and reallocation, and generally enjoy a greater 'economic dynamism'. Although much of the formal evidence is from developed economies, observation and casual evidence suggests the same is true in developing countries. At the same time, large cities do not appear to enjoy most of the benefits associated with such dynamism since neither productivity nor population appears to increase faster in larger cities. To resolve this tension, we need to think about large cities as being part of an urban system.

¹⁸If anything the population growth rate of larger cities is lower. There is also mild evidence that more educated cities grow faster (see Duranton and Puga, 2013, for a broader discussion of urban growth patterns).

4. Urban systems

To deepen our understanding of the effect of cities on growth, we now need to think about cities as small open economies which interact a lot with other cities and rural areas. They are part of an 'urban system'.

Forms of urban specialisation

Starting with innovation, recall that larger cities offer many advantages for both product and process innovation. More specifically, as highlighted by Jacobs (1969), cities favour the circulation and cross-fertilisation of ideas. This naturally leads to more product innovations and this is consistent with the evidence of Feldman and Audretsch (1999) discussed above. For process innovation, Duranton and Puga (2001) underscore the greater availability of intermediate goods in large cities which allows firms to proceed through trial and error at a faster pace. In short, the greater ability of larger cities to innovate may just be another manifestation of agglomeration economies. The key difference with many static aspects of agglomeration economies such as thicker local labour markets is that, with dynamic effects, co-location is not needed all the time. More precisely, spillovers may matter to develop an innovation, but after this is done co-location is no longer needed. Quite the opposite, larger cities are more expensive places to produce. After the dynamic benefits from agglomeration have been exploited, it can make sense for firms to relocate. Often, the entire firm does not need to relocate since it is only the production of particular products that is concerned.

Patterns of establishment relocations in France are highly consistent with this type of product cycle. As shown by Duranton and Puga (2001) about 75% of French establishment that relocate do so from a city with above median diversity to a city with below median diversity and above median specialisation in the same sector. In addition, as documented by Fujita and Ishii (1998), large Japanese multinationals in the electronic sector produce their newest products in 'trial' plants near Tokyo and Osaka. Previous generations of products are produced in rural locations in Japan, other advanced Asian countries, and even less advanced Asian countries for products with a low degree of sophistication. Hence, as their products mature, firms still search for agglomeration economies but will put a greater weight on the benefits of specialisation. Large cities act as nurseries for new goods and new products. Once mature, new goods and products are best produced in more

specialised places.

There is no hard evidence about this but observation suggests that in most developing countries nursery cities phenomena are not at play to the same extent as in developed economies. Although the largest cities in developing countries are the centres of innovation (understood in a broad sense to include the adoption of more advanced knowledge from other countries), there is little in terms of relocations of the production of mature products to secondary specialised cities. Instead, both more advanced and mature products are produced in the largest cities. This probably makes these cities larger than they should be and increase congestion in those cities. Mature products also end up being produced in the most expensive cities at a higher cost. Smaller cities may suffer even more from this since they are stuck with the production of the most backward products without receiving a constant inflow of new goods to produce from their metropolises.

In more advanced economies, cities also specialise by sector. There are countless examples of age-old specialisations including knives and blades in Sheffield or jewelry in Birmingham in the UK as already described by Alfred Marshall (1890). More systematic evidence about specialisation in US cities is provided by Black and Henderson (2003). However this tendency for cities to specialise, while still present in the data, has diminished over time as documented by Duranton and Puga (2005). The same authors also document a rise in the functional specialisation of US cities with the emergence of cities specialised into management type functions whereas others specialise more into production activities.¹⁹ This rise in functional specialisation is rationalised by Duranton and Puga (2005) in a model where lower communication costs make it easier for firms to separate management from production. Since these activities benefit from very different types of agglomeration economies, such separation is beneficial provided the cost of separating activities is low enough. In turn, this separation of activities reinforces the functional specialisation of cities.

There is only limited evidence about sectoral specialisation of cities in developing countries. Ghani, Kerr, and Tewari (2013) examine patterns of specialisation and diversity for manufacturing in Indian districts.²⁰ They show evidence of declining specialisation and rising diversification of Indian districts between 1989 and 2005. They also compare Indian districts with the US metropolitan areas with the most manufacturing for whom the levels of manufacturing employment are

¹⁹Further evidence is provided in Aarland, Davis, Henderson, and Ono (2007) and other related works by Vernon Henderson and Yukako Ono.

²⁰Although they are negatively correlated diversity and specialisation are not exact opposites. A city can be specialised, if it has a sector with many times its national share of employment, and, at the same time, diversified if the rest of its employment mimics the national distribution of employment across sectors.

roughly the same. They find that Indian districts are somewhat more specialised and less diverse. Duranton (2013*b*), by contrast, finds increasing manufacturing specialisation and decreasing manufacturing diversity in both Colombian municipalities and metropolitan areas over 1990 and 2005. Increasing manufacturing specialisation is however counterbalanced by decreasing specialisation and rising diversity in non-manufacturing sectors. Colombian municipalities and metropolitan areas are also less specialised and more diverse than us counties and metropolitan areas, respectively. It is also interesting to note that the share of manufacturing employment is unrelated to city population in Colombia whereas it declines strongly with city population in the us.

These multiple dimensions of specialisation are part of well functioning urban systems in more advanced countries. Adding to this, the notion of cities being specialised by functions and activities is not static. Duranton (2007) argues that the process of continuous location and relocation of economic activity is a crucial aspect of the growth of those activities. To take a simple example, when George Eastman developed a new revolutionary technology in the photographic industry in Rochester, the latter relocated from New York to Rochester. Then, much later, as the technology developed by Eastman got itself superseded by the digital revolution, Rochester lost its status of capital of the photographic industry. Beyond this illustrative example, more systematic evidence of such churning across cities is presented in Duranton (2007) for the us and France and in Findeisen and Südekum (2008) for Germany. Based on the case of Boston, Glaeser (2005) further argues that successful cities are those that are continuously able to reinvent themselves. That different cities specialise into different functions and are able to change their specialisation after negative shocks presupposes a fair amount of 'mobility' across cities. The first important dimension of mobility regards goods and services. It would make little sense for cities to narrowly specialise in an activity if its output cannot be exported. Continuously changing patterns of specialisation also require labour mobility.

Putting all this together, the evidence so far suggests far less differentiation within urban systems in developing countries than in more advanced economies. Then, because of this, urban systems in developing countries may be much less efficient than in more advanced countries. More specifically, this lack of differentiation in urban functionality may hamper the dynamism of cities in developing countries. The largest cities there are burdened by many ancillary activities such as basic manufacturing, call centres, etc. These add to urban crowding without adding to agglomeration benefits. On the other hand, smaller cities in developing countries often lag far

behind and getting some of these ancillary activities would be crucial for their development.

This said, a lack of well functioning urban systems — however important (and neglected in urban policy) — is not the only cause for the lower efficiency of cities in developing countries relative to their counterparts in advanced economies. Non-urban factors such as weak national institutions, poor technology, etc certainly play a role. Urban factors which hinder the functional differentiation of cities also have a direct negative effect on the efficiency of cities. For instance, as we discuss below, high transportation costs limit the specialisation of cities by reducing their ability to trade. At the same time, even if we abstract from these effects, high transportation costs also affect the price of goods purchased by local consumers and reduce market access for local producers.

Urban labour markets in developing cities

In the rest of this section, we examine a number of urban factors that both reduce the efficiency of the urban system as well as the efficiency of cities directly.

The first key difference between cities in developing and more advanced countries regards the functioning of their labour market. In most developing countries, there is a well-known duality in the labour market which usually comprises a large informal sector alongside the formal sector. Aside from its detrimental implications for workers in the informal sector, this duality hinders urban development in several ways. First, it has been accused of inducing too much migration towards the largest cities where most of the formal sector is located.²¹ Duality may also limit mobility across cities since jobs in the informal sector tend to be filled by word-of-mouth through social connections which are missing to newcomers. High barriers to ‘good’ jobs in the formal sector may also hold back the incentives for workers to improve their skills locally and thus limit the scope of agglomeration benefits.

To mitigate the effects of labour market duality, three broad types of policies can be envisioned. The first is to improve the working of labour markets. While this objective is certainly laudable, a discussion of this class of policies would certainly go beyond the scope of this paper.

The second type of policy is to foster local job creation through ‘place-based’ policies. Such policies typically involve tax exemptions or subsidies associated with job creation within well-

²¹See the large literature initiated by Harris and Todaro (1970). See also Lall *et al.* (2006) and Duranton (2008) for critical assessments and discussions of policy misunderstandings of the Harris-Todaro framework.

defined (and often tightly circumscribed) areas. These tools are frequently used to try to reduce the unemployment rate of the residents of poor areas in more advanced economies. While the labour market failures in developed and developing countries differ and the scale at which such policies might be implemented in developing countries may be much broader than poor neighbourhoods of 'rich' cities, there may be useful lessons to learn from the recent North American and European literature evaluating those policies. Simply put, the general record of place-based policies is in doubt (Glaeser and Gottlieb, 2008). Detailed evaluations of particular policies often reach negative conclusions. For the US, Neumark and Kolko (2010) draw negative conclusions about the California enterprise zone programme. Busso, Gregory, and Kline (2013) find evidence that the federal empowerment zone programme boosted jobs locally but no evidence of increased land values. Mayer, Mayneris, and Py (2011) also draw negative conclusions about the French urban employment zone programme. Importantly, they find that the increase in employment within targeted areas is mainly accounted for by relocations from nearby areas. Similar displacement effects are also found by Einiö and Overman (2011) for the UK. These authors also reach equally negative conclusions.²²

The third class of policies attempts to foster job creations in a particular locality by helping firms in a given sector. These policies are usually referred to as 'cluster' policies and follow from the work of Michael Porter (1990). They often entail the development of subsidised supportive institutions and infrastructure using public subsidies and various types of fiscal incentives. The review of the literature in Duranton (2011) draws negative conclusions about the benefits of cluster policies.

Urban land markets in developing cities

The second key difference between cities in developing and more advanced countries regards the functioning of their land market. Like labour markets, land markets in developing cities are characterised by a duality between land used with appropriate property titles and leases and squatted land. Following a conjecture made by De Soto (2000), recent empirical research has focused on the effects of the lack of effective, formal property titles which could prevent residents

²²While there is a long tradition of evaluation of such programmes in the literature, this recent wave of work is methodologically much sounder than earlier work. Most importantly, these recent studies are able to find more meaningful control groups to control for the endogeneity of the treatment. They are also able to work with the high level of spatial resolution that those studies require.

of squatter settlements from using their house as collateral. Informal land markets may thus be a major barrier to enterprise development. The empirical evidence about the relaxation of credit constraints associated with 'titling' policies is weak. Recent work points instead to increases in labour supply (Field, 2007) and to the adoption of more middle-class values and attitudes (Di Tella, Galliani, and Schargrotsky, 2007). While this evidence about titling policies is relatively optimistic about the merits of such policies, it must be noted that the existing literature focuses nearly exclusively on residential land. The extent of land illegality for commercial land (from illegal street vendors to squatter manufacturing) is poorly measured and the solutions not well developed.²³

Roads and infrastructure linking developing cities

The third key difference between cities in developing and more advanced countries regards infrastructure, and particularly the road infrastructure. Two strands of research need to be distinguished here. The first finds its roots in international trade and focuses on the estimation of the effect of 'market potential' variables. The market potential of a city is usually computed as the sum of the income (or population) of other cities weighted by their inverse distance to the city under consideration. Assuming transportation costs and other trade frictions associated with distance, many models of international and inter-regional trade generate the prediction that a location's income and wages will be determined by its market access (Krugman, 1991, Krugman and Venables, 1995, Head and Mayer, 2004). The literature offers strong empirical support regarding the importance of market access for cities in developing countries. Using two different approaches, Lall, Koo, and Chakravorty (2003) and Lall, Shalizi, and Deichmann (2004b) underscore the importance of market access in India. Strong effects of market access are also found in Brazil (Lall, Funderburg, and Yepes, 2004a, da Mata, Deichmann, Henderson, Lall, and Wang, 2007) and Indonesia (Deichmann, Kaiser, Lall, and Shalizi, 2005, Amity and Cameron, 2007). This within-country evidence is complemented by the literature that looks at the importance of market access at the country level

²³This is not to say of course that issues surrounding residential squatting are perfectly well understood. Parallel to the work cited above, recent developments have investigated the political economy of squatting in developing cities (Feler and Henderson, 2011) and modelled the micro-functioning of squatter settlements and eviction (Brueckner and Selod, 2009).

(Redding and Venables, 2004, Head and Mayer, 2011).²⁴

The second strand of literature focuses more closely on the effects of infrastructure. Baum-Snow's (2007) pioneering work finds that the construction of the interstate highway system was a major impetus behind the suburbanisation of US cities. Duranton and Turner (2012) also find that more kilometres of interstate highways in US metropolitan areas in the early 1980s led to faster population growth over the subsequent 20 years.²⁵ These results are confirmed by Holl and Viladecans-Marsal (2011) for Spain. For rural areas in the US, Chandra and Thompson (2000) and Michaels (2008) find that new highways lead to a displacement of economic activity towards the counties served by these new highways and an increase in the demand for skills. For US metropolitan areas, Duranton, Morrow, and Turner (2014) find that highways lead to a greater specialisation into 'heavy sectors' for which transportation costs are higher. That is, more highways in a metropolitan area increase the weight of its exports but not its value.²⁶

This type of approach is also being applied to developing countries. In a remarkable piece of work, Donaldson (2014) documents the effects of the construction of India's railroad network by its colonial power. He shows that railroads increased trade and reduced price differences across regions. Even more importantly railroads increased real incomes and welfare. To minimise identification problems, he compares the network that was built to other networks that were considered but never developed. In related work, but this time about modern India, Ghani, Goswami, and Kerr (2012) show that a major upgrade of India's main highways had positive effect of the productivity and entry of plants in districts close to those highways. In a slightly different vein, Jedwab and Moradi (2011) document that railway lines built by the British colonial power in Ghana for the exploitation of inland mines had a large effect on agricultural production of the main

²⁴The urban literature often considers a nominal measure of market access (city income weighted by inverse distance). Theoretical models highlight that what should matter is the 'real market access' which takes into account price indices in each location. A large city nearby may not be an attractive market for local producers if prices in that city are low. Unfortunately local prices are unobserved. The trade literature has developed a number of ways to circumvent this problem (Redding and Venables, 2004, Head and Mayer, 2004).

²⁵Duranton and Turner (2012) estimate a 20-year elasticity of city population with respect to highway kilometres of about 0.15. Such an elasticity is enough to make roads a major determinants of urban growth as suggested by most theoretical models of cities. However, in terms of cost-benefit analysis, this elasticity is low when one wants to justify the constructions of more highways in US metropolitan areas.

²⁶What distinguishes this recent wave of work on the effects of infrastructure relative to previous vintages is its attention to identification issues. Regressing an urban outcome such as suburbanisation in the case Baum-Snow (2007) on the presence of highways may fall foul of the fact that both variables are simultaneously determined. For instance, highways may have been built to accompany the movement of downtown residents to the suburbs. To solve this problem, Baum-Snow (2007) develops an ingenious instrumental variable strategy which rests on the fact that US highways were originally planned for a whole set of different purposes. This type of strategy is further developed by Duranton and Turner (2012) to look at urban growth.

export crop, cocoa, that was more easily shipped to the coast. In turn, agricultural development bolstered urbanisation. These effects are still present today as districts close to these rail lines are more developed.

In line with some of the arguments advanced above about the importance of transportation infrastructure for the decentralisation of manufacturing activity away from large metropolises, Baum-Snow, Brandt, Henderson, Turner, and Zhang (2011) underscore the importance of railroads in the decentralisation of manufacturing production in China.²⁷ Rothenberg (2011) shows similar effects regarding highways in Indonesia.

Storeygard (2011) provides evidence about the importance of inter-city transportation costs for inland African cities. Using new roads data for Africa and satellite data ('lights at night') to estimate economic activity, he assesses the effect of higher transportation costs. To circumvent the endogeneity of transportation costs (roads may be built to access growing cities) he uses arguably exogenous variations in oil prices. He finds an elasticity of economic activity with respect to transportation costs of about -0.2.

All these findings are suggestive of the profound and long lasting effects of major transportation infrastructure. One needs to keep in mind nonetheless that major transportation networks are extremely costly investments.

Urban favouritism

The last key difference between cities in developing and more advanced countries regards the effects of the favouritism by governments of the largest cities. While the reasons for primate city favouritism are still debated (Ades and Glaeser, 1995, Henderson, 2005), there is little doubt that such favouritism takes place in many different ways. As argued in Duranton (2008) primate city favouritism harms the favoured primate city by making it bigger than it should be. It also harms smaller cities which are, in effect, heavily taxed. The gap that is created between the primate city and other cities may also have negative dynamic effects since, for most educated workers, there is nowhere to go except stay in this primate city. As a result this may reduce the circulation

²⁷Baum-Snow *et al.* (2011) also look at roads and confirm for China the findings of Baum-Snow (2007) regarding the importance of roads for residential decentralisation. They find no effect of roads on the location of manufacturing activity which may not be surprising given the reliance of Chinese manufacturing on rail. Banerjee, Duflo, and Qian (2009) provide further evidence about the effect transportation on the development of China. See also Faber (2013).

of knowledge across cities. Reducing primate city favouritism and providing smaller cities with better local public goods (including education and health) is certainly a big part of any solution.

5. Conclusions

For individual workers, cities in developing countries appear to bring significant benefits both in the short run and in the long run. However, when taking a broader look, the urban system of developing countries appears to involve far less functional differentiation across cities than in more advanced economies. Such differentiation with different cities playing different roles in the urban system is important for the process of growth and development to proceed smoothly. Larger cities innovate and manage. Smaller cities often produce a narrow range of goods. Having larger cities do everything like they often in developing countries reduces their dynamism and holds back small cities which remain stagnant.

A variety of policies can be envisioned to solve this problem. The three more promising areas are: general policies to improve the functioning of labour markets, ending primate city favouritism, favouring labour mobility (or, at least, not hindering it), and the development of major infrastructure to connect cities.

References

- Aarland, Kristin, James C. Davis, J. Vernon Henderson, and Yukako Ono. 2007. Spatial organization of firms: The decision to split production and administration. *Rand Journal of Economics* 38(2):480–494.
- Acemoglu, Daron, Philippe Aghion, and Fabrizio Zilibotti. 2006. Distance to frontier, selection, and economic growth. *Journal of the European Economic Association* 4(1):37–74.
- Ades, Alberto F. and Edward L. Glaeser. 1995. Trade and circuses: Explaining urban giants. *Quarterly Journal of Economics* 110(1):195–227.
- Amiti, Mary and Lisa Cameron. 2007. Economic geography and wages. *Review of Economics and Statistics* 89(1):15–29.
- Audretsch, David B. and Maryann P. Feldman. 1996. R&D spillovers and the geography of innovation and production. *American Economic Review* 86(3):630–640.
- Bacolod, Marigee, Bernardo S. Blum, and William C. Strange. 2009. Skills in the city. *Journal of Urban Economics* 65(2):136–153.
- Banerjee, Abhijit, Esther Duflo, and Nancy Qian. 2009. On the road: Access to transportation infrastructure and economic growth in China. Processed, MIT.

- Bartelsman, Eric, John Haltiwanger, and Stefano Scarpetta. 2004. Microeconomic evidence of creative destruction in industrial and developing countries. Processed, University of Maryland.
- Bartelsman, Eric, John Haltiwanger, and Stefano Scarpetta. 2013. Cross-country differences in productivity: The role of allocation and selection. *American Economic Review* 103(1):305–334. Processed, University of Maryland.
- Baum-Snow, Nathaniel. 2007. Did highways cause suburbanization? *Quarterly Journal of Economics* 122(2):775–805.
- Baum-Snow, Nathaniel, Loren Brandt, J. Vernon Henderson, Matthew A. Turner, and Qinghua Zhang. 2011. Roads, railways and decentralization of Chinese cities. Processed, Brown University.
- Baum-Snow, Nathaniel and Ronni Pavan. 2012. Understanding the city size wage gap. *Review of Economic Studies* 79(1):88–127.
- Behrens, Kristian, Gilles Duranton, and Frédéric Robert-Nicoud. 2012. Productive cities: Sorting, selection, and agglomeration. Processed, UQAM.
- Berry, Christopher R. and Edward L. Glaeser. 2005. The divergence of human capital levels across cities. *Papers in Regional Science* 84(3):407–444.
- Black, Duncan and J. Vernon Henderson. 2003. Urban evolution in the us. *Journal of Economic Geography* 3(4):343–372.
- Bosker, Maarten, Steven Brackman, Harry Gerresten, and Marc Schramm. 2012. Relaxing Hukou. Increased labor mobility and China’s economic geography. *Journal of Urban Economics* 72(1):252–266.
- Brueckner, Jan K. and Harris Selod. 2009. A theory of urban squatting and land-tenure formalization in developing countries. *American Economic Journal: Economic Policy* 1(1):28–51.
- Brühlhart, Marius and Federica Sbergami. 2009. Agglomeration and growth: Cross-country evidence. *Journal of Urban Economics* 65(1):48–63.
- Busso, Matias, Jesse Gregory, and Patrick Kline. 2013. Assessing the incidence and efficiency of a prominent place based policy. *American Economic Review* 103(2):897–947.
- Carlino, Gerald and Robert Hunt. 2009. What explains the quantity and quality of local inventive activity? *Brookings-Wharton Papers on Urban Affairs* :65–123.
- Carlino, Gerald A., Satyajit Chatterjee, and Robert M. Hunt. 2007. Urban density and the rate of invention. *Journal of Urban Economics* 61(3):389–419.
- Chandra, Amitabh and Eric Thompson. 2000. Does public infrastructure affect economic activity? Evidence from the rural interstate highway system. *Regional Science and Urban Economics* 30(4):457–490.
- Charlot, Sylvie and Gilles Duranton. 2004. Communication externalities in cities. *Journal of Urban Economics* 56(3):581–613.
- Chauvin, Juan Pablo, Edward L. Glaeser, and Kristina Tobio. 2013. Urban economics in the us and india. Manuscript in progress, Harvard University.

- Chinitz, Benjamin. 1961. Contrasts in agglomeration: New York and Pittsburgh. *American Economic Review Papers and Proceedings* 51(2):279–289.
- Ciccone, Antonio and Robert E. Hall. 1996. Productivity and the density of economic activity. *American Economic Review* 86(1):54–70.
- Cingano, Federico and Fabiano Schivardi. 2004. Identifying the sources of local productivity growth. *Journal of the European Economic Association* 2(4):720–742.
- Combes, Pierre-Philippe, Sylvie Démurger, and Li Shi. 2013. Urbanisation and migration externalities in China. Processed, Aix-Marseille School of Economics.
- Combes, Pierre-Philippe, Gilles Duranton, and Laurent Gobillon. 2008. Spatial wage disparities: Sorting matters! *Journal of Urban Economics* 63(2):723–742.
- Combes, Pierre-Philippe, Gilles Duranton, and Laurent Gobillon. 2012a. The costs of agglomeration: Land prices in French cities. Processed, Wharton School, University of Pennsylvania.
- Combes, Pierre-Philippe, Gilles Duranton, Laurent Gobillon, Diego Puga, and Sébastien Roux. 2012b. The productivity advantages of large cities: Distinguishing agglomeration from firm selection. *Econometrica* 80(6):2543–2594.
- Combes, Pierre-Philippe, Gilles Duranton, Laurent Gobillon, and Sébastien Roux. 2010. Estimating agglomeration economies with history, geology, and worker effects. In Edward L. Glaeser (ed.) *The Economics of Agglomeration*. Cambridge (MA): National Bureau of Economic Research, 15–65.
- Combes, Pierre-Philippe, Gilles Duranton, Laurent Gobillon, and Sébastien Roux. 2012c. Sorting and local wage and skill distributions in France. *Regional Science and Urban Economics* 42(6):913–930.
- Conley, Timothy G., Frederick Flyer, and Grace R. Tsiang. 2003. Spillover from local market human capital and spatial distribution of productivity in Malaysia. *Advances in Economic Analysis and Policy* 3(1):Article 5.
- Coulibaly, Souleymane, Uwe Deichmann, and Somik V. Lall. 2007. Urbanization and productivity: Evidence from Turkish provinces over the period 1980–2000. World Bank Policy Research Working Paper No. 4327.
- Couture, Victor. 2013. Valuing the consumption benefits of urban density. Processed, University of California Berkeley.
- da Mata, Daniel, Uwe Deichmann, J. Vernon Henderson, Somik V. Lall, and Hyoung Gun Wang. 2007. Determinants of city growth in Brazil. *Journal of Urban Economics* 62(2):252–272.
- De la Roca, Jorge and Diego Puga. 2012. The dynamic earnings premium of dense cities. Processed, CEMFI and IMDEA Social Sciences.
- De Soto, Hernando. 2000. *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else*. New York: Basic Books.
- Deichmann, Uwe, Kai Kaiser, Somik V. Lall, and Zmarak Shalizi. 2005. Agglomeration, transport, and regional development in Indonesia. Policy Research Working Paper 3477, World Bank.
- Di Tella, Rafael, Sebastian Galliani, and Ernesto Schargrodsky. 2007. The formation of beliefs: Evidence from the allocation of land titles to squatters. *Quarterly Journal of Economics* 122(1):209–241.

- Donaldson, David. 2014. Railroads of the Raj: Estimating the impact of transportation infrastructure. *American Economic Review* (forthcoming).
- Duranton, Gilles. 2006. Human capital externalities in cities: Identification and policy issues. In Richard J. Arnott and Daniel P. McMillen (eds.) *A Companion to Urban Economics*. Oxford: Blackwell, 24–39.
- Duranton, Gilles. 2007. Urban evolutions: The fast, the slow, and the still. *American Economic Review* 97(1):197–221.
- Duranton, Gilles. 2008. Viewpoint: From cities to productivity and growth in developing countries. *Canadian Journal of Economics* 41(3):689–736.
- Duranton, Gilles. 2011. California dreamin': The feeble case for cluster policies. *Review of Economic Analysis* 3(1):3–45.
- Duranton, Gilles. 2013a. The Colombian urban system: agglomeration, urban costs, and growth. Manuscript in progress, Wharton School, University of Pennsylvania.
- Duranton, Gilles. 2013b. Roads and the structure of production of colombian cities. Manuscript in progress, Wharton School, University of Pennsylvania.
- Duranton, Gilles, Peter M. Morrow, and Matthew A. Turner. 2014. Roads and trade: Evidence from the us. *Review of Economic Studies* (forthcoming).
- Duranton, Gilles and Diego Puga. 2001. Nursery cities: Urban diversity, process innovation, and the life cycle of products. *American Economic Review* 91(5):1454–1477.
- Duranton, Gilles and Diego Puga. 2004. Micro-foundations of urban agglomeration economies. In J. Vernon Henderson and Jacques-François Thisse (eds.) *Handbook of Regional and Urban Economics*, volume 4. Amsterdam: North-Holland, 2063–2117.
- Duranton, Gilles and Diego Puga. 2005. From sectoral to functional urban specialisation. *Journal of Urban Economics* 57(2):343–370.
- Duranton, Gilles and Diego Puga. 2013. The growth of cities. In Philippe Aghion and Steven Durlauf (eds.) *Handbook of Economic Growth*, volume 2. Amsterdam: North-Holland, forthcoming.
- Duranton, Gilles and Matthew A. Turner. 2012. Urban growth and transportation. *Review of Economic Studies* 79(4):1407–1440.
- Durlauf, Steven N., Paul A. Johnson, and Jonathan W. Temple. 2005. Growth econometrics. In Philippe Aghion and Steven N. Durlauf (eds.) *Handbook of Economic Growth*, volume 1A. Amsterdam: North-Holland, 555–677.
- Einiö, Elias and Henry G. Overman. 2011. The effects of spatially targeted enterprise initiatives: Evidence from UK LEGI. Processed, London School of Economics.
- Ellison, Glenn, Edward L. Glaeser, and William R. Kerr. 2010. What causes industry agglomeration? Evidence from coagglomeration patterns. *American Economic Review* 100(3):1195–1213.
- Eslava, Marcela, John Haltiwanger, Adriana Kugler, and Maurice Kugler. 2004. The effects of structural reforms on productivity and profitability enhancing reallocation: Evidence from Colombia. *Journal of Development Economics* 75(2):333–371.

- Faber, Benjamin. 2013. Trade integration, market size, and industrialization: Evidence from China's national trunk highway system. Processed, University of California Berkeley.
- Faberman, R. Jason. 2011. The relationship between establishment age distribution and urban growth. *Journal of Regional Science* 51(3):450–470.
- Fay, Marianne and Charlotte Opal. 1999. Urbanization without growth: A not-so-uncommon phenomenon. Policy Research Working Paper 2412, World Bank.
- Feldman, Maryann P. and David B. Audretsch. 1999. Innovation in cities: Science-based diversity, specialization and localized competition. *European Economic Review* 43(2):409–429.
- Feler, Leo and J. Vernon Henderson. 2011. Exclusionary policies in urban development: Under-servicing migrant households in Brazilian cities. *Journal of Urban Economics* 69(3):253–272.
- Field, Erica. 2007. Entitled to work: Urban property rights and labor supply in Peru. *Quarterly Journal of Economics* 122(4):1561–1602.
- Figueiredo, Octávio, Paulo Guimarães, and Douglas Woodward. 2002. Home-field advantage: Location decisions of Portuguese entrepreneurs. *Journal of Urban Economics* 52(2):341–361.
- Findeisen, Sebastian and Jens Südekum. 2008. Industry churning and the evolution of cities: Evidence for Germany. *Journal of Urban Economics* 64(2):326–339.
- Foster, Lucia, John Haltiwanger, and C.J. Krizan. 2006. Market selection, reallocation and restructuring in the u.s. retail trade sector in the 1990s. *Review of Economics and Statistics* 88(4):748–758.
- Foster, Lucia, John Haltiwanger, and Chad Syverson. 2008. Reallocation, firm turnover, and efficiency: Selection on productivity or profitability? *American Economic Review* 98(1):394–425.
- Foster, Lucia, John C. Haltiwanger, and C. J. Krizan. 2001. Aggregate productivity growth: Lessons from microeconomic evidence. In Charles R. Hulten, Edwin R. Dean, and Michael J. Harper (eds.) *New Developments in Productivity Analysis*. Chicago: National Bureau of Economic Research and University of Chicago Press, 303–372.
- Freedman, Matthew. 2008. Job hopping, earnings dynamics, and industrial agglomeration in the software publishing industry. *Journal of Urban Economics* 64(3):590–600.
- Fujita, Masahisa and Ryoichi Ishii. 1998. Global location behavior and organizational dynamics of Japanese electronics firms and their impact on regional economies. In Alfred D. Chandler Jr., Peter Hagström, and Örjan Sölvell (eds.) *The Dynamic Firm: The Role of Technology, Strategy, Organization and Regions*. Oxford: Oxford University Press, 343–383.
- Ghani, Ejaz, Arti Grover Goswami, and William R. Kerr. 2012. Highway to success: The impact of the Golden Quadrilateral project for the location and performance of Indian manufacturing. Working Paper 18524, National Bureau of Economic Research.
- Ghani, Ejaz, William R. Kerr, and Stephen O'Connell. 2011. Spatial determinants of entrepreneurship in India. Processed, Harvard University.
- Ghani, Ejaz, William R. Kerr, and Ishani Tewari. 2013. Specialization, diversity, and Indian manufacturing growth. Manuscript in progress, Harvard University.
- Glaeser, Edward L. 1999. Learning in cities. *Journal of Urban Economics* 46(2):254–277.

- Glaeser, Edward L. 2005. Reinventing Boston: 1630-2003. *Journal of Economic Geography* 5(2):119–153.
- Glaeser, Edward L. and Joshua D. Gottlieb. 2008. The economics of place-making policies. *Brookings Papers on Economic Activity* (1):155–253.
- Glaeser, Edward L., Heidi Kallal, José A. Scheinkman, and Andrei Shleifer. 1992. Growth in cities. *Journal of Political Economy* 100(6):1126–1152.
- Glaeser, Edward L., Sari Pekkala Kerr, and William R. Kerr. 2012. Entrepreneurship and urban growth: An empirical assessment with historical mines. Processed, Harvard University.
- Glaeser, Edward L. and William R. Kerr. 2009. Local industrial conditions and entrepreneurship: How much of the spatial distribution can we explain? *Journal of Economics & Management Strategy* 18(3):623–663.
- Glaeser, Edward L., William R. Kerr, and Giacomo A.M. Ponzetto. 2010. Clusters of entrepreneurship. *Journal of Urban Economics* 67(1):150–168.
- Glaeser, Edward L. and David C. Maré. 2001. Cities and skills. *Journal of Labor Economics* 19(2):316–342.
- Glaeser, Edward L. and Matthew R. Resseger. 2010. The complementarity between cities and skills. *Journal of Regional Science* 50(1):221–244.
- Gollin, Douglas, Rémi Jedwab, and Dietrich Vollrath. 2013. Urbanization with and without industrialization. Processed, George Washington University.
- Greenstone, Michael, Richard Hornbeck, and Enrico Moretti. 2010. Identifying agglomeration spillovers: Evidence from winners and losers of large plants openings. *Journal of Political Economy* 118(3):536–598.
- Handbury, Jessie H. and David E. Weinstein. 2010. Is new economic geography right? Evidence from price data. Processed, Columbia University.
- Harris, John R. and Michael P. Todaro. 1970. Migration, unemployment and development: A two-sector analysis. *American Economic Review* 60(1):126–142.
- Head, Keith and Thierry Mayer. 2004. The empirics of agglomeration and trade. In Vernon Henderson and Jacques-François Thisse (eds.) *Handbook of Regional and Urban Economics*, volume 4. Amsterdam: North-Holland, 2609–2669.
- Head, Keith and Thierry Mayer. 2011. Gravity, market potential and development. *Journal of Economic Geography* 11(2):281–294.
- Henderson, J. Vernon. 2005. Urbanization and growth. In Philippe Aghion and Steven N. Durlauf (eds.) *Handbook of Economic Growth*, volume 1B. Amsterdam: North-Holland, 1543–1591.
- Henderson, J. Vernon. 2010. Cities and development. *Journal of Regional Science* 50(1):515–540.
- Henderson, J. Vernon, Ari Kuncoro, and Matt Turner. 1995. Industrial development in cities. *Journal of Political Economy* 103(5):1067–1090.
- Henderson, Vernon. 2002. Urbanization in developing countries. *World Bank Research Observer* 17(1):89–112.

- Henderson, Vernon. 2003. The urbanization process and economic growth: The so-what question. *Journal of Economic Growth* 8(1):47–71.
- Henderson, Vernon, Todd Lee, and Yung Joo Lee. 2001. Scale externalities in Korea. *Journal of Urban Economics* 49(3):479–504.
- Holl, Adelheid and Elisabet Viladecans-Marsal. 2011. Infrastructure and cities: The impact of new highways on urban growth. Processed, Universitat de Barcelona.
- Holmes, Thomas J. 1999. Localisation of industry and vertical disintegration. *Review of Economics and Statistics* 81(2):314–325.
- Hsieh, Chang-Tai and Peter J. Klenow. 2009. Misallocation and manufacturing TFP in China and India. *Quarterly Journal of Economics* 124(4):1403–1448.
- Jacobs, Jane. 1969. *The Economy of Cities*. New York: Random House.
- Jaffe, Adam B., Manuel Trajtenberg, and Rebecca Henderson. 1993. Geographic localization of knowledge spillovers as evidenced by patent citations. *Quarterly Journal of Economics* 108(3):577–598.
- Jedwab, Rémi and Alexander Moradi. 2011. Revolutionizing transport: Modern infrastructure, agriculture and development in Ghana. Processed, Sussex University.
- Jedwab, Rémi. 2013. Urbanization without structural transformation: Evidence from consumption cities in Africa. Processed, George Washington University.
- Kerr, William R. 2010. Breakthrough inventions and migrating clusters of innovation. *Journal of Urban Economics* 67(1):46–60.
- Kim, Sukkoo. 2008. Spatial inequality and economic development: Theories, facts, and policies. In Michael Spence, Patricia C. Annez, and Robert M. Buckley (eds.) *Urbanization and Growth*. Washington DC: World Bank, 133–166.
- Krugman, Paul R. 1991. Increasing returns and economic geography. *Journal of Political Economy* 99(3):484–499.
- Krugman, Paul R. and Anthony J. Venables. 1995. Globalization and the inequality of nations. *Quarterly Journal of Economics* 110(4):857–880.
- Lall, Somik V., Richard Funderburg, and Tito Yepes. 2004a. Location, concentration, and performance of economic activity in Brazil. Policy Research Working Paper 3268, World Bank.
- Lall, Somik V., Jun Koo, and Sanjoy Chakravorty. 2003. Diversity matters: The economic geography of industry location in India. Policy Research Working Paper 3072, World Bank.
- Lall, Somik V., Harris Selod, and Zmarak Shalizi. 2006. Rural-urban migration in developing countries: A survey of theoretical predictions and empirical findings. Policy Research Working Paper 3915, World Bank.
- Lall, Somik V., Zmarak Shalizi, and Uwe Deichmann. 2004b. Agglomeration economies and productivity in Indian industry. *Journal of Development Economics* 73(3):643–673.
- Lin, Jeffrey. 2011. Technological adaptation, cities, and new work. *Review of Economics and Statistics* 93(2):554–574.

- Liu, Zhiqiang. 2007. The external returns to education: Evidence from Chinese cities. *Journal of Urban Economics* 61(3):542–564.
- Marshall, Alfred. 1890. *Principles of Economics*. London: Macmillan.
- Mayer, Thierry, Florian Mayneris, and Loriane Py. 2011. The impact of urban enterprise zones on firms' location. Processed, Science-Po Paris.
- Melo, Patricia C., Daniel J. Graham, and Robert B. Noland. 2009. A meta-analysis of estimates of urban agglomeration economies. *Regional Science and Urban Economics* 39(3):332–342.
- Michaels, Guy. 2008. The effect of trade on the demand for skill - Evidence from the Interstate Highway System. *Review of Economics and Statistics* 90(4):683–701.
- Michaels, Guy, Ferdinand Rauch, and Stephen J. Redding. 2012. Urbanization and structural transformation. *Quarterly Journal of Economics* 127(2):535–586.
- Michelacci, Claudio and Olmo Silva. 2007. Why so many local entrepreneurs? *Review of Economics and Statistics* 89(4):615–633.
- Moretti, Enrico. 2004. Human capital externalities in cities. In Vernon Henderson and Jacques-François Thisse (eds.) *Handbook of Regional and Urban Economics*, volume 4. Amsterdam: North-Holland, 2243–2291.
- Muravyev, Alexander. 2008. Human capital externalities: Evidence from the transition economy of Russia. *Economics of Transition* 16(3):415–443.
- Neumark, David and Jed Kolko. 2010. Do enterprise zones create jobs? Evidence from California's enterprise zone program. *Journal of Urban Economics* 68(1):1–19.
- Nieto Galindo, Victor Manuel. 2007. La aglomeración como una causa de la innovación en Colombia. *Planeación & Desarrollo* 38(1):97–139.
- Olley, G. Steven and Ariel Pakes. 1996. The dynamics of productivity in the telecommunication equipment industry. *Econometrica* 64(6):1263–1297.
- Overman, Henry G. and Diego Puga. 2010. Labor pooling as a source of agglomeration: An empirical investigation. In Edward L. Glaeser (ed.) *The Economics of Agglomeration*. Cambridge (MA): National Bureau of Economic Research, 133–150.
- Overman, Henry G. and Anthony J. Venables. 2005. Cities in the developing world. Report, Department for International Development (UK).
- Peri, Giovanni. 2002. Young workers, learning, and agglomerations. *Journal of Urban Economics* 52(3):582–607.
- Porter, Michael E. 1990. *The Competitive Advantage of Nations*. New York: Free Press.
- Puga, Diego. 2010. The magnitude and causes of agglomeration economies. *Journal of Regional Science* 50(1):203–219.
- Redding, Stephen and Anthony J. Venables. 2004. Economic geography and international inequality. *Journal of International Economics* 62(1):63–82.
- Rosenthal, Stuart S. and William C. Strange. 2004. Evidence on the nature and sources of agglomeration economies. In J. Vernon Henderson and Jacques-François Thisse (eds.) *Handbook of Regional and Urban Economics*, volume 4. Amsterdam: North-Holland, 2119–2171.

- Rosenthal, Stuart S. and William C. Strange. 2010. Small establishments/big effects: Agglomeration, industrial organization and entrepreneurship. In Edward L. Glaeser (ed.) *The Economics of Agglomeration*. Cambridge (MA): National Bureau of Economic Research, 277–302.
- Rothenberg, Alexander D. 2011. Transport infrastructure and firm location choice in equilibrium: Evidence from Indonesia's highways. Processed, University of California Berkeley.
- Saito, Hisamitsu and Munisamy Gopinath. 2011. Knowledge spillovers, absorptive capacity, and skill intensity of Chilean manufacturing plants. *Journal of Regional Science* 51(1):83–101.
- Shefer, Daniel. 1973. Localization economies in SMAs: A production function analysis. *Journal of Urban Economics* 13(1):55–64.
- Smith, Adam. 1776. *An Inquiry into the Nature and Causes of the Wealth of Nations*. London: Printed for W. Strahan, and T. Cadell.
- Storeygard, Adam. 2011. Farther on down the road: Transport costs, trade and urban growth in sub-Saharan Africa. Processed, Tufts University.
- Sveikauskas, Leo A. 1975. The productivity of cities. *Quarterly Journal of Economics* 89(3):393–413.
- Wheeler, Christopher H. 2001. Search, sorting, and urban agglomeration. *Journal of Labor Economics* 19(4):879–899.
- Wheeler, Christopher H. 2006. Cities and the growth of wages among young workers: Evidence from the NLSY. *Journal of Urban Economics* 60(2):162–184.
- Wheeler, Christopher H. 2008. Local market scale and the pattern of job changes among young men. *Regional Science and Urban Economics* 38(2):101–118.
- Williamson, Jeffrey G. 1965. Regional inequality and the process of national development: A description of the patterns. *Economic Development and Cultural Change* 13(4, part 2):1–84.
- World Bank. 2009. *World Development Report 2009: Reshaping Economic Geography*. Washington DC: World Bank.