Cities, Information, and Economic Growth

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> Great are the advantages which people following the same skilled trade get from near neighborhood to one another. The mysteries of the trade become no mysteries; but are, as it were, in the air. . . .
>
> A. Marshall
> *Principles of Economics*

For centuries economists have fervently sought to understand the forces behind economic progress. Smith (1776), Marx (1909), Marshall (1890), Young (1928), and Keynes (1936) all hotly pursued this topic. In the post-World War II period, economic theorists, development economists, macroeconomists, econometricians, economic historians, and growth economists have devoted considerable energy to thinking about the forces behind long-run growth rates.

It would be impossible to claim that these economists have reached a consensus on the causes of growth, but it seems clear that the growth of economies does not involve the simple accumulation of capital and labor. Theoretical models of capital accumulation (based on Solow, 1956, for example) ultimately leave the growth rate as an unexplained outside parameter. Empirically the stunning range of cross-national experiences makes it clear that the forces driving growth are rich and varied.

Instead of continuing to use simple capital accumulation models, economists (following Romer, 1986) have moved toward models in which the stock of knowledge, in the Nation and the world, plays a critical role in facilitating progress. The nature of intellectual capital—mostly the presence of strong external effects—solves certain technical problems when explaining why global increasing returns, which are necessary to explain growth, can coexist with competition. The emphasis on knowledge was needed to solve a technical problem in growth theory, but it also seems to be vindicated empirically. Hard evidence suggests that the levels of human capital in a country strongly predict its growth rates. Historical evidence stresses the role that the production of ideas plays in spurring growth.

A consideration of intellectual spillovers has naturally led growth economists to thoughts about cities. Where are intellectual spillovers more obvious than in dense, urban environments? The physical closeness of workers of Silicon Valley, Route 128, or Wall Street contributes strongly to the flow of ideas in the microchip or finance industries. Even more interestingly, the urban environment can foster the unexpected combination of seemingly unrelated ideas that may provide the most important forward leaps of knowledge.

While the importance of physical proximity to the expansion of knowledge suggests that the role of cities in growth must be considered, it also encourages economists to think about the impact of cities' intellectual functions on optimal urban form. Anecdotal evidence (such as Garreau's) suggests that fax machines have begun to play the same role in influencing urban form in the 1990s as trolleys did in 1900 or commuter highways did in the 1950s. This type of evidence means that to understand urban form one must think as much about informational transport costs as one did about physical transport costs. Henderson and Mitra (1993) is an early, excellent step in this direction.

One primary difference between physical transport and informational transport is the degree to which the benefits of moving into an urban center are internalized by the relevant agent. When a firm lowers the transport costs associated with its inputs by moving downtown, the benefits of those lowered costs are completely internalized by the firm.[1] When firms move downtown to be connected to the information networks of the downtown area, they internalize some of the benefits of their action, but some (if not most) of the benefits are the intellectual spillovers that firms produce, and those benefits will not be internalized. The presence of these externalities leaves room for government action.

The need for, or value of, policy response to informational externalities seems much more striking in the area of negative (or absent) informational spillovers than in the complex area of technological corridors. Informational externalities do good things, but they also speed riots, foster crime, and help form ghettoes. Considering these negative informational features of cities and the appropriate policy response to them seems particularly important after the 1992 riots in Los Angeles.

The informational role of density is quite clear in the formation of riots. Only when individuals know that there are outbursts or crowds in the streets will they decide to join in the riots. This fact is shown quite clearly in that, whereas riots formerly were limited because word-of-mouth information spread slowly, modern riots have spread more rapidly due to the speedy transfer of information by the news media. Likewise, information has an impact on both organized and unorganized crime. Knowledge about, and proximity to, victims or targets of crime is a critical ingredient of violent activity.

Ghettoes are perhaps the most interesting informational phenomenon of all. Kain's (1968) seminal paper on spatial mismatch referred to the lack of information networks connecting the ghetto and downtown. Wilson's (1987) emphasis on the idea that middle class African Americans' flight to the suburbs denies role models to disadvantaged youth is a strongly informational argument. The physical barriers between ghettoes and downtowns are slight, the intellectual barriers immense. The Number 4 train may go to Harlem, but the ideas of Wall Street rarely (if ever) make it past 96th Street.

This article, then, addresses the relationship between information and cities. The next section reviews nine of the most seminal papers related to the area of new regional economics. The third section presents 10 facts about urban growth, taken mostly from my previous work. The fourth section presents a theoretical discussion about the information connection between cities and skills acquisition. The fifth section discusses the informational role that cities play in creating social instability, including riots and crime.

A Review of the Recent Literature

This section discusses some of the primary papers in the area of the new regional economics. The first three authors, whose works are clearly in the literature on growth, are included here because their ideas were central to much of the new thinking about

information and cities. The next four papers are much more distinctly in the urban economics literature.

Earlier Literature

There is a long history of urban economists writing about informational agglomeration economies. Marshall (1890) discussed the informational role that cities played in spurring the accumulation of human capital. Chinitz (1961) wrote a particularly important paper on ideas and intellectual spillovers within cities. Kain (1968) presented one of the first statements of the role that spatial separation might play in creating informational gaps between the poor and the rich in urban areas.

This literature summary does not claim to do justice to the important works by many urban economists who have written about the role that information plays in economic growth. Instead it is meant to give the history of a small body of literature that combines urban economics with recent advances in growth theory. Even with the new regional economics, my goal is to explain certain papers in depth rather than give a comprehensive overview of the entire literature.

Themes of the New Regional Economics

The most important theme of all of this literature is the emphasis on the spread of information. Growth theory has tended to see the rise in the global stock of knowledge as the main feature of human progress. Naturally the means by which new ideas are transmitted are integral to the development of global intellectual capital. Most of these papers suggest either the importance of an efficient flow of ideas or the way this flow of ideas works in practice.

Another theme of the literature is the degree to which the intellectual transfer process generates returns on investment in ideas that are external to the individual making the investment. It is quite possible that knowledge, the investment good of choice and the engine of growth in this literature, generates externalities. However, the degree to which the benefits of knowledge are external is a function of other decisions made by society. Institutions such as copyright or other forms of intellectual property rights determine the degree to which the benefits of innovation are internalized by the innovator.

Urban structure also determines the degree of “appropriability” of ideas. History tells of many inventors who moved to remote areas because they were aware that proximity fosters appropriability. Silicon Valley shows the degree to which density speeds the rate of innovation. Closeness contributes to the degree of appropriability.

Of course greater appropriability may either increase or decrease growth. As more people are able to imitate an idea, more people can build on it, and growth should rise. However, as more people can imitate, there is less incentive to innovate in the first place, since others are apt to steal one’s ideas. Growth thus suffers from this second effect, and the net effect of an increased ability to copy depends on which of the effects dominates.

Another major theme that runs through this literature is the importance of human capital in transforming ideas into products. The best blueprints in the world are no good without engineers who are able to implement them. The empirical work on growth, which generally lacks good measures of intellectual stock, relies on human capital to capture the degree of production of ideas.

Romer (1986)—Knowledge and Growth

It is generally acknowledged, both within the field of academic economics and in the popular press (see articles in *The Economist*, *Business Week*, and so forth), that Paul Romer revitalized the economics of growth. Growth is intrinsically one of the most important and interesting topics in economics. What could be more important to a policy planner than knowing what determines the long-run level of wealth in her country? What topic is more fascinating than understanding why the Western nations grew rich in the 19th century?

By the 1970s the standard neoclassical treatment of growth theory faced major problems. A treatment of growth based entirely on capital and labor accumulation could not adequately explain why countries did not converge to a steady state. Eventually society should find the right capital-to-labor ratio and stop growing. Only by including an exogenous rate of technological change could economic models generate the perpetual growth that one seems to see in the developed countries, but putting growth in an exogenous parameter does little to explain it.

One solution to this problem was to move from the constant returns-to-scale production function employed in standard economics and neoclassical growth theory to a production function that displays increasing returns to scale. This solution has been known since Young (1928): Increasing returns to scale eliminate any kind of convergence and allow for perpetual growth. The problem with increasing returns is that they are incompatible with perfect competition, since marginal costs (or prices in perfect competition) lie under average costs, which means that firms are earning negative profits.[2]

Romer's thesis eliminated these two problems elegantly. He allowed for social increasing returns in production, but made private production constant returns to scale. This was achieved by making much of capital investment have social benefits not reaped by private investors. Immediately this allowed the optimization problem of the investor to be well behaved and firms to make positive profits, but kept the economy as a whole expanding perpetually. These externalities allowed for the combination of competitive behavior and increasing returns that made growth possible in a model.

However, for this model to be more than a mere technical curiosity, Romer needed to present convincing evidence that (1) there existed a form of investment that generated these massive spillovers; (2) this form of investment was important and becoming increasingly so; and (3) the real world resembled the predictions of his model. The form of investment Romer suggested was the accumulation of knowledge, which satisfies all of the criteria. Accumulating ideas clearly benefits others as much as it benefits the original innovator. It would be farcical, for example, to claim that Edison's wealth grew by the full extent of his contribution to human welfare. Hard evidence from Scherer and others documents the extent to which intellectual advances are used outside the inventing firm or even the inventing industry.

Obviously, knowledge is an important form of investment. Consider, for example, the computer industry, a major part of the U.S. economy. Growth in the computer industry has not taken the form of larger physical plants but instead has developed through the accumulation of intellectual capital. The difference between computing today and computing 30 years ago is not the mass of physical capital—if anything, that has decreased—but the way that this capital has been directed by sound ideas.

Romer's work pushed economists into thinking about the generation of ideas. His dissertation and later work persuaded many researchers that generation of new knowledge was

the key to economic progress and that understanding the conditions that allow knowledge to expand quickly was the key to economic growth. It took only 2 years before a paper was published that linked this generation of new ideas with cities.

Lucas (1988)—Cities and Knowledge Accumulation

Lucas (1988) is remembered for many reasons other than his discussion of cities. Lucas was one of Romer's dissertation advisors, and also had a long-term interest in growth. His paper, much more than Romer's work, represents an integrated approach to growth theory. Lucas begins with a discussion of neoclassical growth models and then presents a variety of Romer-style models.

Although this work has many seminal ideas, much of its value is as a teaching tool. Lucas presents the reader with building blocks for growth models and shows how others can use these models in their own work. By contrast the mathematical complexity of Romer's work made him confine his proofs to an appendix, which was available upon request. Lucas' work made the ideas and methods of the new growth theory much more accessible to other economists.

Lucas did put some major twists on Romer's original work. Perhaps the biggest change was that Lucas emphasized human capital investment as opposed to investment in a disembodied stock of knowledge (Barro and Becker, 1988, also switched this emphasis). In a technical sense, the switch is fairly irrelevant; calling the engine of growth "human capital" or "disembodied knowledge" makes little difference to the workings of the model. Conceptually, however, there is a great difference.

The argument behind the externalities of human capital are fairly plausible. Certainly many people have experienced the positive aspects of having smarter colleagues.[3] Public investment in education is justified in part by the idea that there are benefits to society (such as a better qualified voter) from an educated individual that are not taken into account by that individual.

Obviously there is also a strong complementarity between embodied human capital and disembodied knowledge. Blueprints need humans to use them. Surely the correct engine of growth is some combination of physical capital and disembodied knowledge. Knowing whether embodied human capital or disembodied knowledge is more important for economic growth is a subject for empirical research, and empirical research is important for targeting government actions.

The final major point of Lucas' paper is his discussion of the role of cities in the transfer of knowledge. Lucas' outlook draws not from the traditional urban economics literature but from the works of Jane Jacobs. Jacobs (1968) is one of the most passionate defenders of the urban role in the transfer of knowledge. While some of Jacobs' claims, such as her assertion that cities were responsible for the 8000 B.C. agricultural revolution, are somewhat implausible (see Bairoch, 1989, for a rebuttal), her ideas and passion are almost unmatchable.

Lucas followed Jacobs and argued that when one thinks about human capital, knowledge, and growth, the role of cities is almost inescapable. Ideas move quickly in cities; unrelated agents come into contact and share ideas. The externalities that this growth literature discusses seem to be much more features of urban environments than of agents operating alone in the hinterland. Lucas (1988) brought to growth economics the idea that cities may be playing a major role in facilitating the accumulation of knowledge spillovers in the growth process.

Barro (1991)—A Canonical Empirical Form

Barro (1991) wrote one of the first major empirical papers of the new growth literature. This paper looked at a sample of countries over the past 30 years and investigated why and how they grew. Barro started with a simple neoclassical growth model that predicts that per capita gross domestic product (GDP) growth should be influenced by the savings rate, the fertility rate, and the rate of technological change. He then eliminated the effects of investment and fertility to look at the determinants of technological change.

Barro's format was particularly simple and has been used dozens, if not hundreds, of times. He simply regressed growth in per capita GDP—once investment and fertility were controlled for—on various national initial characteristics, such as human capital or political variables. Out of this paper came both the standard form for an empirical literature on cross-country causes of growth and a series of critical results on characteristics associated with country growth.

The advantages of this simple format are great, compared with the complexity of the other possible approaches to testing theories about national, regional, or urban growth. The other literature tends to be much more complicated and has been so for decades. In particular both growth economists and regional economists regularly regressed changes on changes—for example, GDP growth on industrialized sector growth, or growth in a city on growth in a standard metropolitan statistical area (SMSA). The changes-on-changes approach is correct only when the researcher is confident of both using the functional form and not omitting any relevant variables. (Contemporaneous changes are more likely to be determined by omitted growth-causing variables than by a change in initial level.) Modern empirical style is more likely to focus on the less dangerous (and less ambitious) simple regressions between later changes and earlier conditions than on the testing of a complex multiequation structural model.

Barro's major new findings stressed the importance of two forces: education and politics. Human capital variables were particularly important in determining growth. This result, which has proven to be remarkably robust, has been taken as strong evidence for the importance of skills accumulation in economic progress. It has also been seen as strong evidence for the knowledge/human capital view of growth emphasized by Romer and Lucas.

The political results are also interesting, although less relevant here. Barro found that the black market premium, which he took to be an index of the degree of government distortions in the marketplace, is negatively correlated with later growth. A large amount of later work, ably summarized by Alesina and Perrotti (1993) documents and explores further the channels through which politics affects economic progress. Overall the consensus seems to be that national attributes which appear to be "bad" government—such as instability, dictatorship, corruption, and so forth—are all negatively correlated with growth, although it is difficult to determine which one matters most.

Krugman (1991)—Cities and History

Simultaneous to these developments in growth theory, which led some of its most serious proponents to a study of cities, Paul Krugman, a giant in the economics field of international trade, was moving that discipline toward ideas about spatial form and cities. Krugman was interested in fundamental questions about when and why industry concentrates or disperses. His results have certain basic themes that often interrelate with the urban literature as far back as von Thünen (1826).

Krugman began with a simple model of production and local increasing returns—all he did was assume a fixed cost of production borne by all firms. He then assumed a simple transport cost and looked at the way production situated itself over space. This first model predicted multiple equilibria: One equilibrium existed with complete dispersion of activities, and two others with spatial concentration in one region or the other.

This type of multiple equilibria model seems particularly important in understanding why regions develop the way that they do. Frequently one area may have a slight advantage in production, but production becomes concentrated there to an extent that seems far beyond the region's comparative advantage. A multiple equilibria model explains this phenomenon easily: a slight advantage might tip the world out of complete dispersion and, through the forces that lead to spatial concentration, generate extremely high density in one area and low density in others.

The force that Krugman used to explain the concentration was that of transportation costs, the oldest known force behind location. An interesting result is that the connection between these costs and concentration is not monotonic. At low levels of costs, lower costs lead to more dispersion, as can be seen currently, both across regions and in the spread to suburbs supported by better transport; at high levels of transport costs, *higher* costs also lead to more dispersion. The reason may be that when transport is too expensive it becomes more important to be near the nonmobile factors of production. An example of this effect is Bairoch's claim that the first cities of 8000 B.C. would have been impossible without pack animals to carry food to the city from the farms of the hinterland.

Although the emphasis on transport costs was not new, Krugman's dynamics were, as was his systematic approach to modelling agglomeration economies. In contrast to the more standard urban economics, which was much more likely to simply postulate a series of agglomeration economies and place its reduced form into a model, Krugman insisted (correctly in my opinion) that these economies should be explicitly modelled whenever used. His paper did not mean to suggest that transport costs were driving most locational decisions, but it did suggest that transport costs were one of the forces behind agglomeration that could most easily be explicitly modelled. This theoretical advance towards explicit modelling was a big contribution of Krugman's paper.

His other contribution is the importance of coordination, expectations, and history on regional development. Certainly urban economists have understood that these forces were important for decades if not centuries, but no one before Krugman had put them all together in as simple and rigorous a form. Krugman's work shows the conditions under which history can influence expectations and vice versa. He also shows the potential role of government in coordinating the flow of activities between regions.

Rauch (1991)—Human Capital Across Cities

Rauch, like Krugman, came from the field of international trade, but his paper is clearly a test of the Romer-Lucas human capital spillover framework. It starts with the assumption that human capital spillovers are local—that is, limited within an SMSA. Given this assumption, human capital externalities can be treated like any other standard urban amenity (see Rosen, 1979, or Roback, 1982). Rauch, following the demand for amenities literature, was able to use both wage and rent gradients to explain how productivity was enhanced by living near better educated people.

Because the simple model is one in which human capital in the SMSA enhances everyone's productivity, wages in SMSAs with high levels of human capital should be higher than those in other SMSAs. However, so that everyone in the model does not move

to the highest human capital SMSA, Rauch needed a balancing force and used the classic urban restraint on growth, land rents. In highly productive cities, rents should be high. Landowners are expected to charge more for the privilege of living where one can work near smarter people.

Using a data set with both wages and rents, Rauch was able to test this theory and found that SMSA cities with high levels of human capital had both higher property costs and higher wages, holding individual characteristics constant. Even more startlingly, the magnitudes of the spillovers that he found were very close to those found by Lucas (1988) using aggregate data. Rauch's paper presents the strongest evidence to date on the productivity-enhancing advantages of living in cities with higher levels of education.

Rauch did his best to strengthen his work against the first line of criticism, omitted variables. He included a variety of other urban amenities and found little change in his results. The only remaining problem was one of unobserved heterogeneity. Since by definition "more educated" cities contained people with more observable human capital, might not large cities also have workers with less unobservable skills? The presence of such unobservable variables would lead to Rauch's results without having to resort to human capital spillover models.

In order to test just this notion, I (Glaeser, 1992) looked at migrants to cities with higher average levels of human capital and to cities in general. I found that wages did not rise immediately for migrants when they entered new cities. Instead there seemed to be a slow increase over time, although I could not reject the strong possibility that there were large, unobserved differences among residents of different urban areas. Johnson (1952) had found similar results 40 years earlier. I had to conclude that the difference across cities was caused either by unobserved heterogeneity or by a slow accumulation of productivity in cities with high levels of human capital.

Glaeser, Kallal, Scheinkman, and Shleifer (1992)—The Spread of Ideas

This paper was our first major foray into urban economics. Two of the authors, Scheinkman and Shleifer, were major contributors to the growth literature. Scheinkman was a pioneer of mathematical methods in growth in the 1970s and was one of Paul Romer's primary advisors. Shleifer had written extensively on growth and emphasized coordination issues and pecuniary externalities.

The authors wanted to use urban data to test three prominent possible forms that intellectual spillovers might take: MAR (Marshall-Arrow-Romer) increasing returns spillovers, which predicted that initial size should generate growth; Jacobs small firm-diversity spillovers; and Porter spillovers from highly competitive locations. The data used were 30-year employment patterns across SMSAs. We looked only at the larger city-industries (defined as an industry such as steel in a city like Pittsburgh). This type of selection, based on initial characteristics, does not lead to common selection error, as many commentors on this paper have erroneously claimed. Instead it simply restricts the authors from having much to say about industrial growth for smaller city-industries. Thus we estimated only the growth relationship for the set of larger city-industries.

The authors used two measures of initial scale as their basic controls: overall employment and relative employment (defined as employment divided by city employment) within the city industry. These scale measures are supposed to reflect the various Romer-style theories about the way sheer size increases the ability to generate new ideas. We found both initial measures negatively correlated with later growth and concluded that

initial concentration does not seem to foster creativity. Later work sharply disputed the relative employment findings. Henderson, Kuncoro, and Turner (1992) found that relative size is positively related to later growth, in a study involving a much smaller set of industries with a much wider range of initial levels. Miracky (1993) reported ambiguous results on this connection. However, since both investigations found that absolute levels are sharply and negatively related to later growth, the authors also supported the idea that scale economies on the local-industry level do not really create growth.

The second result that we found was that urban diversity is positively related to later growth. Using a concentration index, we found that city-industries in highly diversified cities grow much more quickly than city-industries in one-industry towns. This finding, which is sporadically supported by Miracky (1993), supports Jacobs' idea that growth is a function of cities combining unrelated activities and that the biggest innovations result from a combination of seemingly unrelated ideas.

The third finding of our paper, which is strongly supported by Miracky (1993), was that more competitive industries grow much more quickly. It can be interpreted as a statement that competition breeds growth, as in Porter's books, and can also be interpreted as evidence for the dynamic benefits of smaller firms over monopolies.

Henderson and Mitra (1993)—Ideas and Urban Form

This paper was inspired by Garreau's popular volume, *Edge City*, in which he details the rise of communities on the fringe of existing metropolises. These "edge cities" use many of the advantages of the existing cities but avoid the problems of crime and congestion. The differences between the edge cities and the older suburban communities are that (1) businesses are completely located in the edge cities and (2) edge cities are able to stay closely connected informationally with the older city. It is the informational connection that ties this paper to the new regional economics.

Henderson and Mitra in some ways present a fairly standard intra-urban location model in which they examine the location of agents within a single metropolitan region. They broaden the standard framework by having more than one center of business, and they also consider the important role of the informational connection. This paper generates a variety of interesting results about the way the cost and range of the information connection should relate to urban structure.

The importance of this paper lies, of course, in its handling of goods and ideas within an urban context. It allows for limits on urban size to come from both informational constraints and goods constraints. As economists move toward understanding how the field of telecommunications changes urban structure, I suspect that this paper will be one of the most important and most cited in the literature.

Ten Facts About the Recent Growth of Cities

The following facts are generally taken from Glaeser, Scheinkman, and Shleifer (1993), although new facts are included in this article. In this work I present simple ordinary least squares results combined with scatterplots, an arrangement chosen for simplicity. All results were checked with a variety of controls, ranging from regional dummies to initial conditions. The results are still strong, and in many cases become stronger, when other controls are included. The results are presented in the figures that give R-squareds and slopes. All t-statistics are over 3, so that every result is significant at the 99-percent level and many are over 5.

It should be noted that the unit of observation used here is the city and not the SMSA. The emphasis on human capital and other spillovers makes the smaller unit of observation much more desirable. While cities certainly suffer from being artificial, political constructs, they seem to be a much more reasonable unit for looking at spillovers. The relevant population that generates human capital spillovers for the residents of Roxbury, Massachusetts, for example, is much more likely to be the residents of Roxbury than those of Newton.[4]

Finally, the relevant sample of 200 cities contains the 100 largest cities in 1960 and the 100 cities with the largest nonwhite populations. This somewhat odd sample was created for other reasons. All results are robust only for the 100 largest cities. The variables are described at length in Glaeser, Scheinkman, and Shleifer (1993).

Population and Income Move Together

A fundamental issue when thinking about urban growth is, how does one measure growth? Across countries, increases in per capita GDP seem to be a very natural way to measure the economic growth of countries. Across cities, this choice is much less obvious. General equilibrium models show that any real differences in income across cities should be quickly eliminated by migration, and any differences that remain simply reflect negative amenities—such as higher rents in the higher wage city. Employment or population growth is, in fact, the more natural unit for looking at growth across States or cities with free migration, but these measures rarely resemble the wealth (or welfare) increases that we are ultimately interested in examining.

Alternative methods of measuring growth might include looking more closely at the housing and real estate markets. Increases in land prices and development of new real estate structure might prove to be an important, alternative index of the degree of expansion of a city. The relative preferability of one index of growth to another depends on the elasticity of supply of new structures. (Perfect elasticity of real estate supply means that growth will show up only in new structures, not in prices. Perfect inelasticity of real estate supply means that prices alone will reflect growth.)[5]

One of the interesting things about growth across U.S. cities in the past 30 years is that the two measures move together, so that most things that predict per capita income growth predict population growth as well. The correlation between income and population growth is 39 percent; the plot of income and population growth is shown in Figure 1. While there is certainly a great deal of unexplained variance, the overall connection is clear. This connection was not present in my earlier work on the growth of city-industries (Glaeser et al., 1992) in which declining city-industries frequently experienced increasing wages, presumably as the less skilled workers were fired first.

There are three natural explanations for this observance. The first states that changes in urban population were labor demand driven. Certain cities experienced positive shocks to demand for their products, and as a result both wages and employment rose. This explanation is plausible only if one believes that migration would not have eliminated the wage increases over a 30-year period.

The second possible explanation is that growing cities experienced an increase in the number of highly skilled workers. More highly skilled migrants might have been going to the more popular cities. A third explanation may be that the popular cities had some attribute that was valued more over time, such as the initial skills distribution of the city.

Population Growth Persists

Figure 2 shows another important fact about urban growth: The cities that grew from 1950 to 1970 also grew from 1970 to 1990. This is not merely a regional phenomenon (the South has been growing for 40 years), as it holds true within every region of the United States. In fact the best predictor of whether a city will grow over the next 20 years is whether or not it has grown over the past 20 years. As the figure shows, the correlation between the growth rate of the population in the earlier period and the growth rate in the later period is 66 percent.

This fact dovetails nicely with a similar one presented by Blanchard and Katz (1992) about U.S. States. They document that there is a strong correlation—although weaker than ours—between the growth of States in the early postwar period and the growth of States in the later postwar period. Of course, this correlation holds at the regional level as well. The South and the West grew during both time periods.

There are several possible interpretations for this correlation. A simple one is that there are good cities and there are bad cities. The good cities just keep growing, and the bad cities keep declining. It is unclear from Figure 2 just what makes a city good or bad, but it seems easy to argue that there are profound city-specific effects that determine growth.

Another interpretation is that growth begets growth despite congestion problems. Models such as Krugman (1991) suggest that the presence of other people is one of a concentrated area's biggest attractions. If such forces are at work, then one would expect a positive shock to a sector's population in one period to be followed by a second shock in the second period.

A third interpretation is that the postwar period has simply featured remarkable continuity in demand and supply shocks to urban areas. The products that became more valuable from 1950 to 1970 also became more valuable over the later period. The urban attributes that rose most in their valuation by residents during the earlier period also rose more in value over the later period. The demand story would focus on the postwar rise of services relative to manufacturing. The labor supply story would focus on the value of certain amenities such as weather rising perpetually over the period.

Human Capital Generates Growth

Figures 3 and 4 show the relationship between population and income growth across the sample of cities, with initial levels of human capital as measured by the percentage of college-educated people in the city. The correlation coefficient for both measures of growth is over 30 percent. In fact this connection rises when regional dummies are corrected for. The South was a "low-schooling" region that did well in my sample.

This work is consistent with Barro's (1991) finding that schooling precedes the growth of a country's GDP. It is slightly different in that Barro measures human capital investment flow while these measures capture the stock of human capital in the economy. However, cross-national regressions, controlled for initial stocks of human capital, show the same results, with human capital predicting later growth. These results have been duplicated and confirmed by Miracky (1993) for a different time period.

Again interpretations abound. These results could be saying that highly skilled individuals make cities good by generating ideas and productivity-enhancing innovations. These ideas and innovations then attract migrants and raise everyone's wages, at least in the short run.

The results could reflect the increasing importance of skills in the U.S. economy, as documented most thoroughly by Murphy and Welch (1992). As skills became more valuable, the incomes in cities with highly educated workers rose because the workers were being paid more. Also, if the education of a community influences the education of the individual, a nationwide rise in returns to skills would create incentives for individuals to flock to places where there are highly skilled people from whom to learn.

Another interpretation is that these results reflect government or political economy concerns. More highly educated people might have created better school systems through increased spending on schooling and greater parental involvement. Better schools might have attracted more residents to the city. In general, education might have been linked to the quality of government, and governmental quality might be attracting capital and labor to the city. A final possibility is that low-skilled people might elect officials who support redistributional policies that deter capital and high human capital labor flows.

Schooling Follows Schooling

Figure 5 shows the relationship between the initial percentage of college-educated residents and the increase in the share of the city's population that is college educated. The graph is strikingly positive, with a correlation that is more than 63 percent. This connection between initial schooling and schooling growth has been found across countries by Glaeser (1993).

The connection means, basically, that cities which began with a high degree of schooling had the greatest increases in percentage of college-educated people over the past 30 years. The well-educated moved (or were born) in greater numbers where well-educated people were already located. This shift in population has resulted in a greater disparity among cities in the level of human capital. (This shift is much less obvious when one is observing SMSAs.)

The reasons behind this finding are not immediately obvious. One explanation may be that migrants tended to be better educated members of the population, in part because they are younger. Because cities whose inhabitants have a higher average level of skills attracted more migrants, they had more well-educated people than other cities. Another interpretation is that more educated people benefit from being with others of similar educational level. As time passes, people sort themselves out so that they can be near those whom they like best.

A final explanation is that this sorting occurred not because of complementarities among highly skilled individuals in productive activity (at work or at home) but because of the political economy. If governments have increased their activities as redistributors of incomes since 1960, then there is a greater incentive for sorting across cities. When cities redistribute income, it is more important for highly paid individuals to live among similar people who do not want redistributional policies.

Schooling Becomes More Important Over Time

Figures 6 and 7 show the way schooling changes growth over two different time periods. Figure 6 shows the relationship between schooling and population growth between 1950 and 1970, while Figure 7 shows the same relationship between 1970 and 1990. Both relationships are strong and positive, but the slope is significantly higher for the later period. In addition, the accuracy with which education can explain population change has risen over time.

This work relates to the findings of authors such as Murphy and Welch (1992) who document the rise in returns to skill. The later period was one in which skills were increasingly valued by firms; the earlier period did not display the rise in returns to skill. The result for urban growth is that the city-education connection rose just as the wage-education connection did.

The Murphy and Welch results are the most natural way of thinking about this phenomenon. If skills have become increasingly valuable in the U.S. economy, it is not surprising that the ability of schooling to generate growth has risen as well. If being around skilled people is like having skills oneself, then it is much more important to be around skilled people in the later period. The increased connection between schooling and population growth can therefore be explained because migrants have increasingly desired to be around highly skilled people.

An alternative explanation again emerges as a political economy story. Between 1950 and 1970, cities were not yet fully involved in redistributional activities, so there was less of an incentive to flee cities with low levels of human capital. Between 1970 and 1990 redistribution increased, so for those people who wanted to avoid it, being around people with high levels of human capital became more important.

Unemployment Eliminates Growth

Figures 8 and 9 show the relationship between initial unemployment and later growth. The graphs show a relationship between unemployment growth and both population and income growth. The connection between unemployment and later income growth is stronger.

Unemployment may deter growth, because it serves as a proxy for an unobserved negative demand shock. Cities with high unemployment rates may be suffering from a decrease in demand for their local product, and (as in Blanchard and Katz, 1992) individuals leave those cities that no longer produce what people want. This interpretation sees unemployment as a reflection of demand and part of a local business cycle.

An alternative interpretation sees high unemployment as a measure of human capital in the community. High levels of unemployment reflect a city with (1) low levels of human capital; (2) badly structured spatial characteristics that separate workers from jobs; or (3) other major difficulties. The presence of a core group of unhappy, low-skilled workers may be especially damaging to a city, particularly if they generate large negative spillovers such as riots, crime, or political difficulties. These spillovers may be the cause of the negative relationship.

Unemployment Persists

Figure 10 shows a piece of evidence that argues for the second interpretation of the fact that unemployment eliminates growth. Unemployment rates persist very strongly over time. There is a high correlation and almost no convergence when comparing unemployment rates in 1960 with unemployment rates in 1990. The best prediction, when observing high 1960 unemployment rates, is not that those rates would have converged back to a normal full employment level by 1990. Instead the best prediction is that the unemployment rates would remain approximately constant.

This argument suggests, of course, that urban unemployment is not a reflection of a temporary business cycle shock. Rather it reflects something far more disturbing: a permanent problem with the city's labor market. That this permanent problem does not seem to

disappear, even over a 30-year period, suggests that when growth avoids high unemployment rates, it does so because the rates are a measure of permanent pathologies, not temporary shocks.

Violence Begets Violence

Figure 11 shows a similar fact for violence within cities. The growth of violent crimes per capita between 1960 and 1990 is positively correlated with the level of violence initially in the city. This correlation is robust to the exclusion of the various outliers (in Figure 11) at the high end of the violence scale.

One interpretation of this effect is that urban problems repel workers, particularly good workers. As law-abiding citizens leave high-crime areas, a higher proportion of people indulging in criminal activities are left, and the level of crime goes up. In addition, it is possible that the police may more or less abandon areas they consider to be "lost."

Other interpretations include the spillover stories discussed in the section on crime below. As criminal activity rises, it becomes less likely that a given individual will be caught. When that happens, more people begin to indulge in criminal activity.

Crime Growth Falls With Human Capital Levels

Figure 12 shows that crime growth falls with human capital levels. This effect is distinct from the initial crime effect—violence begets violence—and both variables appear significant when they are run together in a regression. This result again emphasizes the important connection between human capital and urban problems.

Crime Rates Display Leptokurtosis

Figures 13 and 14 display histograms of city population and per capita crime rates. Both histograms show that each distribution is highly skewed, or it displays leptokurtosis. This type of distribution is well known for city populations and is part of Zipf's law. However, for crime rates, it is, I believe, new with this article.

This fact is particularly important because of economists' understanding of these skewed distributions. Averages are supposed to converge, under standard conditions, to normal distributions, and the convergence is guaranteed by the central limit theorem. When this convergence does not occur, as it does not in cases of high skewness, one of the standard assumptions must be violated.

The usual interpretation is that there is an interrelationship between the events being averaged. In regard to cities, Zipf's law is interpreted as meaning that having more people in a city attracts still more people. As regards crime rates, the standard interpretation would be that having more people involved in crime makes it more appealing for others to indulge in crime also.

Information, Silicon Valley, and Wall Street: Cities and Skills

The structure of cities can interact with the development of human capital in many different ways and through many different mechanisms. The facts discussed above have strongly suggested that human capital increases city growth. The data presented by Rauch (1991) and Glaeser (1992) suggested that cities affect the returns to human capital and skills as

well. This subsection details some of the theories about the ways that dense, urban areas should change the returns to skills.

I have included a variety of anecdotal evidence that would justify a connection between cities and enhanced human capital. These stories are meant to be suggestive and to motivate the reader to look for a connection between cities and skills. They occasionally predict empirical findings but usually are flexible enough so that several effects might be connected with any individual story.

The Transfer of Knowledge

In many different contexts, it has been argued that spatial proximity allows ideas to flow more freely. This effect should act to facilitate not only the imitation of patents, as Jaffe (1989) shows, but also the broader imitation of skilled activities. As the opening quotation from Marshall (1890) suggests, skills are often learned through imitation, and the imitative process is speeded up in cities. Although Marshall writes specifically about the secrets of tradesman, cities provide information more broadly in many fields. By comparison with nonurban workers, workers in cities learn their talents better and by observing errors more often, they can learn to avoid them. While the exposure to throngs of individuals and activities in cities might serve as an immediate jolt to worker productivity, it also increases a worker's human capital over time.

Marshall (1890) may have been the first to argue that locational proximity speeds transfers of information, but his view was later popularized by Jacobs (1968) and many others. Chinitz (1961) in particular made a strong statement about the importance of intellectual transfers in cities and their relation to human capital acquisition. He argued that excessive industrial concentration stopped the intergenerational transfer of entrepreneurial skills.

These arguments, when applied to the learning of skills, suggest that wages in the cities should not be raised immediately but over time, as workers improve their human capital by observing others and gaining access to a wide variety of ideas and production techniques. In general wages should grow more quickly in larger cities, and perhaps more quickly among workers with more formal education, assuming they are the workers most likely to invest greater effort in human capital. These spillovers might suggest a particular pattern of wage movements, but neither the movements nor their absence validates the theory of intellectual spillovers (since other anecdotal evidence can easily be told) or invalidates the connection between intellectual transfers and cities (since there are many other ways in which transfers might operate).

More traditional arguments about transfers and cities suggest that intellectual transfers increase productivity in cities and might even increase the productivity of better trained workers to a greater extent, but that these effects should not work directly through facilitating human capital investment. The first argument, that there should be greater productivity in cities, as argued by Rauch (1991) or Lucas (1988), is distinguishable from the cheapening investment story, which is that the cost of acquiring skills is lower, because it predicts a level effect for new migrants.

The second argument does predict that migrants should receive the full-wage premium over time as they respond to the incentives to acquire more human capital, but it also suggests that cities will probably affect skilled workers more than unskilled workers. In straight-level regression, skills premiums should be heightened in cities, and more highly skilled migrants should receive higher wages.

Coordination of Talent

The importance of coordination has most recently been stressed by Becker and Murphy (1992) and Jovanovic (1992), but it certainly has older roots. The literature on matching, and even Adam Smith (1776), emphasize the importance of coordinating workers and jobs.

The possible role of spatial proximity in facilitating good matching is an old idea. Marshall (1890) emphasized that industrial concentration might be important because it facilitates coordination of talent. Kain (1968) and the subsequent spatial mismatch literature argue that the spatial dislocation of nonwhites plays a major role in their negative labor market outcome, because they are not being matched to the right jobs.

Once again, if the structure of cities allowed workers to choose among firms and find the best possible match, an urban wage premium would be created. Workers would get a higher return on their human capital by being matched to the right job. Again this effect would heighten returns only gradually, as workers were able to access the urban labor market and make a correct match. I will not try to distinguish this effect from the argument that intellectual transfers speed human capital growth.

Specialization and the Extent of the Market

A similar argument asserts that cities should allow workers to pursue particularly specialized tasks. Urban areas are especially hospitable to specialized tasks because they have larger markets and because coordination costs for the same number of people may be lower in an urban setting. The argument concerning the size of the market belongs to Smith (1975) and the second argument to Becker and Murphy (1992).

If cities do facilitate specialization, this phenomenon might have several effects on human capital. First, workers might only receive the wage benefits of cities when they have specialized further, and it will take time to achieve their gains. Second, specialization might be complementary to human capital, as Becker and Murphy (1992) argue, so that highly skilled workers in particular benefit from being in cities. Finally there is the counterargument that specialization is actually a substitute for skill, in which case more highly skilled workers will not benefit from being in cities.

Superstars and the Extent of the Market

Rosen (1981) argued that given a technology in which one or a few individuals can almost without cost serve a large number of consumers, the returns to human capital will explode in the upper tails of the ability distribution, that is, among individuals with unusually high levels of ability. Cities interact with this effect, he argued, because they allow a larger number of consumers to be serviced more cheaply by the “superstars,” those high-ability individuals who serve a large market.

Broad data sets are surely not the right approach for examining this connection between cities and highly able individuals, but the Rosen story does suggest that workers will gain only slowly from cities as they rise to the top of their fields. His story is also supported by the larger urban wage premiums observed by those workers at the very high end of the wage distribution—an effect that does seem to be present in the data.

Risk, Urban Diversity, and Investment

Another conceivable way in which cities interact with human capital accumulation is that they might reduce the risk to workers in undertaking human capital investment. Following

Marshall's argument that industries agglomerate to ensure that their workers will have another firm to move to, it should be true that workers will be more likely to invest in human capital if they are assured that one company's demise will not leave their investment valueless.

Similarly the argument given by Rotemberg and Saloner (1991) that industrial concentration saves the worker from the firm's having excessive bargaining power also works to increase the incentives for worker investment in human capital. Because workers know that they can play one firm off against another and will not be subject to ex post appropriation, after their human capital investment, they will be more willing to invest in skills. Again this argument will be grouped with others in suggesting that the urban wage premium should show up over time.

Uncertainty and Ability

The preceding subsection argued that cities eliminate some types of uncertainty but increase other types of uncertainty. Globally, rare events are more common in New York than in Peoria. If skills increase the ability to handle adversity or new occurrences, as Welch (1970) showed in the agricultural sector and as Schultz (1988) has argued recently, then skills should be valued more highly in cities.

In general this effect should act to (1) immediately heighten the returns to ability; (2) induce individuals to make a greater investment in human capital; and (3) in particular, limit negative shocks for skilled urban workers. The third effect is the truly distinguishing feature of this argument, but I will not deal with it here. Again this story could be manifested by heightened returns to skills for migrants, level regressions, or increased wage growth in cities.

Cities and the Provision of Education

Finally cities have a long tradition of providing public education. Because of political factors, increasing returns to scale in public education, or easier specialization in teaching, cities traditionally have housed universities and frequently a great number of secondary schools. American public school education began in cities. It is often argued that migrants to large cities in less developed countries are drawn by the prospect of better education for their children.

Information, the South Bronx, and Los Angeles, 1992: Cities and Instability

The previous section detailed several ideas about ways that cities can interact to increase the returns to human capital. These positive aspects of cities are certainly one side of the modern metropolis. There is also another, more troubled side to cities, that of ghettoes, riots, and crime. This section describes a set of ideas—some old, some new—about the way cities interact to create crime and social instability.

The theme is basically that these difficulties come not out of particular features of particular cities, but rather that there are aspects of all cities that lead to forms of socially destabilizing behavior. Just as cities intrinsically raise the returns to human capital, they intrinsically create social problems. This is not meant to present merely a bleak picture of the urban future, but rather to suggest that the forces policy analysts must deal with when they consider making cities better are bleak indeed.

This section begins with a simple model of violent activity that can be applied to riots, crime, or a variety of other problems. Subsequent sections deal explicitly with ways that cities might change the incentives for participating in violent activity.

A Framework

This theoretical framework is not an original model but instead is a simplification of work by Tullock (1974), Lohmann (1993), and others. A stronger statement of the model is given in DiPasquale and Glaeser (1993). The basic point of the model is to give an idea of the way interactions between individuals can have socially unstable, violent outcomes. The framework is generally sufficient to relate to any of the types of violent activity.

For the model, I assume that in the population there exists a range of tastes for violent activity. These tastes may be the desire to rob or express outrage or a combination of the two. Without loss of generality, I order the population on the unit interval with an index i, which measures the degree of passion for the activity. I then specify a function B(i, X), which represents the net benefits of rioting. X is a vector of city characteristics. I assume that this net benefit function includes both material and psychological benefits and costs of rioting, excluding those specific to being arrested. The time costs of rioting would thus be included in this function, but the potential costs of being arrested would not.

I also assume that there is a cost associated with being caught rioting, C. Finally there is a probability of being caught, P(N), where N should be interpreted as the number of individuals engaging in the activity. With a fixed number of law enforcement agents, the probability of being caught goes down as the number of rioters goes up, so $P'(N) < 0$. While I am assuming that P(N) and C are independent of urban and individual characteristics for simplicity, extending the model would change little. One should think of N as the number of rioters, but as long as people on the street delay law enforcement, they should be included in N as well.

The equilibrium is characterized by a marginal rioter whom I index with i*. When the number of rioters is known by everyone, it must be the case that for all $i > i^*$, rioting is preferred, and for all $i < i^*$, rioting is avoided. This comes trivially from the condition on $\delta B(i, X)/\delta i$. In this case, it must be true that $N = F(i^*)$, where F(.) is the cumulative distribution of i. So the equilibria are found by the i* that satisfy the following equality:

$$B(i^*,X) = C\,P(F(i^*))$$

Figure 15 plots the equilibria in the case where the index i is distributed uniformly on the unit interval and where $P(1 - i) = \text{Max}[1,T / (1 - i)]$, $B(i,X) = a(X) + b(X)i$. T is supposed to measure the total number of individuals that can be caught by the police force in one period; if more than that number riot, a fraction, $T/(1 - i)$ gets caught.

Figure 15 illustrates the standard case of multiple equilibria in violent activities. The first equilibrium, marked point 1, has a high level of violence and a low probability of arrest. The second, marked point 2, has a moderate level of violence and a moderate probability of arrest. The third, marked point 3, has a low level of violence and a high probability of arrest. The first two equilibria are points at which line A and curve B intersect, so for the marginal agent the costs and benefits of violence are equal. In the third equilibrium, the costs of violence are higher than the benefits, so everyone is at the corner solution of no violence.

More than in any other case in economics, it seems reasonable to think of multiple equilibria in the context of rioting. The number of minor incidents that set off riots in the 1960s strongly suggests a situation in which almost any city has the potential for riots and merely requires a focal point to push it over the edge. The Kerner Commission gives many cases of riots set off by arguments in dance halls and similar minor incidents.

There are other ways of reaching these multiple equilibria without congestion in police technologies. It is possible that small riots have no political benefits whatsoever and that both the average benefits and the marginal benefits of rioting rise with the number of rioters. However, assumptions of this sort seem less natural.

Of these three equilibria, the central equilibrium is unstable in the case shown in Figure 15. The simple logic is that at that point if, by mistake, a positive measure of rioters with an $i > i^*$ engage in violence, then not only will they be happy with their mistake but others will also want to engage in violence, since they have made the probability of arrest that much lower. This unstable equilibrium is probably uninteresting as an outcome but has great economic importance.

In a better specified dynamic model, the central equilibrium determines the point at which an initial level of rioting will converge either to a large riot or to no riot. If an event that creates an initial level of violence occurs (or perhaps an initial crowd of potential rioters mills on the streets) and that level is beyond point 2, then the level of violence should keep rising (since benefits exceed costs for high i individuals) until point 1 is reached. However, if the level is below point 2, then the level of violent activity should converge to point 3. The probability that a riot will occur is shown by point 2.

Thus both the unstable equilibrium and the stable equilibrium are of interest empirically. The stable equilibrium shows how big the riot will be if it happens, while the unstable equilibrium shows what will cause the riot. However, making this distinction is useful only if there are forces that affect the two points differently. Standard decreases in the apprehension probability or increases in the expected benefits from violence should increase both the likelihood of the riot occurring and the size of the riot when it occurs. Most changes across cities will likely be of these forms, so in most cases it makes sense to think of incidence and intensity simultaneously.

Still there are some city-specific effects that affect only incidence. For example, if the slope of the benefits becomes steeper closer to $i = 1$, it would increase incidence without changing intensity. That extra-high slope is easily interpreted as the presence of a large group that really wants to—or in fact does—commit crimes generally. It seems possible that this group would riot for political reasons rather than material aims, so high probabilities of riots occurring should be related to political passions in small groups of the population.

The size of the riot, however, is based on the desires of a different group of the population. If the benefits function rises on the lower levels of i's, then the size of the riot will rise without affecting the likelihood of a riot. This effect seems more likely to occur because of the material gains from rioting, which should appeal to a wide range of the population, rather than the political benefits, which are concentrated in the hands of the few. This simple model therefore presents an alternative hypothesis to the competing hypotheses that "the Rodney King riot was a political statement" and "the Rodney King riot was greed-based mayhem." Material gains from rioting may have been necessary to generate the large number of rioters observed; however, without a core group of politically motivated rioters, the riot would never have happened.

Evidence on Spillover Models

Theoretical work on models with interagent spillovers, especially on models with multiple equilibria, has been extensive. Contributions of this nature occur in macroeconomics (Shleifer, 1986), growth economics (Matsuyama, 1991), labor economics (Prendergast, 1989), and urban economics (Krugman, 1991), and these are only a few examples. However, empirical work in this area is much more limited. Regime-shifting models attempt to use time-series evidence to look at possible multiple equilibrium states for a single economy or market across time (Ellison, 1993; Cooper and Durlauf, 1992). Perhaps the most convincing empirical work done in this area is the plot of Smith and Wright (1992), which simply shows that the data strongly resemble a situation with two possible equilibria.

In fact, DiPasquale and I (1993) show a plot that also resembles two equilibria for riot intensity variables from the 1960s: log of arrests, arsons, and injuries divided by the nonwhite population. This sort of plot is fairly trivial when 53 cities in the sample did not experience riots and 47 did, and most of those that did had moderately high levels of activity grouped closely together across cities. While the evidence may seem trivial, it makes the point that cities either riot or do not, and the proper way to think of riots is as a group activity, not as randomly distributed individual choices to riot.

Discussion of the Way Cities and Information Work to Create Social Instability

The previous framework was largely free of connection to cities or institutions. The discussion section that follows details the ways in which cities in general—and large cities in particular—act to enhance the possibility of being at the high-violence equilibrium. Specifically, I discuss a variety of features of cities that may act to influence instability. (Technically I am talking about the X vector in the model.)

Coordination

The introduction to this article focussed on the flow of ideas across urban areas. This flow of ideas is central to the framework described above, especially mass riots, both controlled and uncontrolled. In the framework, equilibrium 3 is possible only if everyone knows that a large number of people are committing crimes. If only a noisy signal of the size of the crowd is received, then as the noise level increases, the possibility of the large riot equilibrium disappears.

To be precise, suppose that only s percent of the population observes the riot taking place. In that case 1 - s percent of the population will not riot, directly lessening the size of the riot but also changing the shape of the curve in Figure 15, which then becomes CM / (s(1 - i)). This shift shows that both the probability of the riot and the size of the riot will fall as s goes to zero. Obviously there are other ways of modelling uncertainty, but this method makes the central point that riots are both smaller and less likely when information flows deteriorate.

Further confirmation of this point comes from the importance, and occasionally the blame, that public opinion attributed to the media in the 1992 Los Angeles riots and in the earlier riots of the 1960s. The possibility that short riots were not observed by anyone out of earshot had essentially disappeared by the 1960s. The media were quicker to notify the public that riots were occurring and thus to enable others to take part.

The role of density in facilitating information flow concerning a riot may have lessened since the advent of televised news. However, it is still important for the initial stages of

large-city riots, where local residents are the first to join in. It is even more important historically. Bread riots certainly existed outside of the cities in the days before mass communications, but they tended to have much more organization (for example, Wat Tyler's peasant revolt in 14th-century England) and to be much rarer than urban riots. Uncontrolled mass violence was very difficult in areas where people had to travel long distances to learn of the event. Even today, in countries where news services operate with significant lags or in countries where the central government has control over the news service, the role of urban density in facilitating information flow may still be critical.

The importance of cities in coordinating activity is even more important for controlled violence than it is for uncontrolled violence. Nash (1982) emphasizes the importance of cities in organizing the American Revolution. Agitators and other supporters of antiroyal activity were able to organize much more effectively in urban areas than in the hinterland.

Urban Human Capital

Cities can create various types of instability through the transmission of human capital as well as through coordination. A variety of evidence strongly suggests that neighborhoods play a role in the development of a variety of types of human capital. Skills are learned from peers, but so are habits and a tendency toward various types of behavior (see Case and Katz, 1991, on a variety of behaviors). Borjas, Bronars, and Trejo (1992) show that variation across ethnicities in various attributes almost disappears when neighborhood effects are controlled for.

On the positive skills accumulation side, cities have long served as training grounds for lawyers and doctors, who learn from their many peers and from the steady flow of diverse experiences the urban environment offers. Even as cities provide excellent training ground for lawyers, they also provide excellent training ground for criminals. Most of the 20th century's great criminal minds—Arnold Rothstein, Alfonse Capone, Meyer Lansky, and so on—came out of large cities.

Jankowski (1991) presents some of the most complete evidence on gang life in America. His descriptions show the extent to which learning to be an effective gang member depends on exposure to older gang members and on the density of this type of activity in urban environments. These skills allow for the formation of large criminal organizations that may facilitate both individual and group violence.

Cities sometimes provide such a barrage of concentrated negative experiences that positive influences may be crowded out and no human capital acquired. For example, consider a situation in which a child learns by observing adults but lacks the ability to select the adults from whom to learn. The child merely observes a number (assume it to be a fixed number) of adults as closely as possible. If the child lives in a ghetto or any other highly homogeneous neighborhood, his education will be based on the narrow band of skills present in that area. If the neighbors have few skills, the child will learn few skills. Alternatively, in a less dense environment, the child is less likely to have all of his experiences based on a homogeneous group of people who chose to live in one neighborhood. Instead, he learns from a variety of people who were not so strongly selected.

The presence of this neighborhood human capital effect makes it possible for large cities to foster instability through the training of individuals who are highly skilled in coordinating and leading group violence. The importance of the neighborhood also makes it likely that the city may have a particularly poor group of residents, one that remains poor and deficient in skills over generations. This type of poverty does not intrinsically breed

instability, but as the gains from legal activities decrease, there will tend to be a greater likelihood of members of the group entering into illegal activities.

Property: Physical vs. Human Capital

One of the central themes of this article is the role that cities play in increasing the availability of human capital. At the same time, the price of certain types of physical capital (for example, land) rises in urban areas as more people must be spread over a fixed supply of land. The net result is that human capital will provide a larger amount of the average urban household's portfolio than will physical capital.

This relative lack of physical capital can play a role in the decision to undertake destabilizing activities. Holding an individual's overall value of life constant, the individual is far more likely to suffer a loss during a riot if he or she has property close to the riot scene than if his or her wealth is in human capital or in physical investments elsewhere. For example, in smaller towns or rural areas, anyone who decided to start burning buildings would have a high probability of damaging his or her own property or that of a neighbor or friend. In large cities, where property often is owned by absentee landlords, the incentives to riot are not lessened by fear of damaging the rioters' own property.

Chafets' (1990) descriptions of Halloween fires in Detroit illustrate well the connection between absence of property ownership and participation in damaging activities. Annually on October 31 Detroit is lit up by a wave of arsons that are started primarily by members of the poorer communities. These fires usually damage abandoned buildings that have no owner, and those who set the fires have little property that might be damaged by the flames.

Absence of property ownership plays a role in expanding the number of people who want to participate in socially destabilizing activities. Perhaps even more important, it means that there is no group in the community with a stake in fighting against these activities. During the Los Angeles riots, shopkeepers formed circles of cars around their stores and defended them from looters.

When law enforcement is limited or expensive, or when there is a comparative advantage in monitoring being provided by residents of the community, the amount of physical property the residents possess clearly influences the intensity of their monitoring. Because they have their own property to protect, they will watch the streets and thereby protect everyone. Jacobs (1961) was a strong advocate of the importance of local monitoring and the role that a stake in the community plays in promoting monitoring.

Migration and Impermanence

Another facet of cities that may contribute to the connection between urban areas and social instability is that cities are centers for migrants. Particularly in the third world, megalopolises such as Mexico City, Santiago, and Cairo serve as the destination for large numbers of rural-urban migrants. Frequently this type of migration is impermanent, as the migrants decide to return to their farms. Evidence of this sort of movement is particularly strong in Bangkok. Cities, such as New York in 1900, often serve as ports of entry or centers for migrants who plan to move elsewhere.

Jacobs (1961) emphasized the importance of long-term relationships in fostering monitoring behavior. Migration and impermanence may increase social instability because of the absence of such relationships. The importance of long-term relationships in solving incentive problems is a major theorem of game-theoretic research over the past 15 years. Folk

Theorem arguments reveal that games which suggest only opportunistic behavior in the short run can allow much better outcomes if given sufficiently long time horizons. The literature on the way good behavior comes about through long-term relationships has become quite extensive (an excellent example is Abreu, Pearce, and Stacchetti, 1990).

The basic argument is simple. Individuals will not commit actions that hurt others if they believe that those they hurt will hurt them in the future. The complexities of the argument tend to hinge on problems associated with backward induction, but in general the degree of impermanence seriously undermines the ability of communities to enforce good actions by their residents. The sociological literature is particularly strong in showing how certain communities impose sanctions on miscreants (see Gans, 1958, for a classic example).

This effect makes it less likely that the mobile will fear reprisals. Accordingly they will be less willing to undertake difficult preventive tasks, which must be enforced by implicit long-term promises of rewards and punishments, and more willing to break social contracts. This type of argument perhaps justifies State subsidies for homeownership, which reduce migration facilitated by renting or small-town residents' fear of strangers over whom they have no control.

Impermanence may create a sense that one has less to lose because reprisals are unlikely, but it also eliminates any sense of vested interest in the town. A long-term resident is willing to take actions that improve the community, since she reaps their benefits over time, while an individual who plans to move on will take far fewer actions. In the case of violent or riotous behavior, impermanence means that the individuals have little to lose if they damage the community.

Interethnic Conflict

Because cities are centers of migration, they also serve as centers where groups from different backgrounds can mix. The large port cities of the United States are classic examples of places in which various ethnic groups mix in a single urban area.[6] Many other examples exist, such as the large number of Arab immigrants in Paris or the Pakistanis in London. Since the mixing of ethnicities is often associated with strife, the city's role as a center for various ethnic groups may also act to increase social instability.

Economics has thus far had little to say about the reasons why different ethnic groups frequently engage in social conflict, but there are some possible economic explanations that may help to predict why ethnicity is related to strife. One way of interpreting what is meant by differences in ethnic groups is that the groups have different rules of social behavior. Different rules are most obvious in language, but they figure in other characteristics as well.

These rules may differ because they were formed in other locations, where different rules were optimal. For example, a stigma about polygamy may be absent in some societies, where it is seen as a solution to social problems (see Becker, 1981, for details). The rules may also differ merely as a result of historical accident. Rules that are simply conventions with no intrinsic logic will differ across groups that have, by chance, created different conventions. Many aspects of clothing surely fall into this category.

However, even if the choice of convention for the entire group has no economic content—for example, the group is equally well off if people drive on the left side or on the right side of the road—a single person's deviation from the convention can be disastrous, particularly in the example given. In order to stem these deviations, groups have developed punishment strategies to keep behavior within the conventions (see Gans, 1958, for details). These punishment strategies are optimal for the usual Folk Theorem arguments.

If two individuals with different conventions come into contact, it is likely that they may perceive each other as violators of implicit group rules and therefore deserving of punishment. Of course, if the individuals can credibly suggest that they did not know the rules, the punishment should ideally be lessened or eliminated. However, too much leniency for strangers (1) makes it possible for true cheaters to claim to be ignorant (hence the principle in U.S. law that ignorance of the law is not an excuse) and (2) makes it less appealing for strangers to learn the rules.

Such ignorance-based conflicts may not be the only reason for interethnic difficulties. If group conflicts are being coordinated, urban ethnic groups may fight because one group is trying to achieve gains at the expense of another. (Coordination is a necessity, since individuals are not generally thought to internalize benefits to their group of their own volition.) In addition there is simply the possibility of taste-based differences, as used by Becker (1957). People might simply find it distasteful to interact with individuals of different races or ethnic origins. All of these forces may come together to create a situation in which conflicts occur because of ethnic mixing in cities. However, at least the explanation that interethnic conflict occurs because of ignorance suggests that the problem lies with new ethnicities, not with longstanding ethnic neighbors. Animosity among groups that know one another must be the result of coordinated rent-seeking or tastes.

The Proximity of the Poor to Wealth and Power

Urban areas also differ from rural areas in that wealthy members of society and poorer members live closer together. The poor may also have more physical access to the governmental power. And because physical force is much easier to use in proximity, this closeness provides an incentive for the poor to try to use physical force to wrest resources from the government or from the wealthy.

The city's role as a place where poor and rich mix comes from several sources. The high price of urban land makes it costly even for the rich to separate themselves spatially from the poor. In the hinterland the wealthy are able to buy large estates and distance themselves from poorer neighbors. Cities also act to mix rich and poor, because they contain larger populations. Smaller jurisdictions make it natural to sort along income lines (see Tiebout, 1958), as various jurisdictions have different levels of taxes and services. Larger jurisdictions eliminate this sorting device.

Other aspects of cities may also appeal to both the very poor and the very rich. In many classic urban models (see Mills, 1972), either the poorest or the richest members of society live closest to the center. The very rich who do not live in the center of the city have the highest costs of commuting. The very poor consume so little land that they are unwilling to suffer the commutes necessary to live in suburbia. Other models that can generate high inequality in the center use an assumed complementarity between workers who have very high levels of human capital and those with very low levels (for example, between lawyers and maids) and the cities' attraction for workers with the highest levels of human capital.

If cities do generate this type of inequality, it is natural that it would increase the likelihood of begging and theft, two activities that may destabilize and, in any case, lower the average level of well being. Naturally the costs of begging or theft to beggars or thieves go down as their market opportunities decline, so there are more potential beggars or thieves when the number of those who are very poor increases. The benefits are higher when there are a larger number of very rich people in the community, so inequality of income should increase the volume of these activities.

Another important role of cities is that they foster proximity to political power— particularly important when the power of the centralized government resides in the city. Even in federalized systems, large city governments such as New York's are vulnerable to local agitators and have resources that make political agitation worthwhile.

A clear description of the importance of proximity to political power in fomenting agitation can be found in Kendall (1988), who presents a detailed history of Mexico City. He describes a group of recent rural-urban migrants to Mexico City who were originally squatters but were organized by a local political agitator. The agitator organized demonstrations in which the squatters called for overthrow of the government. The central government responded to this threat by giving the squatters the right to their lands and by providing them with some public infrastructure. In this case proximity to power provided an incentive for agitation and controlled violence.

Connection With Other Cities

Cities have traditionally been far better connected to other cities than to the hinterland. Many Midwestern cities had their origins as stops on the railroad with convenient transit to other urban areas. Even today it takes less time to go from downtown Boston to midtown New York—often less then two hours by air shuttle—than it does to go from either city to points in western Massachusetts that are equidistant from the two. Informational technology is particularly effective at linking cities, but it can be harder to access areas that are removed from urban centers. For example, it may be easier to learn something about the New York financial situation in Tokyo than in Rahway, New Jersey.

This informational connection can enhance instability in several ways. Traditionally violent outbursts in a given city would follow violent outbursts elsewhere. That is still the case today: There were riots in Toronto and other cities following those in Los Angeles in 1992. Riots seem to provide a focal point for future riots, but they cannot provide a focal point if information about them has not been received. In some cases, there are limits on national policing so that information about a riot elsewhere serves to significantly reduce the costs of rioting in one's own city.

Such effects should be less important today. In the developed world, at least, nearly everyone can learn about riots quickly via television. The issue is more relevant historically, or in today's developing societies where television is not universal and more informal mechanisms of information transmission prevail. In those cases, it is likely that individuals in the hinterland will not learn about outbursts in the capital until a significant time has passed.

Another important role that linkage with other cities can play pertains to mass violence as a signal. In many cases (see Hobsbawm, 1959, for a discussion in the case of rebels) local violence may be fomented to influence a distant power that has not traditionally paid much attention to the locale's situation. This distant power is thought to be more just than the local government, and by signalling the problem to the distant power, the rebels hope for good results.

Examples of this type of behavior abound. The resistance movement in India or the rioters in South Africa take actions to induce the outside world to put pressure on their governments. Actions in the American South at the beginning of the civil rights movement (sit-ins, for example) were calculated to influence Federal or northern power to support African Americans in the South. These types of signalling activities are much more effective in cities that are (1) well connected informationally to the outside world and (2) important (generally) to the outside power source.

Cities and the Provision of Government Services and Transfers

A final feature of cities that potentially relates to urban unrest is the concentration of government services and transfers in urban areas. Presumably because urban areas are particularly sensitive and because unrest in urban areas is particularly costly to governments (as discussed in the "proximity to wealth and power" subsection), governments frequently overendow transfers and other services within central areas. Classic examples of this sort of activity include public housing in Santiago, Chile, under the Frei and Allende governments or the bread handed out exclusively in the city of Rome during the Classical period.

This high degree of transfers in the central city can create social problems in many ways, as detailed in Glaeser, Scheinkman, and Shleifer (1993) or Ades and Glaeser (1993). First, it creates incentives for particularly poor people to come to the central city, resulting in crowding and concentration of poverty that can easily contribute to unrest. Furthermore, these transfers can also create problems within the city for a given level of the population. If the transfers hinge on particular negative economic states—for example, unemployment transfers—they can limit the incentives to avoid them. (For evidence on the incentive effects of unemployment insurance, see Topel, 1982.) By increasing the extent of unemployment, the number of teenage pregnancies, or any other social problem, large levels of government transfers in central cities can exacerbate social instability.

Conclusion

This article has emphasized the role of information in influencing urban form. Many important papers on growth have found that disembodied knowledge and human capital play major roles as engines of growth. This important role in economic growth suggests that any informational role that cities play may be crucial for America's future.

Cities and the spread of population across space interact importantly with information, deriving some of their natural advantages as centers for the flow of new ideas. Cities also have some of their greatest failings when their informational advantages fail to function. It seems that among the most crucial policy issues for the next century is the elimination of the informational barriers between downtown areas and ghettoes.

Author

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Notes

1. If anything, the firm fails to consider congestion costs imposed on others when moving downtown.

2. Another problem is simply the technical complexity of solving nonconvex dynamic programming problems.

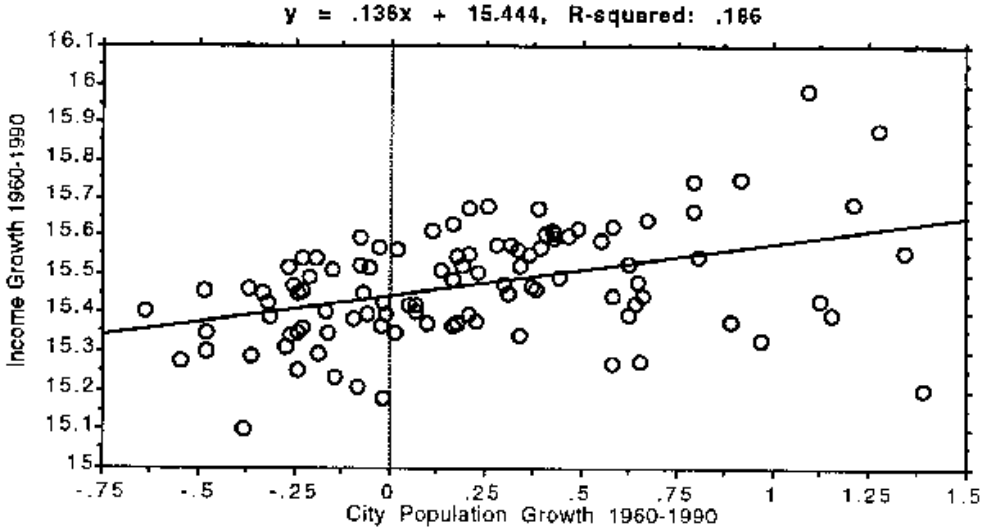
3. Of course it is always more believable that the Coase theorem will apply to human capital spillovers: if I benefit my colleagues, I should be able to charge them implicitly or explicitly for the benefits my presence created.

4. A better formulation would actually allow interactions between Newton and Roxbury but would not require the spillovers to be equivalent, which is implicitly assumed in an SMSA framework.

5. This idea was suggested to me by James R. Follain.

6. Another possible outcome, though, is that groups mix together in those cities that have been able to accommodate immigrants of various ethnicities effectively. In that case, through selection, cities with a strong ethnic mix may be ones with fewer ethnic conflicts.

Figure 1



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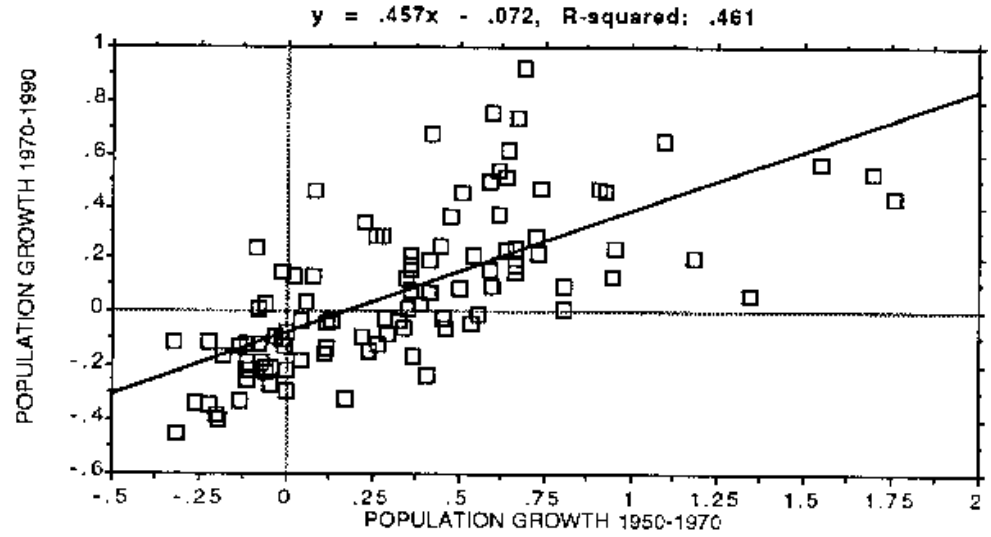

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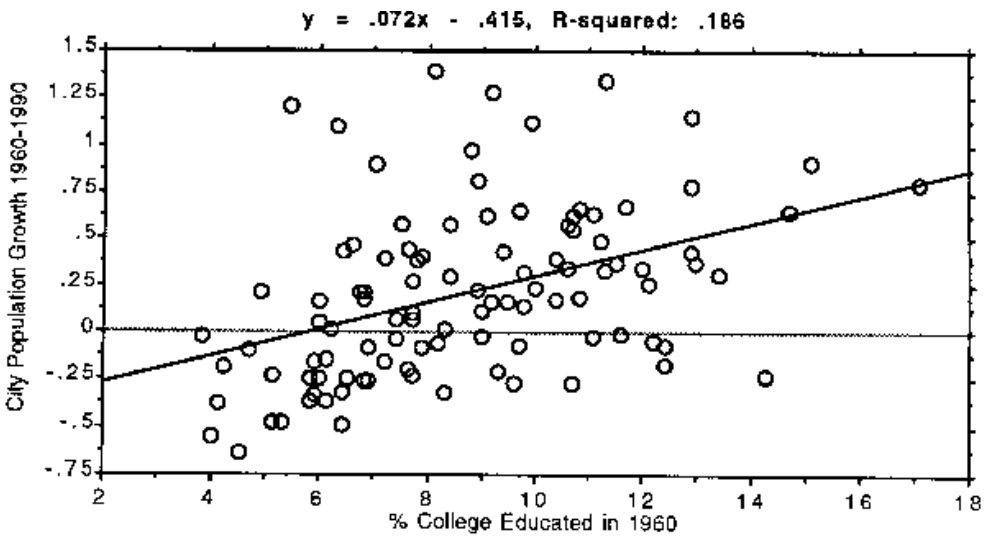

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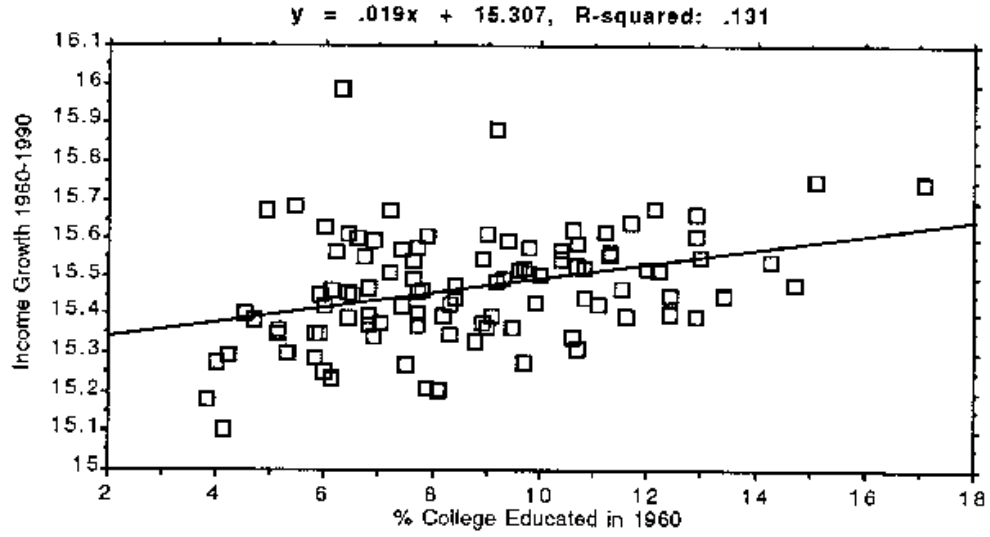

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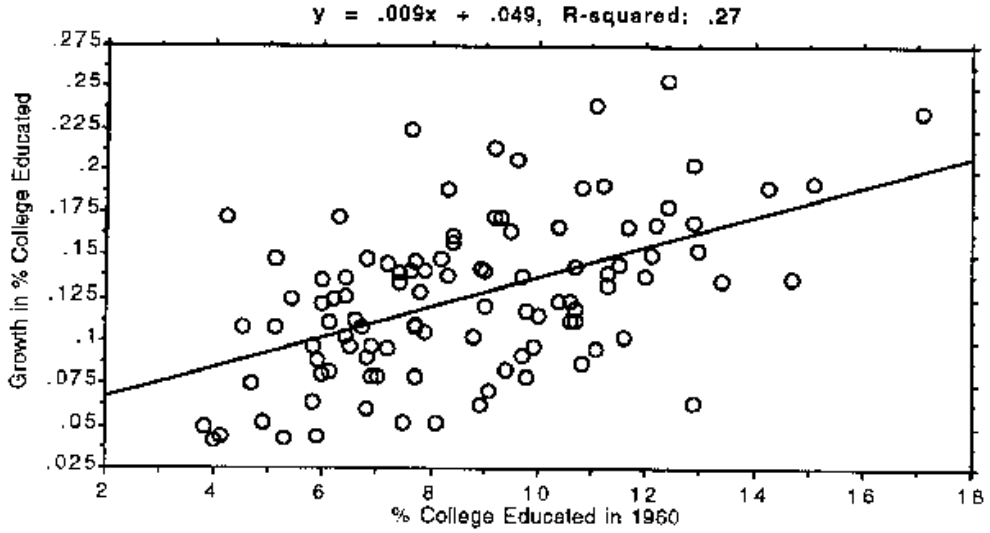

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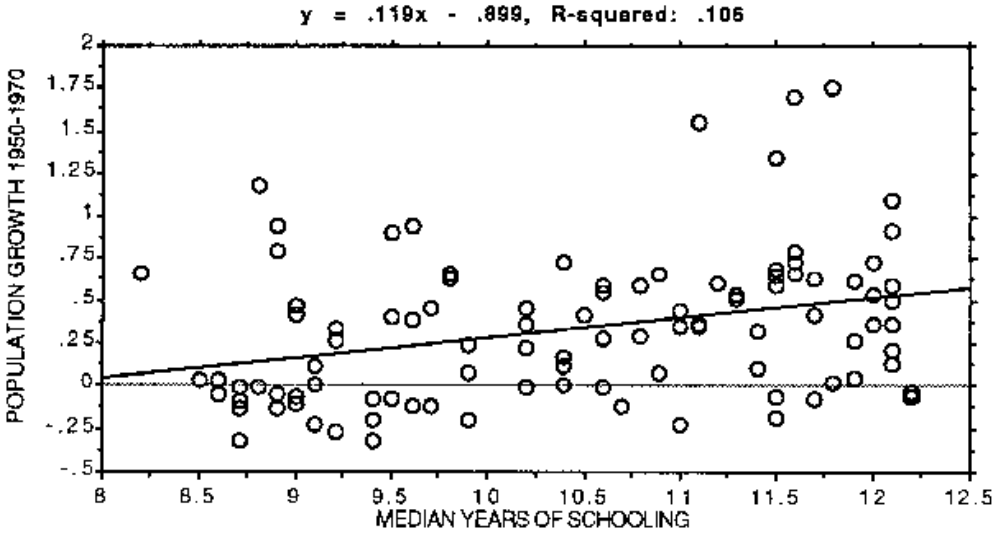

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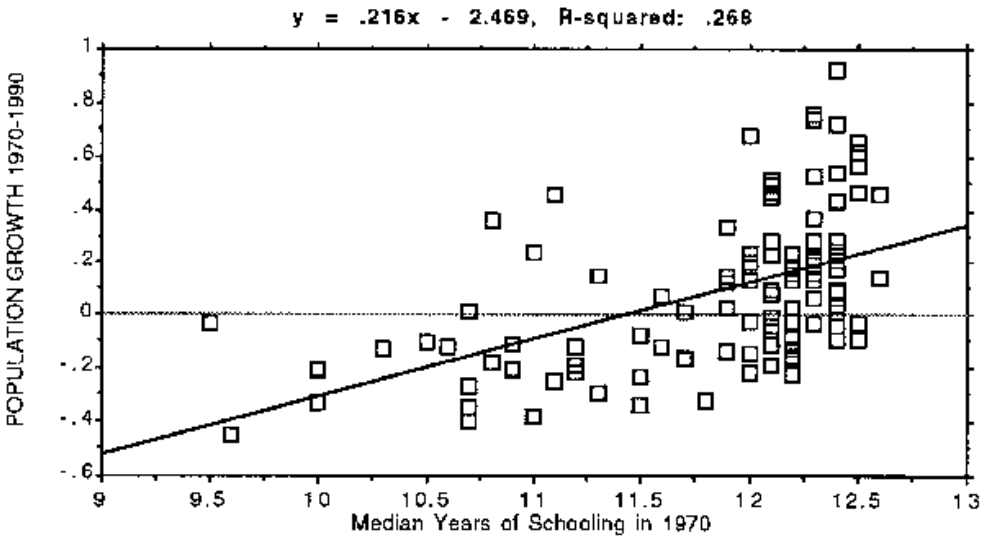

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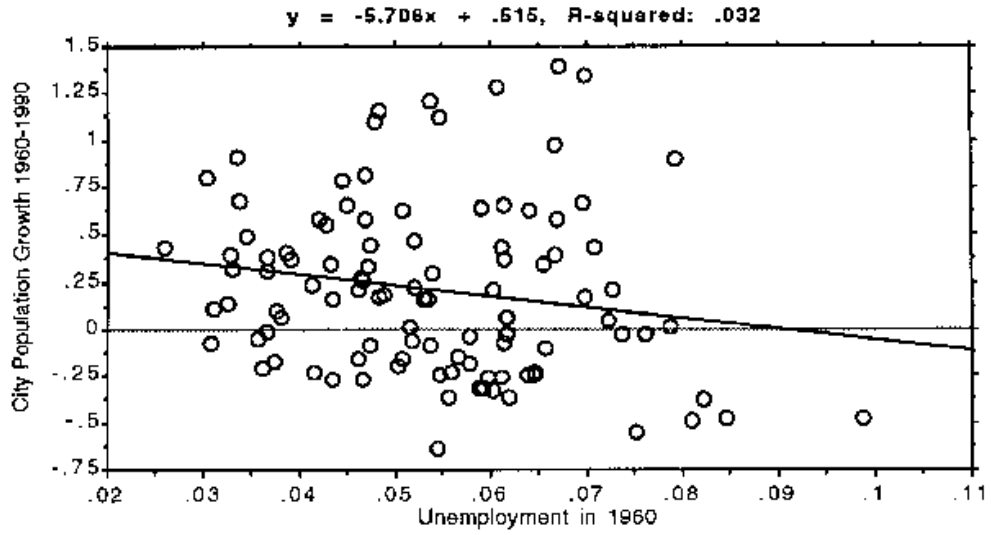

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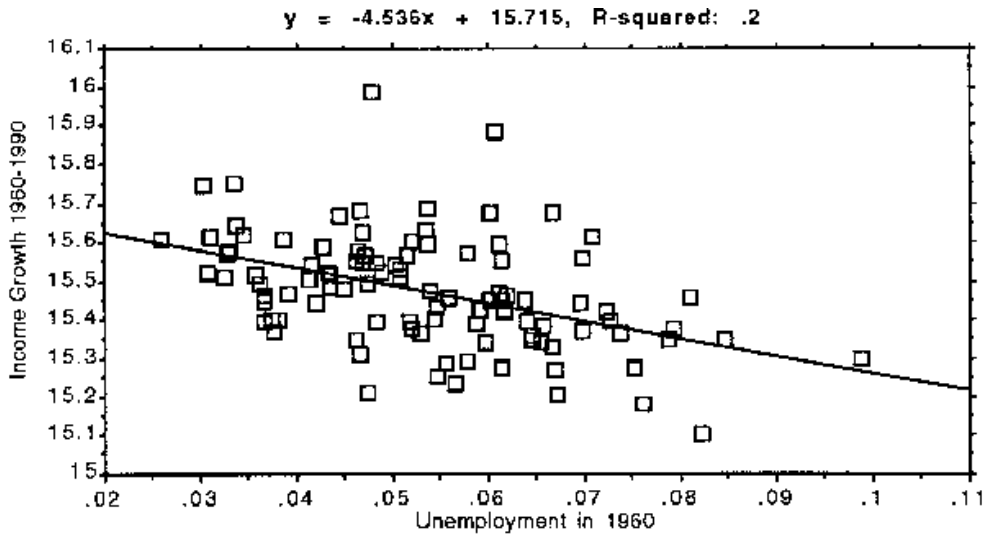

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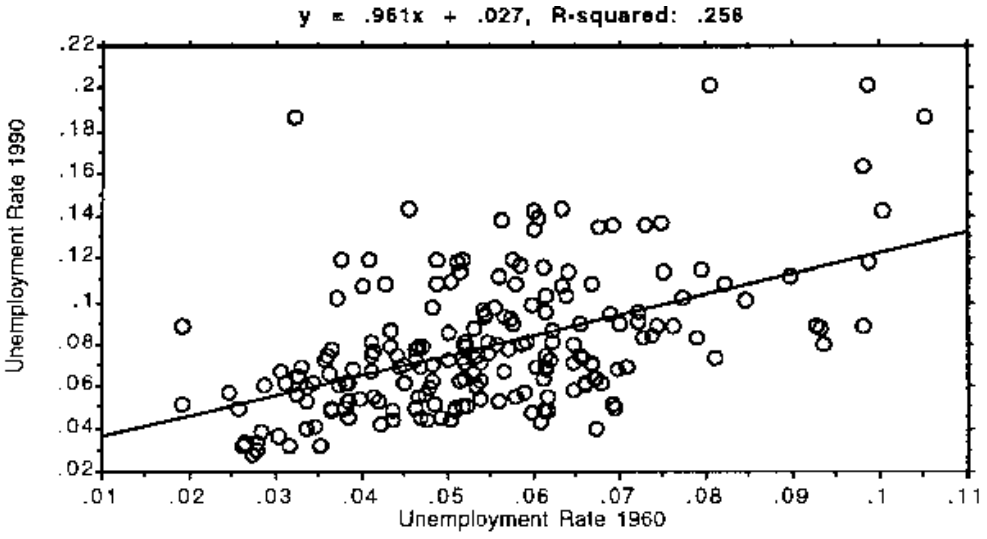

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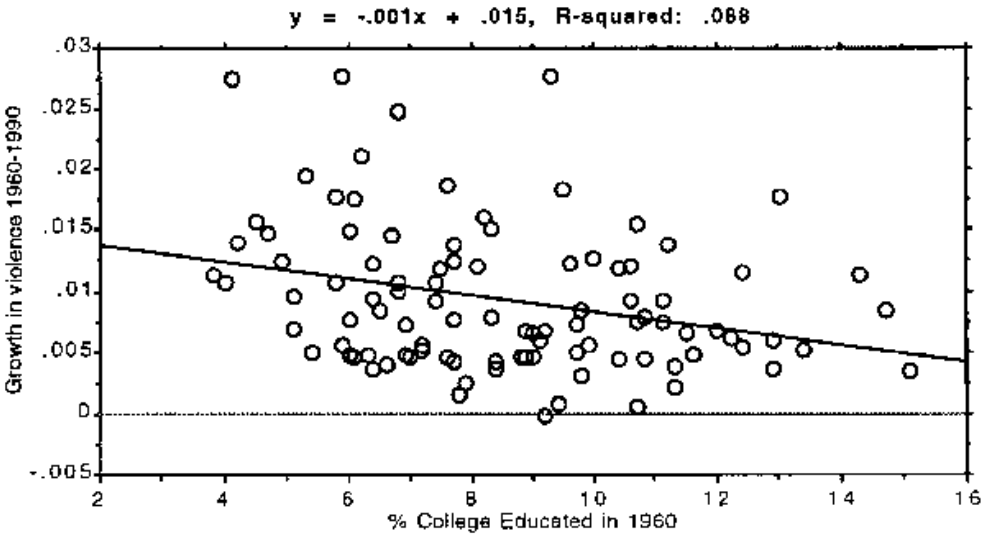


Figure 12

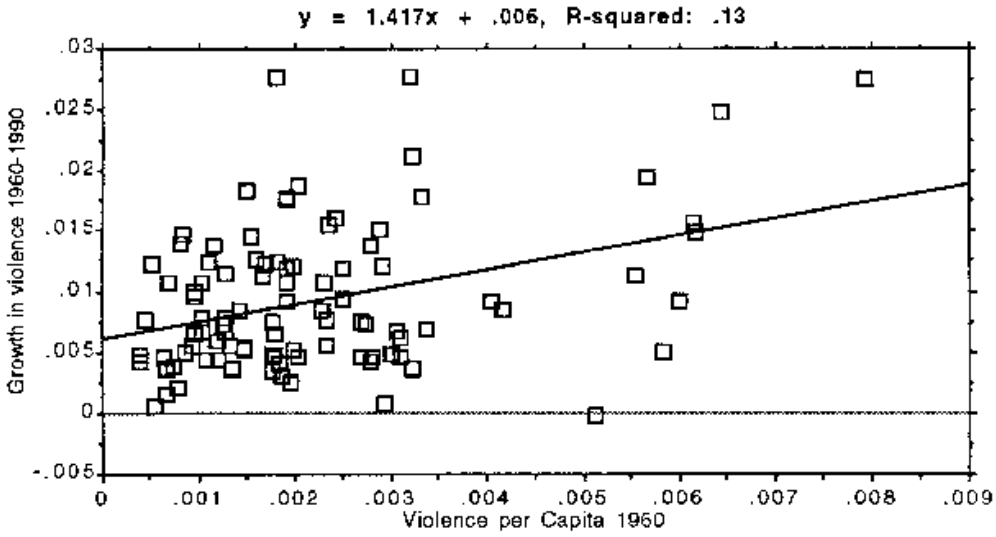


Figure 13

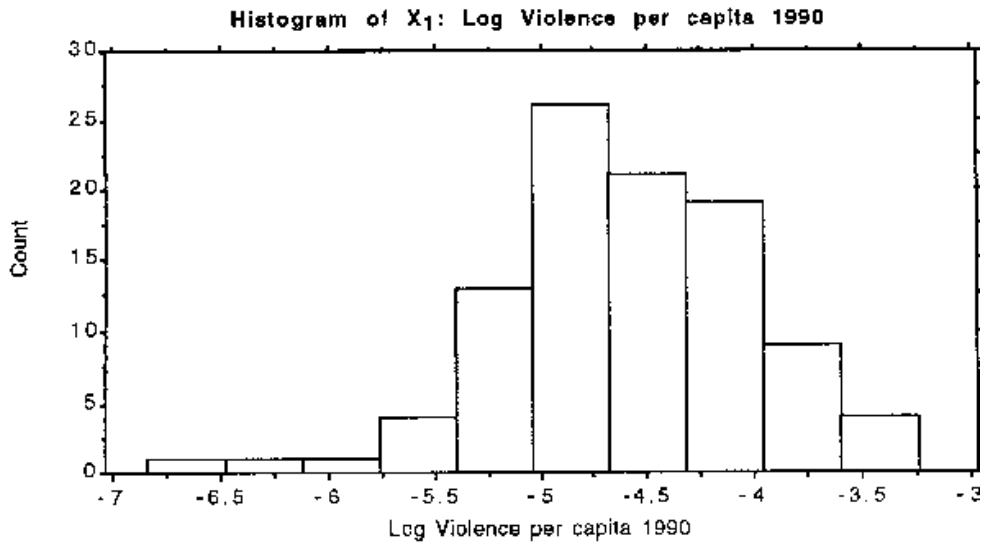


Figure 14

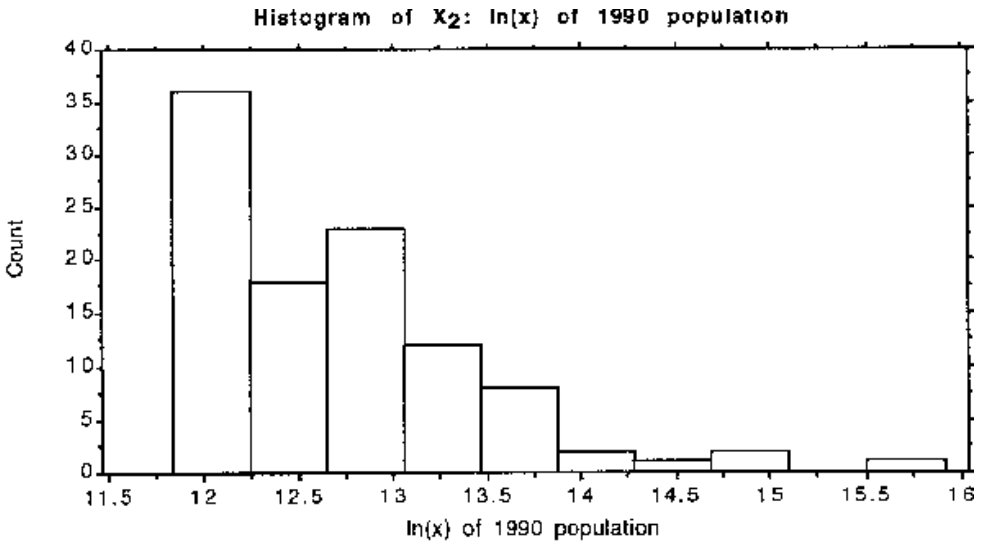
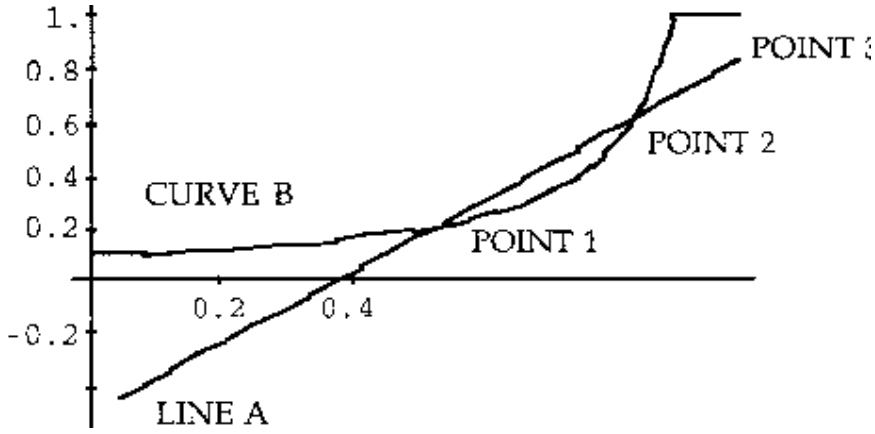


Figure 15



Line A, which is -.5 + 1.33X, represents the benefits to the potentially violent of engaging in violence. Line A rises with X because the population is ordered by X, which represents the desire of entering into violence.

Curve B, which is max [1, .1/(1 - X)], represents the costs to the potentially violent of being caught. The police cannot arrest more than 10 percent of the population. Curve B rises with X to indicate that the costs of engaging in violence rise as fewer people engage in violence (since there is a higher chance of anyone being caught).

Points 1,2, and 3 are equilibria. Points 1 and 2 are points where the benefits and costs of engaging in violence are equal. Point 3 is an equilibrium with no violence, where the costs of violence outweigh the benefits of violence.

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