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Cities and Growth

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The study of economic growth is an important part of economics. Traditionally, economists have attempted to understand the process of growth at the level of the aggregate economy, focusing, for example, on concepts such as the economy-wide levels of saving or of education. More recently, they have turned to the study of a smaller unit: the city. This *Letter* describes some of the motivation behind the focus on cities and also what the study of cities has taught us about the process of growth so far.

A basic growth model

Robert Solow's (1956) neoclassical model of economic growth has become a workhorse for economists engaged in the study of growth. In this model, output growth depends upon the growth of two factors of production — capital and labor– and upon exogenous changes in technology. The model has been quite useful in describing the growth experience of the U.S. and other industrialized nations. It also has been used to study the enormous disparities in growth rates and income levels among countries. In this role it has helped economists rule out some popular misconceptions about the causes of sustained disparities in growth rates, such as differences in tax codes and trade barriers.

Yet, cross-country data on growth provide a fundamental challenge to a key prediction of the Solow model: the model predicts that incomes should converge, but the data show convergence only among some subsets of countries. More generally, the problem is that the persistence and magnitude of differences in growth rates across nations are difficult to account for in the traditional growth model framework.

Lucas (1988) suggests a further elaboration of the role of technology as a solution: "This [technology] seems to me to be the one factor isolated by the neoclassical model that has the potential to account for

wide differences in income levels and growth rates" (p. 15). If by the term "technology" we mean society's stock of knowledge, its level and growth rate should not vary dramatically across countries; human knowledge is for the most part not proprietary to nations, but universal. Instead Lucas suggests that in addition to the general knowledge already included in the Solow growth model we should also consider the knowledge and skills of particular people.

A role for human capital

It is not hard to see why the skills of the labor force might matter. For instance, more highly skilled workers are likely to learn new technologies faster than less skilled workers. Consequently, an economy with a more skilled labor force is likely to grow faster than an economy with a less skilled labor force. Thus, the performance of an economy depends not only upon the size and growth of its labor pool, but also upon the level of skills possessed by the members of this labor pool. This level of skills can be thought of as the stock of human capital, much like the stock of physical capital in the economy.

So far, the role we have envisaged for human capital is straightforward: replacing a less skilled worker with a more skilled worker will raise the level of output, much as replacing a typewriter with a computer will. According to Lucas, however, the level of human capital matters for another reason as well: the productivity of a worker with a given amount of human capital depends upon the human capital of the workers that she interacts with. It is reasonable to think workers' skills are augmented through learning, and that workers learn from those around them. Thus, moving a worker from a "group" where the average level of human capital is low to one where the average level is high will raise her productivity.

What is the appropriate empirical counterpart of the "group"? Its defining feature is the level and kind of interaction that occurs among a variety of its members. Clearly, interaction will not be uniform across space (for instance, across the nation), but will be concentrated at certain nodes. Lucas suggests that cities are a particularly important kind of node: "It seems to me that the 'force' we need to postulate to account for the central role of cities in economic life is of exactly the same character as the 'external human capital' I have postulated as a force to account for certain features of aggregative development" (p. 38).

Concentrations of activity ranging from Silicon Valley to the garment district in New York suggest that dense agglomerations of economic activity can be beneficial. The diversity of activity in New York City also suggests that these gains from agglomeration are not limited to people engaged in the same kind of activity. Glaeser (1998) points out that cities provide increased opportunities for interaction, and to the extent that learning is facilitated by interaction, cities will accelerate the learning process for urban workers. Geographic proximity allows ideas to travel more rapidly, and therefore cities reduce the cost of moving ideas. These knowledge spillovers can lead to increased human capital accumulation through learning and ultimately to higher productivity levels.

In fact, in the absence of such external effects or spillovers, it can be hard to explain the existence of cities. Traditional theory would suggest that rather than clustering together in cities, industries would disperse as competition for space (cheaper rents) and labor (lower wages) would drive firms away from urban areas. According to Glaeser, the fact that firms still choose to locate in cities and pay the higher wages means that workers in cities are more productive: "...if workers weren't more productive firms would leave cities altogether and hire elsewhere. Since the urban wage premium appears to be a centuries-old phenomenon, we must assume that over the long run, firms are quite willing to pay these higher wages" (p.142).

This explanation is compelling even in the face of more traditional explanations for the existence of cities. Traditional explanations focus on the role of cities in reducing transportation costs, and in providing firms with easy access to numerous consumers and intermediate suppliers. There is some evidence to suggest that such factors may be becoming less important over time. For one thing,

transport costs as a share of GDP are falling (reflecting the decreasing significance of transport as a factor in the production process). Manufacturing has been in decline relative to the burgeoning service sector. Particularly notable is the fact (pointed out by Glaeser) that manufacturing has moved out of cities faster than it has moved out of the U.S. as a whole.

At the same time, we are aware of no evidence that suggests that cities are becoming less important over time. The implication is that cities have advantages beyond the traditional ones related to transportation cost and market size. These additional advantages appear related to knowledge and learning, and accrue due to human interaction. As Lucas asks, "What can people be paying Manhattan or downtown Chicago rents *for*, if not for being near other people?" (pp. 38-39). We now turn to the formal evidence that economists have found in support of the hypothesis that cities lead to higher productivity.

Some empirical evidence

Sveikauskas (1975) provides some early evidence on the correlation between productivity and city size. Using a sample consisting of data on 14 industries and (up to) 212 metropolitan areas, Sveikauskas estimates the relationship between a measure of productivity (value added per worker) and the population of the region. Based on the results of this estimation, he concludes that a doubling of city size is associated with a close to 6% increase in labor productivity. He goes on to show that this difference in labor productivity does not reflect the fact that capital investment in cities exceeds investment outside cities. Similarly, he finds that a doubling in city size leads to a nearly 5% increase in wages, even after allowing for the influence of some other factors such as education. Sveikauskas's results show that large cities tend to be more productive, but as he points out, a significant question remains — that of causation. He is unable to answer whether city size causes productivity gains or whether already productive cities grow large.

Rauch (1993) uses data from the 1980 population census to estimate productivity gains due to human capital externalities (or spillovers) in U.S. cities. He points out that such a study is better suited for this purpose than a study based on country level data. Countries with high human capital will tend to be more developed; for instance, they will tend to have a "…large and technologically current stock of physical capital." This means that it will be hard to determine the reason for any observed differences in productivity across countries; such differences could be due to human capital or to some of the other factors that go with high levels of development. These considerations are not likely to be as important for a study that looks at cities within a country.

Rauch defines human capital to contain both education and work experience components. He estimates a series of wage and rent equations to show that there are spillovers associated with the level of average human capital. Further, he finds that the spillover effects associated with education exceed those associated with experience. These results hold even when Rauch controls for the effects of other factors such as R&D investment policies that favor cities, as well as university concentration in urban areas. Further, his estimates of these externalities are similar to Lucas's and imply a significant social return to education. Specifically, he finds that the social return to education is 1.7 times that of private returns, in line with Lucas's estimate of an external human capital effect of 1.6. Raising the average education level of a metropolitan area by one year raises total factor productivity by 2.8%, in line with Lucas's estimate of 3.2%.

Ciccone and Hall (1996) note large discrepancies in productivity levels across U.S. states: a worker in the most productive state is two-thirds more productive than a worker in the least productive state. They use data at the county level to see if variations in population density can explain some of these differences. In their analysis, Ciccone and Hall go to substantial lengths to prevent their results from being contaminated by "reverse causation," that is, they try to ensure that the correlation between density and productivity that they find is not the result of productive regions growing faster than less productive ones.

They find that doubling employment density increases labor productivity by 6% and that local gains due to employment density can explain more than half of the labor productivity variation across states. They also show that the differences in productivity do not reflect other factors, such as the level of public capital, and that they persist even after the level of education is taken into account. Finally, they also show that the positive relationship between density and productivity does not reflect the influence of market size (since an alternative hypothesis could be that access to large markets leads to faster growth).

Conclusion

While the results of these studies differ in some ways — such as the relative importance of education — they all find significant spillovers associated with cities. More specifically, the productivity of workers in cities is higher than can be explained by the kind of neoclassical production function used by Solow (where output depends upon labor, capital, and an exogenous productivity term) or even a neoclassical production function that has been augmented to allow for direct effects of human capital. These results provide support for Lucas's statement that such spillovers are an important part of economic growth.

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