On the Dynamics of Growth and Poverty in Cities

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This article presents a model of the city as a growing, small, open economy in which the uneven distribution of technical knowledge and skills—primarily acquired through formal education—across population subgroups interacts with the growth of business facilities (factories and associated production facilities) to drive the dynamics of population and employment.[1] The urban economy is modelled as a system in which long-term capital flows are strongly influenced by relative after-tax rates of return on capital between the local economy and the "outside" world. Further, the division of the urban population into a skilled middle class and a largely unemployable underclass is the consequence of two forces: educational failure and middle class flight from the city. The educational underclass is a result of a meritocratic educational system that divides each student cohort into a skilled middle class and an underclass bereft of the skills required for legitimate employment. The presence of an educational underclass creates a number of problems for both middle class residents and city authorities that may induce a portion of the middle class to leave the city, thereby worsening the problems associated with poverty. Poverty concentrated in the city increases the costs associated with public services, driving up taxes, reducing city services, and generally worsening the business climate. This, in turn, reduces the long-term, after-tax rate of profit from capital accumulation in the city.

The central theme of this article holds that the logic of meritocracy creates class divisions in the urban labor market which may undermine the very conditions that make rapid economic growth possible. Merit, especially in recent years, is essential to securing high-wage employment. Marshall and Tucker (1992), in an important study of the changing skill requirements of work in the American economy, show how modern telecommunications, manufacturing, and high value added services in finance, design, information processing, and analysis require workers to have significantly greater numeracy, literacy, and technical skills as a prerequisite for training and employment than was the case 30 years ago. In particular Marshall and Tucker noted that two opposing tendencies have emerged in the aftermath of technological change that have profound consequences for the nature of labor demand and the structure of employment in modern economies. First, advanced technology is creating a whole new set of employment possibilities that demand high levels of skill and initiative on the part of workers, leading to high wages and satisfaction (Marshall and Tucker, 1992, p. 36). Indeed many studies suggest that a growing number of jobs will require high levels of intellectual ability and initiative, with a steady escalation of skill requirements over time (Marshall and Tucker, 1992, p. 36). Second, technological advances in communications, precision engineering, and the application of computers in a wide range of production technology has greatly increased the demand

for highly educated labor at the expense of jobs for workers with modest academic achievements. As a result of these changes, educational credentials are now essential for obtaining high-paying work, whereas the lack of credentials is increasingly a barrier to these jobs and may even block the possibility of employment altogether.

In an urban setting, such developments mean that knowledge capital plays a dual role in creating and driving economic growth at the local level. On the one hand, economists like Romer (1986) and Lucas (1988) have developed formal analyses of the interaction between capital accumulation and human capital in generating high rates of growth in per capita output. In particular Lucas' presentation has pointed out the role of human capital—whether in the form of embodied technical skills imparted through formal education or the increase in technical knowledge associated with the creation and growth of a highly educated scientific segment of the labor force—in generating rapid and sustained economic growth. However, there is little reason to assume that knowledge capital is spread evenly over a population. Nor is there a legitimate reason to assume away a basic and frightening aspect of modern urban education: Schools in large cities are failing to provide many of their students with the literacy and numeracy skills necessary to obtain work in a skills-driven economy.

Indeed, in an economy in which educational achievement is an increasingly important qualification for high-wage employment, education becomes a de facto class sifter that divides each generation of students in a community into a class of workers and an underclass. This division of society has caste-like qualities, since most recent works on education clearly show that the primary determinant of the educational achievements of children is the socioeconomic status and educational achievements of their parents.[2] Thus success in acquiring knowledge capital is concentrated among those groups that have already succeeded in school while those who have not fared well in school are likely to pass their lack of success on to their children.

In an urban setting, the winners and losers in the competition for credentials live close enough together to have an impact on each other. The underclass constantly sees the high living standards of the middle class but is unable to acquire the human capital that makes this standard of living possible. In turn the anger, frustration, and envy that drive much of youth crime among the urban poor reduce the quality of city life for middle class residents, increasing the likelihood that a portion of the middle class will leave the city in favor of safer, less poverty-ridden surroundings. The underclass is sometimes a labor force for the illegal sector of the urban market system, usually, but not solely, represented by the market in illegal goods sold both inside and outside the regional economy, such as narcotics, and goods and services sold within the regional economy only, such as prostitution. Further, class conflict between the educated working class and the underclass is expressed in part by the persistent problem of robbery, burglary, and other property crimes, as well as by the gradual coarsening of social relations as differences in living standards and life prospects fuel frustration and violence among the underclass.[3]

The antagonistic relationship between the urban middle class and underclass has consequences for the long-range composition of the city's population, affecting the long-term growth and development of cities by shaping the size and scope of public-sector activity as the city government tries to balance the needs to control crime, alleviate poverty, and provide education against the need to attract and retain both capital and middle class residents. The dynamics resulting from the logic of meritocracy and middle class/underclass conflict in a small, open economy are studied in detail below.

The Actors and Their Behavior

The Underclass

Members of the underclass have two sources of income: transfer payments and crime. The representative member of the underclass is assumed to maximize the utility of consumption (c_u) and minimize the disutility associated with criminal activity, which is assumed to be proportional to the fraction of each period devoted to participating in illegal activity (ϕ, $0 \leq \phi \leq 1$). Further, members of the underclass are strongly affected by the living standards of the middle class. Increases in the standard of living for middle class citizens have a demonstration effect on members of the underclass, encouraging poor people to consume more.

Underclass participation in criminal activity can be thought of as a labor-leisure choice issue. On the assumption that the poor do not save, the utility of consumption (c_u), leisure and criminal behavior (ϕ) is represented by the function V_u:

$$(1) \qquad V_u = w\ln c_u + \lambda \ln (1 - \phi),$$

where λ ($\lambda \geq 0$) is the strength of the utility of "leisure." This formulation of underclass preferences assumes that increases in the level of middle class income (w) raise the marginal utility of consumption for members of the underclass.

The budget constraint faced by a member of the underclass is expressed as

$$(2) \qquad c_u = [\Omega + \varepsilon\phi]w,$$

where w is the level of real income per middle class worker, Ω the ratio of poverty relief per member of the underclass to real middle class per worker income, and $\varepsilon\phi$ the fraction of income per middle class worker that is transferred to the underclass through theft.

Each member of the underclass is assumed to maximize the expected utility of consumption and leisure with respect to a budget constraint (2). The probability of arrest and imprisonment when a person commits a crime is κ. Hence the expected utility associated with a ϕ degree of participation in criminal activity is

$$(3) \qquad (1 - \kappa)\, w\ln c_u + \lambda \ln (1 - \phi),$$

assuming that $c_u = 0$ in the event of arrest and imprisonment.[4] Optimal labor-leisure choice on the part of the underclass results in a crime-participation function of the form $\phi = \phi(w, \kappa)$, where $\phi_w < 0$ and $\phi_\kappa > 0$ if the gain from criminal activity exceeds poverty relief.[5†]

Given the fraction of time each representative member of the underclass spends in illegal activity (ϕ), the total number of persons participating in crime is ϕU, where U is the size of the underclass. Assuming that each person engaged in crime earns εy, the total transfer of income from the middle class to the underclass is $\phi\varepsilon yU$. Further, the loss of income per worker is expressed as $\phi\varepsilon y(1 - m)/m$, where $m = U/T = (T - M)/T$ is the middle class ratio (M is the size of the middle class, and T the size of the total population).

The Middle Class

A middle class worker will stay in the city if the benefits of doing so outweigh the costs. For simplicity it is assumed that the pleasure or utility of living in the city is determined first by the net income a middle class citizen can expect to earn there over his or her

† See note 5 for equation (4).

lifetime and second by the pleasures of living and working in a more densely populated, racially diverse, and socially and culturally liberal setting than could be found in surrounding suburban areas.

However, middle class workers are also victims of robbery, burglary, and other property crimes that characterize the underside of the class and caste diversity of cities. The probability of being victimized by crime is assumed to be a function of the extent of criminal activity relative to the size of the middle class. Hence the probability of a middle class worker being a victim of crime is represented by

$$(5) \qquad \frac{\phi(1 - m)}{m} .$$

Given the loss suffered by a middle class victim of crime (εw), the expected loss from crime for a middle class worker is expressed as

$$(6) \qquad \varepsilon w \phi \frac{(1 - m)}{m} ,$$

and the expected income of a middle class worker as

$$(7) \qquad w[x - \varepsilon \phi \frac{(1 - m)}{m}] ,$$

where x is the employment rate. The lifetime earnings associated with living in the city is simply the present discounted value of expected middle class after-tax income over the time horizon (T^*), given the income tax rate (θ) and the discount rate (α), and is denoted by V_C.[6†]

As stated above the typical middle class citizen stays in the city as long as the perceived benefits of doing so outweigh the costs of moving to the suburbs. Suburbs are assumed to offer sure employment and freedom from crime. Hence, assuming that the wage earned in the suburbs is the same as that in the city, the benefit associated with moving to the suburbs is simply the present discounted value of after-tax income associated with suburban living.[7†] However, two kinds of costs are associated with a move from the city to the suburbs. Aside from the usual financial costs of moving, a move to the suburbs can entail psychological and cultural costs. Given the realities of racial, ethnic, and cultural conflict and segregation in the United States, as well as the lower quality of artistic and intellectual life in the suburbs, a move to the suburbs may well involve significant psychological distress and cultural alienation for many members of marginal cultural, lifestyle, and racial groups, leading to a loss of γ in utility (measured in monetary terms for analytical convenience) that partly offsets the pleasures of suburban life. In addition persons who move from the city to the suburbs will suffer losses associated with leaving high-density areas that offer a number of unique services and opportunities.

This aversion to suburban living may be nonexistent for some ($\gamma \leq 0$) but quite strong for others. The aversion to suburban living is assumed to be distributed over the population of new workers according to the density function $f(\gamma)$, which satisfies the usual properties of a probability density function. It is further assumed that the distribution of the aversion to suburban living does not change much over time.[8] Hence a fraction of new workers, $F(\Gamma)$, will leave the city if the income associated with suburban living (V_S) exceeds the income

† See notes 6 and 7 for equations (8), (9), and (10).

from living in the city (V_C) plus the premium (expressed in money terms) associated with the nonpecuniary benefits of living in the city (Γ), where

$$(11) \qquad F(\Gamma) = \int_0^{\Gamma} f(\gamma)d\gamma.$$

and $\Gamma = \Gamma(w, m, \theta, \theta_S) = V_S(w, \theta_S) - V_C(w, m, x, \theta)$. In light of the foregoing analysis, the fraction of each new cohort of workers that chooses to leave the city is $F(m, x, \theta, w)$. It is a simple matter of algebra to show that the exit rate of new middle class workers (F) rises if m falls or if θ or w rises, that is, where $F_m < 0$, $F_\theta > 0$, $F_w > 0$.[9]

Schools, Poverty, and Population Dynamics

Success or failure in school is the critical element that determines the ultimate class position of an adult in this model of an urban economy. While the nature of the local race/caste system, family wealth, and other caste factors are obvious forces that shape the fortunes of individuals and groups in a city, educational success is assumed to be the most important single determinant of a child's life prospects.[10] Graduation from the formal school course with a certificate that demonstrates a person's mastery of essential technical subjects and testifies to his or her ability to complete a course of study allows a student to enter the labor force. Conversely, failure either to graduate from school (drop out) or to attain sufficient competence in core subjects greatly reduces a person's likelihood of employment.[11]

Research into educational effectiveness suggests that class size, facilities, and teacher qualifications play only a small role in accounting for educational success. However, it also shows that the educational and class status of parents, as well as early intervention programs for economically disadvantaged students (for example, Head Start in the United States), have significant effects on educational achievement.[12] In particular the work of John Ogbu and his associates has clearly shown that attitudes towards education and educational attainment are greatly influenced by a group's "caste" status in a social system. Ogbu's cross-cultural research on the role of caste status in educational attainment in the United States, India, Japan, and Israel has demonstrated that lower caste groups—defined as groups that have been involuntarily incorporated into a dominant society, systematically relegated to occupations of the lowest status, and subjected to continual defamation and derogation in public culture—perform poorly on educational tests compared with more highly favored groups (Ogbu, 1986). Further, Ogbu's research has shown that class and caste status, rather than race, is the major correlate of lower educational attainment on the part of disfavored groups.

Competent graduates enter the labor force—which, in this context, is synonymous with the middle class—while incompetent graduates are largely cut off from the possibility of employment. The interaction between educational success and labor force growth is a critical determinant of the evolution of poverty in the city. Given the number of students at a point in time (gT), a fraction (ξ, $0 < \xi < 1$) of students from poor communities fail to complete the curriculum at the required level of competence. Hence the number of students that complete the educational course at the required degree of competence is $gM + (1 - m)(1 - \xi)gT$, which is also the increase in the size of the labor force (M). However, middle class flight leads to the emigration of a fraction (F(x, m)) of the labor force, thereby reducing the size of the labor force. These considerations imply that the net increase in the labor force is

$$(12) \qquad \dot{M} = gM + (1 - \xi)(1 - m)gT - F(x, m)M.$$

The description of the evolution of poverty in the city is completed by an equation representing population growth. The rate of population growth is simply the difference between the rate of population increases due to "natural" growth and immigration (gT) and the rate of population decline that results from middle class flight (-F(x, m)M). Given the size of the current population (T), the rate of population growth is expressed as

(13) $g_T = g - F(\Gamma)m.$

Combining equations (12) and (13) yields an expression for the change in the middle class ratio of

(14) $\dot{m} = (1 - m)\ [\ (1 - \xi)g - F(x, m)\ ].$

The Government Budget Constraint

Income tax revenue is expressed as $\theta K/\sigma$, on the assumption of a uniform income tax rate. Government spending finances education, public safety, and poverty relief. Public safety operations consist of the police, prisons, and the court system. The ratio of the police to the total population is denoted by π. Given the wages of public-sector employees (ω), total spending on police is represented by $\pi\omega T$. The remaining elements of public spending are poverty relief and education. Poverty relief is assumed to be the simple product of poverty relief per person (Ω) and the number of poor people in the city ((1 - m)T). In addition education spending ($\tau\omega gT$) is limited to teachers' salaries in this analysis. Thus the government budget constraint can be written as

(15) $\theta \frac{K}{\sigma} = [\Omega\ (1 - m) +\ \omega\ (\tau g + \pi)\ ]T.$

The per capita form of the government budget constraint is expressed as

(15a) $\theta\beta mx = \ \Omega\ (1 - m) +\ \omega\ (\tau g + \pi).$

Employment Dynamics

The urban capital stock grows when the rate of profit in the city (ρ) exceeds the rate of profit elsewhere (ρ^*). Given a production function of the form

(16) $Y = \min \left[\frac{K}{\sigma},\ \beta L \right],$

where β is the level of output and L the level of employment, the rate of profit would then be

$$\rho = \left(1 - \frac{w}{\beta}\right) \frac{1}{\sigma}.$$

The rate of growth of the capital stock is represented by

(17) $\frac{\dot{K}}{K} = G\ [\ (1 - \theta)\ \rho - \rho^*\ ] - \delta,\ G > 0,$

where $\delta > 0$ is the depreciation rate and G a positive constant. Given the growth rate of the labor force (equation (12)), the evolution of the employment rate is represented by

$$\frac{\dot{x}}{x} = \frac{\dot{K}}{K} - \frac{\dot{L}}{L},$$

(18)
$$= \left(G\ [\ (1 - \theta)\ \rho - \rho^*] + F\ (x, m) - (1 - \xi)\ (1 - m)\frac{g}{m}\right).$$

Dynamics

The growth of cities caught in the conflict between the poor and the middle class can be studied through the use of a simple phase diagram. A phase diagram is a device used by economists, engineers, and others to study the way a system develops over time without actually having to solve complex dynamic systems. In this case a phase diagram approach to studying urban dynamics is especially helpful since, like most economic analyses, the interaction of middle class dynamics and employment growth is represented by very general relationships rather than by precise mathematical formulas.

Phase diagrams are helpful for illustrating the role of feedback and dynamic coupling in causing an economy to move over time. Feedback is a simple and powerful phenomenon that may be familiar to those who have experienced the annoying noise of an open microphone at a concert or speech. In that situation the microphone amplifies its own speaker output, producing an ever-growing resonance that results in the screeching sound called "feedback." The open microphone problem is an example of positive feedback: a process that grows on itself.[13]

Dynamic coupling is a bit trickier to explain, even though it is a relatively simple process that constantly makes itself felt in economic life. In the simplest sense, dynamic coupling is the interaction between processes that change over time. Malthus' theory of population growth is a gloomy, but unfortunately apropos, example of dynamic coupling between the rate of population growth and the growth of the means of subsistence in a simple industrial economy. Malthus' theory of population growth maintained that the population grows at an exponential rate as long as there is an adequate supply of food, while the supply of food only grows at an arithmetic rate. Hence population growth would periodically outstrip the growth of food, leading to mass starvation, crime, and violence as checks on population growth. In Malthus' analysis food and population are dynamically coupled together to produce a cycle in population growth rates: a rise in per capita food availability increases the rate of population growth (an example of positive dynamic coupling or, more simply, positive coupling). However, higher levels of population reduce the availability of food, thereby leading to a gradual and painful decline in population growth (an example of negative coupling). The cyclical Malthusian dynamic is driven by a combination of positive feedback on population growth and offsetting positive and negative coupling between food and population growth.

The evolution of the urban economy can be represented by the movement of the middle class ratio (m) and the employment rate (x) over time. The dynamic system governing the evolution of the urban system is expressed as equations (14) and (15a), given the government budget constraint (18).[14] Figure 1 shows a phase diagram that illustrates the evolution of the economy over time. Line mm represents those combinations of the middle class ratio and the employment rate that keep the middle class ratio stable, that is, that keep it constant over time. Similarly line xx represents those combinations of m and x that keep the employment rate stable. Line mm is positively sloped, because the middle class rate is a negative feedback process while positively coupled to employment rate. This means that a rise in the level of the middle class ratio leads to a smaller rate of change in the middle class ratio (in much the same way that a negative real rate of interest means that a larger stock of wealth loses more purchasing power with the passage of time), while a rise in the employment rate leads to a compensating influx of middle class residents into the city, leaving the level of the middle class ratio unchanged.[15]

In addition line xx is negatively sloped on the assumption that x is a negative feedback process while negatively coupled to the middle class ratio. The negative feedback link

between the movement of x and its level means that a rise in the employment rate reduces the rate of increases in that rate. In turn the negative coupling of the employment rate to the middle class ratio depends on the size of the educational failure rate ξ. A bit of calculus and algebra can show that there exists a level of the educational failure rate $\xi = \xi_C$, the critical failure rate, that just balances the positive effects of a large middle class ratio on the growth of the middle class (by slowing middle class flight) with the negative effects of a rise in m on the growth of the middle class as a result of school graduation.[16] When $\xi > \xi_C$, a rise in m leads to smaller growth in the middle class as a result of school completion relative to middle class flight, which causes the growth rate of the middle class to rise and paradoxically, the employment rate to fall. The economic meaning of line xx is clear: Line xx is the combination of points in (x, m) space where the growth rate of labor demand is just equal to the growth rate of labor supply. If a rise in the middle class ratio raises the growth rate of labor supply (which is the same as the growth rate of the middle class), then the only way that balance can be restored between labor demand growth and labor supply growth is with a falling employment rate (labor demand growth is independent of both m and x in this model).

The intersection between mm and xx is the long-term equilibrium configuration of the economy. If xx slopes downward, the equilibrium point shown in phase space is said to be a stable node, meaning that the urban economy will tend to move toward this point in the presence of shocks to the economy. However, if xx is steeper than mm, then the equilibrium point in phase space is said to be a saddlepoint, meaning that shocks to the economy can lead to cumulative departures away from equilibrium. The motion of the economy in the aftermath of a shock is shown by the small arrows in each part of the phase space.

An example of the use of phase diagrams helps show why this technique is so powerful. A rise in the tax rate (θ) raises the middle class exit rate ($F(x, m)$), thereby lowering the change in the middle class rate over time. In Figure 1 this phenomenon is represented by a leftward shift in line xx, meaning that the region of phase space associated with a decline in x becomes larger. In addition the foregoing analysis shows that a rise in θ reduces the rate of capital accumulation and employment growth as well as the rate of labor force growth (which is the same as the rate of growth of the middle class). This fact means that a rise in θ has an ambiguous effect on the evolution of the employment rate. If the decline in the rate of capital accumulation is greater than the decline in the growth of the labor force, the employment rate falls, as shown in Figure 1 by a downward shift in line mm. These kinds of shifts will lead to a reduction in the long-term middle class ratio in a stable regime, as is evident by the lower intersection of xx and mm along the vertical axis. However, the simultaneous drop in x and m over time means that the long-term value of the employment rate is uncertain.

In the case of a saddlepoint, two kinds of cumulative movements are possible. First, a shock to the economy that causes both the employment rate and the middle class ratio to exceed the equilibrium value can lead to a “virtuous circle,” in which increases in the employment rate can lead to increases in the middle class ratio, which in turn can further boost employment rates, and so on. Second, an economic shock that pushes x and m below the equilibrium point can lead to the threat of a “vicious circle,” in which falling employment rates encourage a decline in the middle class ratio and lead to further employment declines.

This distinction between dynamic regimes is crucial for the understanding of urban growth. On the one hand, a stable growth regime (as shown in Figure 1) is one in which city officials can use public safety and educational policies to affect marginal shifts in the presence of the middle class in the city. By contrast a saddlepoint regime (as shown in

Figure 2) is rather more ambitious (if risky), precisely because it is a situation in which, given the right kind of economic shock, the way a city grows promotes a cumulative expansion in both jobs and middle class prosperity.

The foregoing dynamic analysis highlights the role of educational failure, capital flows, and middle class tastes in shaping the process of urban growth and development in a society where conflict between the middle class and the poor is a central social and economic force. In particular this analysis shows that when the sensitivity of capital flows to profit differentials (G) is "small" and the failure rate is above its critical value (ε_C), poverty and high unemployment can persist indefinitely. It is noted above that, in the language of dynamics, a stable equilibrium is a situation in which changes in important parameters can alter the long-term position of a system but do not fundamentally change the way the system develops over time. Hence, if G is low and $\varepsilon > \varepsilon_C$, then government policy regarding education and taxes can cause minor changes in the long-term values of the middle class ratio (m) and the employment rate (x).

There is no question that improvements in the lives of a city's residents, no matter how small, are valuable, especially since small changes are frequently the only sort that can realistically be pursued. Yet this dynamic analysis is a bit depressing, because it points to the possibility of more dramatic change in the mechanisms that generate persistent poverty and unemployment in cities. As noted earlier the critical value of the failure rate,

$$\xi_c = 1 + \frac{m^2}{g}\left[G\theta_m\rho + F_m + F_\theta\theta_m\right] < 1,$$

plays an important role in the analysis of growth in cities suffering from the conflict between a technologically marginal underclass and an employable middle class, called the "modern social conflict" by sociologist Ralf Dahrendorf (1988). The critical value of the failure rate (ε_C) depends on

- The sensitivity of capital flows to profit differentials (G).
- The sensitivity of middle class flight to change in the middle class ratio ($|F_m|$).
- The sensitivity of middle class flight to changes in the tax rate ($|F_\theta|$).[17]

An increase in G, $|F_m|$, or $|F_\theta|$ lowers the critical value of the failure rate. A smaller critical value of the failure rate would be bad news for a dynamically stable city, in that it would foreclose the possibility of using public policy to create a "virtuous circle."

However, a reduction in any or all of these parameters would raise the critical value of the failure rate, thereby altering the process of urban growth by converting the equilibrium values of the middle class ratio and the employment rate from a stable node to a saddlepoint. If a city can push ε below ε_C, then it can create the conditions for a "virtuous circle," whereby higher values of the employment rate lead to reciprocal increases in the middle class ratio which, in turn, further boost employment rates. Analysis of the determinants of the critical value of the failure rate (ε_C) shows that this sort of cumulative expansion in employment and middle class prosperity can only be brought about by either (1) changing middle class attitudes about taxes ($|F_\theta|$) and the poor ($|F_m|$) or (2) raising the sensitivity of capital flows to profit rate differentials (G). Unfortunately none of these parameters is under the control of city authorities.

Middle class attitudes, as represented by $|F_m|$ and $|F_\theta|$, largely determine the extent to which a city can turn persistent poverty and unemployment into a virtuous circle of growing employment and more widespread prosperity. Given the actual failure rate, growing

middle class fear of poor people (increases in $|F_m|$) or increasing middle class opposition to taxes (increases in $|F_\theta|$) will lower the critical value of the failure rate, thereby increasing the gap between ξ and ξ_C and making any attempt to change the way a city grows that much harder.

Given middle class attitudes and the dynamics of capital flows, public policy may be able to influence the long-term middle class ratio and long-term unemployment in two ways:

- Increase spending on public safety as a way to stem middle class flight.
- Increase education spending (by increasing the teacher/student ratio and other resources in schools) as a way of combatting the caste-creating aspects of urban schooling.

Of course the requirement that city budgets be continuously balanced implies that any attempts to improve employment and reduce poverty will require lower tax rates or reduced public services to finance greater spending for police and teachers.

Figure 3 shows the effect of a shift in resources from schools to police in a dynamically stable city where tax rates are unchanged. A policy that substitutes more police for teachers may well increase the presence of the middle class in the city if the link between the educational failure rate and the teacher/student ratio is weak.[18] In a dynamically stable city, the way the city grows is not greatly affected by increased police spending; instead a rise in police spending at the expense of schools increases the long-term presence of the middle class (Figure 3). However, if the teacher/student ratio has a significant effect on the educational failure rate, then a policy of reducing educational resources to boost police spending eschews the possibility of creating a virtuous circle of cumulative expansion in favor of incremental efforts at crime control. Political considerations may force the authorities to favor crime control over education, despite the possibility of altering the dynamics of city growth.

A more likely barrier to a policy aimed at radically reducing educational failure and long-term poverty is the need to secure minimally acceptable degrees of public safety in the face of revenue and balanced-budget constraints. It may not be possible to reduce educational failure to the point at which a virtuous circle of growth and development emerges without incurring hideous expenses, including major cuts in public safety spending. Worse, increases in tax rates simply increase middle class flight and reduce capital inflow, leading to a reduction in the long-term middle class presence. If increases in taxes are not possible and minimum levels of public safety are required, there may be little prospect of radical and expensive reform in the education of poor children, leaving a city in the ironic position of opting for more police even if it is possible to create a virtuous circle.

Conclusion

This article has explored a seemingly exotic question: Can a city use education policy, in the form of major increases in resources devoted to schooling, to change the way it grows? In particular can a city reduce the caste-creating aspect of knowledge capital by reforming education, thereby converting a situation of persistent poverty into a virtuous circle of growth and development? The results of this discussion are, not surprisingly, rather mixed. On the one hand, educational failure plays a critical role in shaping the way a city grows, at least at the level of economic theory. High degrees of educational failure lead to persistent, stable poverty and unemployment in a city. On the other hand, a stable urban regime (in the dynamic sense) can be improved through a variety of means, including changes in cultural, political, and social conditions that may reduce educational failure

without dipping into the public purse. Still, without reducing the educational failure rate below the critical level, a city is not likely to greatly increase the presence of the middle class through policy initiatives.

A second major point in this article is the effect of middle class attitudes on the critical value of the educational failure rate. As noted earlier middle class aversion to the poor—a primary determinant of the sensitivity of middle class flight to the presence of middle class residence (m)—and middle class aversion to taxation determine the critical failure rate. If the middle class can be convinced to stay in the city even in the presence of the poor or despite higher taxes (taxes dedicated to education reform and public safety), then changes in middle class attitudes can themselves change the way a city grows, converting a dynamically stable urban economy into a virtuous circle. This result is important because it suggests that the future of the city, and particularly its ability to change the way it grows, may ultimately depend on the willingness of the middle class to remain in the city despite the difficulties of caste division and crime that are the underside of the role of knowledge capital in economic life. In turn a national government policy that encourages the exodus of middle class citizens from the city may make significant urban reform and reconstruction impossible.

Indeed this article points to a theoretical link between knowledge capital and urban poverty that should shape urban policy. The caste-creating aspect of knowledge capital in modern economic life is a classic example of a negative externality, in the sense that the creation of an unemployable underclass is an unintended consequence of technological change in a society with unequally distributed access to learning. The urban system adjusts to this negative externality through a class conflict between the middle class and the underclass which, in this article, resolves itself through middle class flight from the city. This adjustment process undermines the capacity of the city to improve its long-term economic position, because driving the middle class out of the city condemns many cities to persistent poverty. This finding suggests that the increasing importance of knowledge capital in economic growth contributes to the problem of urban poverty. The Federal Government must recognize the role of knowledge capital in unwittingly exacerbating the urban crisis. In particular any urban policy that intends to make cities into virtuous circles must recognize the folly of forcing local governments to deal with the negative aspects of knowledge capital with diminishing economic resources. Further, a macroeconomic growth strategy that emphasizes human capital must carefully address the inequality, poverty, violence, and crime that result from educational failure.

The central argument of this article has been that knowledge capital, though a major factor in multiplying the productive capacities of humans, divides a population in profound ways. Those who by virtue of social class, accident, or historical circumstance are unable to complete the school course in a manner deemed satisfactory are not simply without adequate technical and intellectual skills. In the context of a modern economy, the underclass is largely bereft of the language and routines of technology and science, making its members inept in dealing with the daily rigors of politics, commerce, and culture in this country. In a very real sense, the underclass becomes estranged from and hostile to—yet is largely dependent on—a middle class it envies but cannot join. In turn the envy and anger of the estranged underclass drives the middle class out of the city, thereby deepening the intellectual isolation of the poor. At that point cities become reservations for the poor which the middle class, through its control of local and State government, must manage in order to preserve its own safety and well-being.

The prospect that knowledge capital creates a form of intellectual apartheid, where the educated class separates itself from the undereducated and manages public affairs to

maintain or deepen its physical distance from the poor, is deeply disturbing to economists. However, the most disturbing aspect of the impact of knowledge capital on the growth of cities is that it threatens to create a permanent, irrevocable breach between a dependent class of unemployables and a resentful, frightened middle class.

This article has explored the consequences of this conflict for the long-term dynamics of cities in an open economy, in the hope that a coherent, tractable model of this subsystem can serve as the basis for serious attempts to reform urban systems. The picture I have painted is stark and no doubt overdrawn, largely because it is being presented in the form of a dynamic system. Still, even if it were softened a bit, the fundamental challenge that knowledge capital poses to the possibilities of social peace in liberal democratic cities would remain.

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Notes

1. Economists frequently use the terms human capital or knowledge capital to designate technical knowledge and skills.

2. As reported in a summary of research on educational achievement in Jaynes and Williams, 1989, p. 365.

3. Currie (1993), in particular, summarizes four decades' worth of work by sociologists and psychologists which clearly shows that persistent intergenerational poverty leads to a disidentification with mainstream social norms by the young poor, fueling the creation of an alternative subculture that establishes status norms different from—and frequently overtly hostile to—conventional roles, rules, and behavior.

4. This assumption makes no difference to the results as long as the level of consumption in prison is far lower than that which might be available outside prison walls. However, it does reduce the amount of tedious algebra that must be gotten through.

5. Maximizing (3), subject to (2), yields

$$(4) \qquad \phi = \frac{(1 - \kappa)\, w\varepsilon - a\Omega}{\varepsilon[a + (1 - \kappa)\, w]},$$

where

$$\frac{\partial \phi}{\partial \kappa} = \frac{-aw(\varepsilon + \Omega)}{(\varepsilon[a + (1 - \kappa)\, w])^2} < 0,$$

$$\frac{\partial \phi}{\partial w} = \frac{a[\varepsilon - (1 - \kappa)\Omega]}{(\varepsilon[a + (1 - \kappa)\, w])^2} = ?$$

A rise in the level of middle class income (w) will raise ϕ only if $\varepsilon - (1 - \kappa)\, \Omega > 0$.

6. The lifetime earnings associated with living in the city is calculated as

$$(8) \qquad V_C = \int_O^T \left(w \left[x(1 - \theta) - \varepsilon\phi \frac{1 - m}{m} \right] \right) e^{-\alpha t} dt,$$

or

$$(9) \qquad V_C = \frac{w}{\alpha} \left[(1 - \theta)\, x - \varepsilon\phi \frac{1 - m}{m} \right] (1 - e^{-\alpha T})$$

on the assumption of shortsightedness over real wages (w), employment rates (x), and the fraction of the population in the middle class (m).

7. Because suburban and city wages are identical and suburbs are assumed to be free of crime, the present discounted value of income associated with suburban living is calculated as

$$(10) \qquad V_S = \int_O^T w(1 - \theta_s) e^{-\alpha t} dt = (1 - \theta_s) \frac{w}{\alpha} (1 - e^{-\alpha T})$$

where ($\theta_S < \theta$) is the suburban tax rate.

8. This implies that the fraction of new workers who have a particular distaste for city life—those who may require, for example, income in the city to exceed income in the suburbs by 50 percent in order to see the city as an attractive place to live—is about the same from year to year.

9. Since

$$V_C = \frac{w}{\alpha} \left[(1 - \theta) x - \varepsilon \phi \frac{1 - m}{m} \right] (1 - e^{-\alpha T^*}),$$

and

$$V_S = (1 - \theta_s) \frac{w}{\alpha} (1 - e^{-\alpha T^*}),$$

then

$$\Gamma_m = -\partial V_C / \partial m < 0, \ \Gamma_\theta = -\partial V_C / \partial \theta > 0, \ \Gamma_x = -\partial V / \partial x < 0.$$

10. Kaus (1992) has provided a popular account of the role of credentials in determining economic success. Kaus' analysis, though quite caustic in its attack on traditional liberal approaches to inequality, notes that the increasing role of technical skills and credentials in modern labor markets means that meritocracy is increasingly consistent with a more or less permanent class system driven by educational inequality. Marshall and Tucker (1992) provide detailed empirical evidence of the role of skills deficiencies in accounting for the persistent low incomes and poor living conditions of poor and minority (mainly black and Latino) workers.

11. Marshall and Tucker (1992, pp. 68–69) note that the United States has few programs for recovering and retraining high school dropouts. The general equivalency diploma (GED) program certifies that the holder of the certificate is trained to a seventh-grade level of literacy and numerical ability. Given the increasing levels of technical and numerical skills required in a growing number of occupations and positions, the GED is an increasingly inadequate preparation for secure, high-wage employment. See Marshall and Tucker, (1992), pp. 63–75.

12. See Kareit (1986). This work shows that the educational achievement of parents, the level of educational success in the larger community, the class composition of the larger community, and other "positive externalities" associated with the intellectual and economic characteristics of a child's environment play a pivotal role in that child's long-term development. This finding suggests that an important determinant of educational success is the presence of a middle class population in urban schools. However, most studies also show that educational attainment is an exceedingly complex process involving many extra-economic factors that have no particular relationship to identifiable economic factors.

13. Economic examples abound: Interest generates a process of positive feedback in wealth accumulation; when real interest rates are positive, the purchasing power of wealth over time grows as long as a saver refrains from spending interest income.

Similarly, a negative real interest rate generates negative feedback. For example, the purchasing power of wealth steadily declines with the passage of time, leaving the patient but misguided saver with ever-smaller consumption capabilities.

14. The appendix presents a complete local stability analysis as well as a brief discussion of the role of ξ as a bifurcating parameter.

15. The negative feedback property of the middle class ratio is the result of the assumption that middle class flight (F(x, m)) is inelastic with respect to a rise in m. This appendix explores this point in more detail.

16. The appendix provides a complete discussion of the role of the failure rate in the analysis of local stability.

17. All of these relationships are discussed in terms of absolute values to facilitate exposition. Hence, when I speak of $|F_m|$ rising, I mean that the relationship between the middle class exit rate and the middle class ratio is stronger, even though $F_m < 0$.

18. The government budget constraint implies that

$$d\gamma + gd\tau = 0.$$

This relationship means that

$$\frac{d\dot{m}}{d\gamma} = -(1 - m)\left[F_\gamma m - \frac{\partial \xi}{\partial \tau}\right],$$

and

$$\frac{d\dot{x}}{d\gamma} = -\frac{x}{m}\left[F_\gamma m + (1 - m)\frac{\partial \xi}{\partial \tau}\right],$$

where $\partial\xi/\partial\tau \leq 0$ is the relationship between the educational failure rate and the teacher/student ratio. If $|F_\gamma m| > |\partial\xi/\partial\tau|$, then the teacher/student ratio has a "small" influence on educational failure, which would shift lines mm and xx leftward because of a shift in public-sector resources from schools to police.

Figure 1

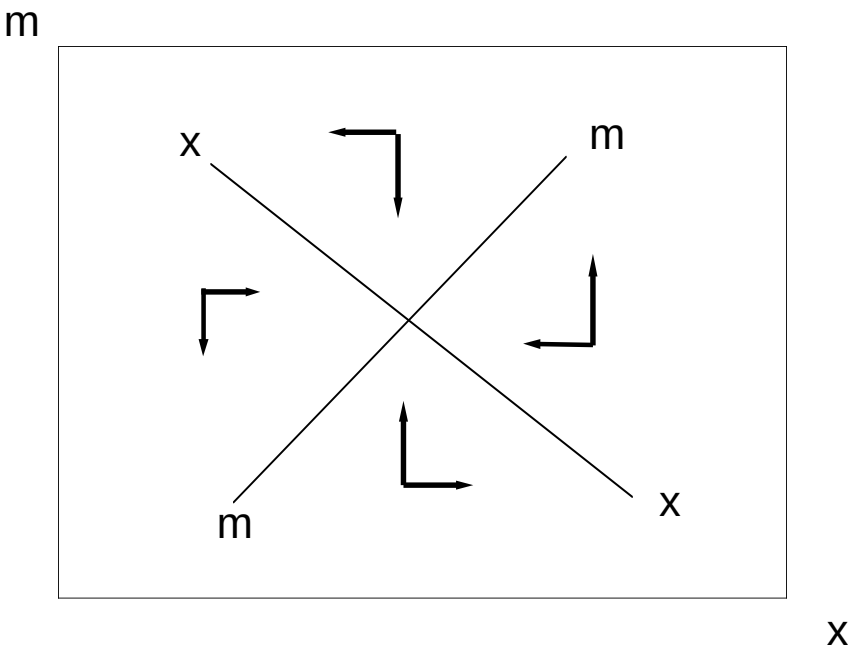


Figure 2

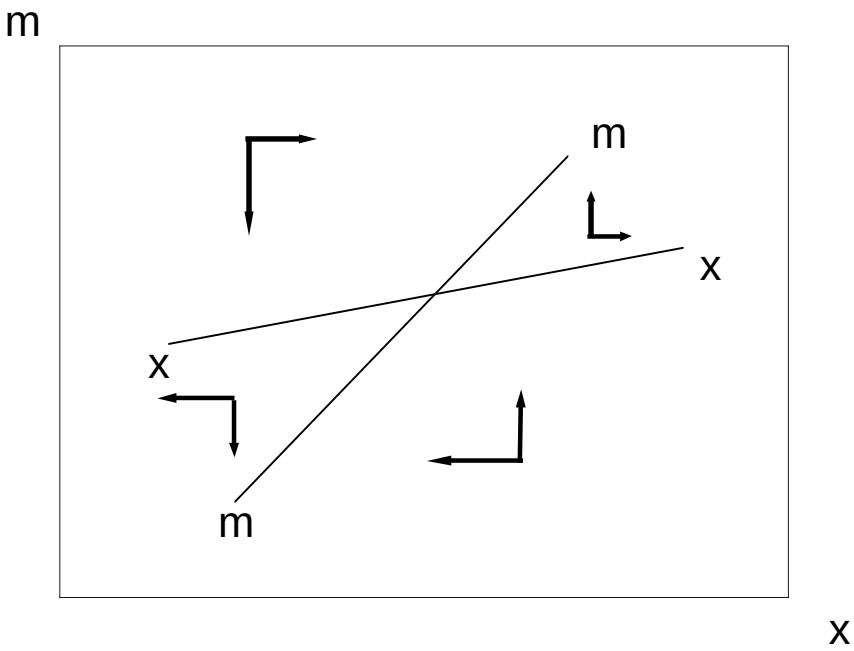
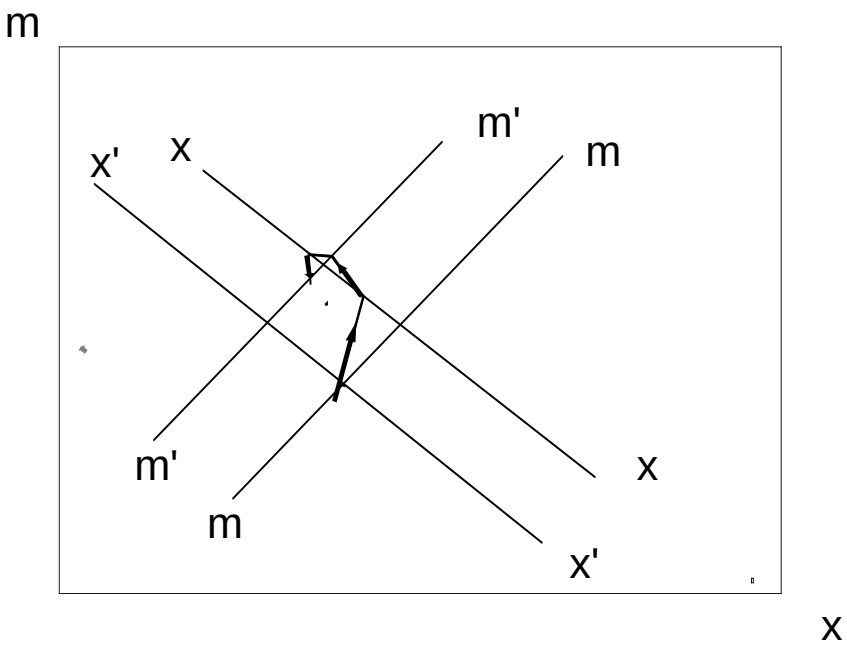


Figure 3



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Appendix: Local Stability

The government budget constraint is

$$\theta\frac{K}{\sigma} = \Omega\,(1 - m)\,T + \omega\,(\tau g + \pi)\,T,$$

or

$$\theta\beta\, mx = \Omega\,(1 - m) + \omega\,(\tau g + \pi)$$

on a per capita basis. It is a simple matter to show that $\theta_\omega > 0$, $\theta_\gamma > 0$, $\theta_\tau > 0$, $\theta_\Omega > 0$, that is, a rise in the real wages of public employees (ω), per capita police spending (η), the teacher/student ratio (τ), or poor relief (Ω) increases the tax rate. A rise in the employment rate or in the middle class rate reduces the tax rate, that is, $\theta_x < 0$ and $\theta_m < 0$, given the requirement of a continually balanced budget.

The Jacobian associated with the system comprised of (14) and (15a), given the government budget constraint (18), is expressed as

$$J = \begin{Bmatrix} \frac{\partial \dot{m}}{\partial m} & \frac{\partial \dot{m}}{\partial x} \\ \\ \frac{\partial \dot{x}}{\partial m} & \frac{\partial \dot{x}}{\partial x} \end{Bmatrix}$$

where

$$\frac{\partial \dot{m}}{\partial m} = -(1 - m)\,F\left[F_m\frac{m}{F} + F_\theta\theta_m\frac{m}{F} + 1\right],$$

$$\frac{\partial \dot{m}}{\partial x} = -(1 - m)\,m\left[Fx + F_\theta\theta_x\right] > 0,$$

$$\frac{\partial \dot{x}}{\partial m} = -x\left[G\theta m\rho + Fm + F_\theta\theta_\mu + (1 - \zeta)\frac{g}{m^2}\right],$$

$$\frac{\partial \dot{x}}{\partial x} = -x\left[G\theta_x\rho - F_x - F_\theta\theta_x\right].$$

Note that if

(C1) $F_m\frac{m}{F} + F_\theta\theta_m\frac{m}{F} + 1 > 0$,

and

(C2) $\xi > \xi_c = 1 + \frac{m^2}{g}\left[G\theta_m\rho + F_m + F_\theta\theta_m\right]$,

then

$$\frac{\partial \dot{m}}{\partial m} < 0, \qquad \frac{\partial \dot{x}}{\partial m} < 0.$$

Condition (C1) implies that middle class ratio is a negative feedback process if the rate of middle class flight is not inelastic with respect to changes in the middle class ratio. Further, condition (C2) both defines the critical value of the failure rate and shows the condition under which the employment rate and the middle class ratio are negatively coupled. Finally, if

$$\text{(C3)} \quad 0 < G < \frac{Fx + F_{\theta}\theta_x}{\rho\theta_x},$$

that is, if G is "small" in the sense of a relatively low sensitivity of capital flows to profit rate differentials, then

$$\frac{\partial \dot{x}}{\partial x} < 0.$$

In that case, trace $J < 0$ and $\det J > 0$, so the equilibrium point is a stable node. If $\xi < \xi_C$ and G violates (C3), then $\det J < 0$, which means that the equilibrium point is a saddlepoint. Further, if $\xi < \xi_C$ and G is consistent with (C3), then the equilibrium point may still be a saddlepoint if $\det J < 0$.

The foregoing analysis suggests that a virtuous circle is a possibility if failure rates can be pushed below the critical value ξ_C and if the sensitivity of capital flows to profit rate differentials is sufficiently large.