

Age Structure, Income Distribution and Economic Growth

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Un corpus de recherches empiriques effectuées dans différents pays a confirmé que l'inégalité des revenus est liée d'une manière négative à la croissance économique. Cet article fournit une voie à suivre pour expliquer ce rapport. La nouveauté de notre démarche réside dans l'utilisation de la démographie pour expliquer l'écart entre les pays en matière de croissance économique et répartition des revenus. Nous présentons quatre modèles qui sont apparus comme les mécanismes de transmission les plus plausibles reliant l'inégalité à une croissance plus lente. Dans chaque cas, nous démontrons comment la prise en compte de la répartition par âge démographique peut compléter les quatre évaluations traditionnelles.

A recent body of empirical cross-country research has confirmed that income inequality is negatively related to economic growth. This paper provides an explanatory channel for this observed relationship. The novelty of our approach consists in the use of demographic channels to account for cross-country differentials in economic growth and income distribution. We present four models that have emerged as the most plausible transmission mechanisms linking inequality to slower growth. In each instance we demonstrate how a consideration of demographic age structure can complement the four mainstream accounts.

INTRODUCTION

One of the more challenging goals in economics is to explain the variation in economic performance that one observes across countries. In this regard, Solow's (1956) neo-classical growth model and its prediction of absolute convergence has served economists well. Absolute convergence refers to the proposition that regardless of initial conditions, all economies approach the same steady-state level of

income and growth per person. Despite its elegance and predictive appeal, the Solow model has performed rather poorly in empirical estimations (Mankiw 1995).

As a result of its empirical failure, economists have abandoned their belief in absolute convergence and today adhere to a less restrictive proposition termed conditional convergence. Conditional convergence makes two alternative predictions

regarding income and economic performance. First, depending on country-specific initial conditions (i.e., saving rates and population growth) countries will reach different steady-state levels of income per person. Second, depending on any initial deviation from their own steady state, countries will display differing rates of economic growth. These predictions are in accordance with what is generally observed in cross-country empirical work.

Over the past decade, applied macroeconomists have tried to link differences in initial conditions with variations in economic growth across countries. The approach typically adopted involves taking samples of 50 to 100 countries and regressing the average growth rate of income per capita against a host of independent variables measured at the starting point of the growth period. The literature stemming from this approach has now become rather vast and summarizing the results has proved to be a rather daunting task (Temple 1999; Lloyd-Ellis 2003). For our purposes, however, only one finding is worth noting: when factors such as the initial level of income and human capital are held constant, countries with more egalitarian distributions of income tend to grow faster than otherwise similar counterparts. Empirically, this finding has been confirmed in several recent studies (Aghion, Caroli and García-Peñalosa 1999).¹

Four theoretical channels have been advanced as an explanation for this empirical regularity: the (i) agency cost and (ii) credit constraint approaches are purely economic, while the (iii) fiscal policy and (iv) social instability models are political economic in nature. This paper contends that both the politico-economic and the economic-based explanations have underlying demographic determinants that have yet to be fully explored. In more precise terms, our argument is that age structure and economic growth are related via the same four mechanisms that link inequality to performance.²

There is, of course, a fairly straightforward connection between demography and economic growth.

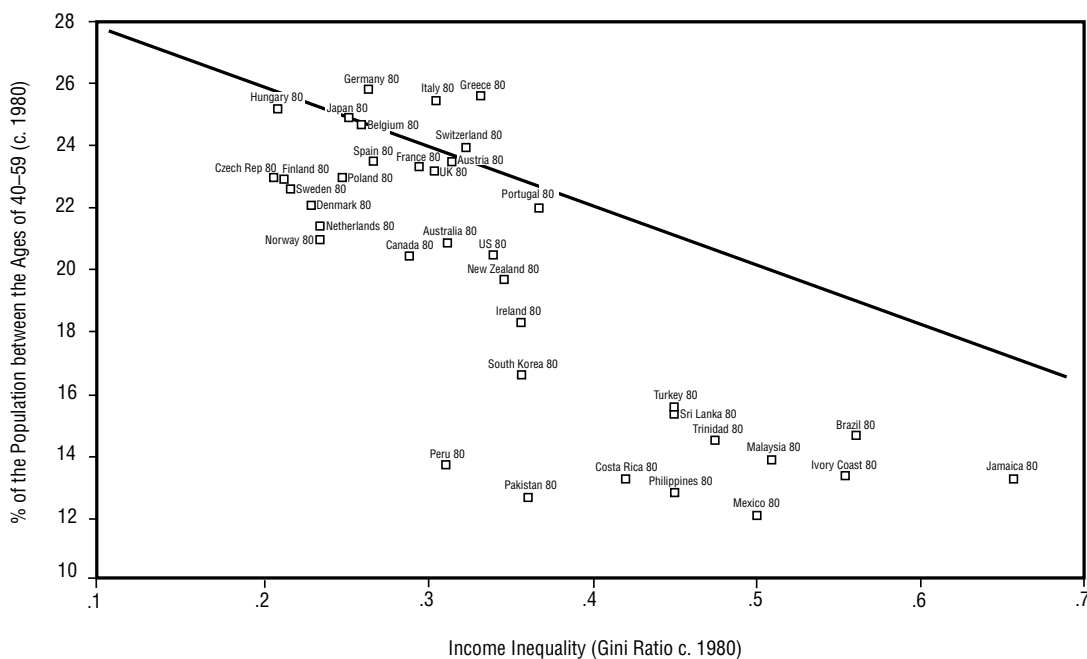
Empirical evidence recently presented by Higgins and Williamson (1999) demonstrates that countries with younger relative cohort sizes tend to display greater income inequality. A graphical illustration may prove useful. Figure 1 plots the relation between income inequality and the percentage of the mature working-age population (e.g., those aged 40–59) across 38 countries for the early 1980s. It shows an inverse relationship between income inequality and mature working-age populations, with a cluster of Organisation for Economic Co-operation and Development (OECD) economies in the top left-hand quadrant and lower income countries occupying the lower right-hand portion of the graph.³ If the link between inequality and growth is to be believed, then age structure affects growth by first influencing income distribution. In this paper, however, we restrict our attention to the direct causal links between age structure and economic performance.

The paper is organized as follows. After presenting an overview of the relevant historical literature, the next section sets out the basic questions explored here. Section three presents the intuition behind the agency cost, credit constraint, fiscal policy, and social instability models, and then demonstrates how demographic considerations provide complementary transmission mechanisms to those found in the inequality-growth literature. Section four summarizes the theoretical arguments and assesses their strengths against the empirical literature surveyed. In the final section we conclude our discussion.

LINKING INCOME DISTRIBUTION AND AGE STRUCTURE TO GROWTH

Given the number of recent literature reviews (Ferreira 1995; Temple 1999; Aghion, Carolia and García-Peñalosa 1999; Lloyd-Ellis 2003) we sketch, rather than synthesize, the logic of studies linking inequality to growth. Our focus is on the manner in which demographic considerations — in particular cross-national variations in age structure — can complement the four mainstream explanations on

FIGURE 1
Age Structure and Inequality



Source: Calculations based on data from Deininger and Squire (1996) dataset and United Nations, *World Population Prospects 1998*.

offer. We do this with special attention paid to Canadian and OECD cases where appropriate.

A Tale of Three Countries: Japan, Korea and the Philippines

To introduce the theme of this section we shall revisit, in a slightly amended fashion, a case raised by both Lucas (1993) and Benabou (1996) at the beginning of their respective papers. During the early 1960s, Japan, South Korea, and the Philippines were similar with respect to many major socio-economic indicators (i.e., population, primary and secondary school enrolment) but Japan was clearly the outlier in the group with gross domestic product (GDP) per capita roughly triple that of South

Korea and double that of the Philippines. Based on conditional convergence criteria, this should have made Japan's per capita economic growth rate significantly lower than that of South Korea and the Philippines. However, this was not the case, as Japan over the next two decades grew faster than the Philippines and just as fast as South Korea. How was this possible? The answer, according to Benabou (1996) resides in looking beyond first moments (e.g., averages) and instead examines the distribution of income.

As pointed out by Benabou and as reproduced in Table 1, South Korea was considerably more egalitarian than the Philippines in 1960, with a Gini

TABLE 1
Japan, Korea and the Philippines

	1960			
	<i>Gini Ratio</i>	<i>GDP per capita (US\$)</i>	<i>Population Aged 40–59 (%)</i>	<i>GDP Growth 1960–80 (% per year)</i>
Japan	0.33	2,954	18.9	5.76
South Korea	0.35	904	14.5	5.95
Philippines	0.48	1,033	13.7	1.77

Source: Calculations based on data from Penn World Tables Mark 5.6, Deininger and Squire (1996) dataset; United Nations, *World Population Prospects 1998*.

ratio that was 40 percent lower, while Japan was even more equal with a Gini ratio slightly lower than that of South Korea's. But there was another difference not mentioned by either Benabou or Lucas. Much like the distribution of income, demographic conditions were more highly skewed in the Philippines. Although not as dramatic as the difference in inequality, the relative cohort size — the ratio of young to older adults in the population — was larger in the Philippines than in South Korea, with Japan possessing the most mature workforce in 1960, as measured by the percentage of the population between 40 and 59 years of age.⁴ Naturally this particular example does not constitute proof that either greater equality or larger mature working-age populations are associated with faster economic growth. The example merely highlights that age structure and income distribution are potentially very important determinants of cross-country economic performance.

The Link between Inequality and Growth: An Historical Perspective

The analysis of the relationship between income distribution and economic growth has undergone a number of phases. Persson and Tabellini (1992) are

often credited as the first to link initial distributions of income with subsequent levels of economic growth. While this might be true of their empirical work, theoretically this line of argument dates back to a much earlier period.⁵ Beginning with Keynes (1936), the emphasis was first placed on the issue of how income distribution could affect aggregate demand. Kaldor (1956), building upon the work of Klein (1947) and Harrod (1939), shifted attention to the relationship between distribution and growth and in the process established what has come to be known as the pro-equality argument. Though these theories are fast approaching their fiftieth and in some cases sixtieth anniversaries, they have not been completely forgotten (Leightner 1992).⁶

Over the past ten years roughly 15 published papers have sought to answer the question of whether inequality is bad for growth. In a majority of cases (though not all) the results confirm that inequality is detrimental to growth. Interestingly, the modern literature shares a similarity with more traditional institutional arguments.⁷ The link centres on the role that imperfections play in the market, which in the modern literature take the form of financial and credit market discontinuities rather than social

barriers. The modern approaches, though differing in their transmission mechanisms, all emphasize that growth is the result of investment in physical or human capital.

MODERN PERSPECTIVES ON INEQUALITY AND GROWTH: CAN AGE STRUCTURE “ADD VALUE”?

As mentioned above, four models currently share the lead role in accounting for the link between income distribution and economic growth. They are: (i) fiscal policy channels; (ii) social conflict channels; (iii) agency cost models; and (iv) capital market imperfection models with human capital spillovers. Below, we present an overview of the four models and then point to the potential demographic linkages present in each.

Political Economy Channels: The Fiscal Policy Approach

The fiscal policy approach has been advanced simultaneously by Persson and Tabellini (1994) and Alesina and Rodrik (1994) and both follow the logic of public choice theory. Alesina and Rodrik (1994) begin by assuming that voter preferences influence government policies and argue that when income inequality is quite large, vast segments of the population are more likely to tax growth-promoting activities and press for state transfers. Growth-promoting activities are simply defined by the authors as investments in physical and human capital. Policies that maximize growth are optimal only for a government that cares about investors. The greater the inequality of wealth and income, the higher the rate of taxation/fiscal redistribution and consequently the lower the rate of growth.

While intuitively appealing, these models suffer from a curious flaw: the evidence runs counter to that predicted by the median voter model. Across OECD countries, pre-tax inequality has a significantly negative effect on every major category of social transfers and taxation as a fraction of GDP

(Rodriguez 1998; Gomez and Meltz 2001). More surprisingly, the effect of transfers on growth is actually positive in most studies (Benabou 2000).

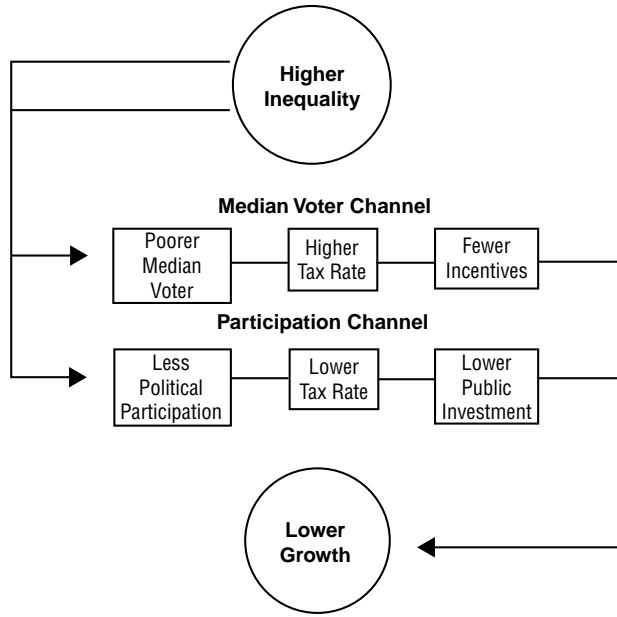
The channel linking higher *ex-ante* inequality to lower *ex-post* tax rates is simple and relies on the well-established phenomenon that voting propensities, along with every reported form of political activity, increase with income (Rosenstone and Hansen 1993; Benabou 2000). The poor simply participate and vote less than the rich. This may explain why economies with more compressed earnings distributions also tend to have higher voter turnout (IDEA 2001).⁸

This reason may also explain why so many countries are below their “optimal tax threshold” — the region where higher taxes combined with productive public spending will lead to higher growth. The concept of an optimal tax threshold rests upon the notion that richer agents can substitute private alternatives for public goods while lower income agents are dependent on state expenditures for services such as health, education, public transport, and basic infrastructure. Public expenditure can therefore play a simultaneously equalizing and performance-enhancing role (Ferreira 1995). Ultimately, inequality may indeed cause lower growth for fiscal policy reasons, but only because inequality leads to (i) less political participation amongst the poor, (ii) lower taxes, and (iii) less public investment. This implies a fiscal policy mechanism different from the one espoused by Alesina and Rodrik (1994). Figure 2 contrasts the two political-economic channels discussed above.

Fiscal Policy Channels and Age Structure

There are two ways in which demographic considerations can enhance the fiscal policy picture presented above. The first builds upon the observation that political participation is positively related to age.⁹ Given this micro-foundation, one could predict that at the macroeconomic level, greater proportions of mature-aged voters in a population will increase voter turnout and political

FIGURE 2
Two Alternative Fiscal Policy Channels Linking Inequality to Lower Growth



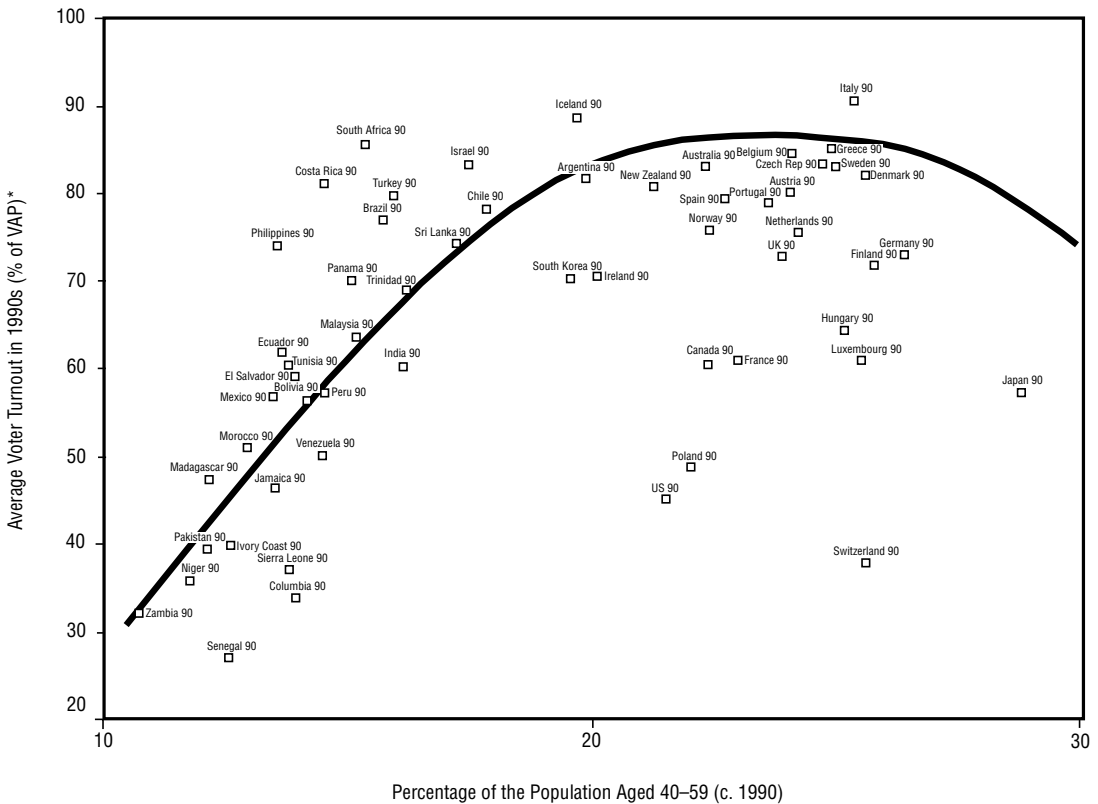
participation. Figure 3 reveals that over the low-to-medium range, countries with more mature populations (e.g., the proportion of the voting age population aged 40–59) do indeed exhibit greater voter turnout in national elections. Empirically, the relationship appears much like a logistic function with voter turnout rising with age and then declining as it reaches an asymptote when approaching 100 percent.¹⁰ A more precise estimate of this turning point is found when we regress the proportion of those aged 40–59 and its square in 1990 against voter turnout in the 1990s for 52 countries.

Table 2 shows that a robust and highly significant relation exists between voter turnout and mature age populations even after controlling for levels of eco-

nomics development and education. Voter turnout amongst the voting aged population (VAP) peaks when the proportion of voters aged 40–59 constitutes roughly 23 percent of the population. In this paper we do not offer a theory as to why voter turnout appears to increase and then flatten as a country’s population grows older; all we suggest is that age structure should form part of any fiscal policy explanation that purports to account for the effect of inequality on voting propensities and political pressure to redistribute income.

The second link between demography and fiscal policy rests upon the observation that attitudes toward taxation, redistribution, and demand for public expenditures differ significantly across age groups. Table 3 shows that in Canada the young (18–24) and

FIGURE 3
Voter Turnout and Age Structure



Note: *Voting Age Population.

Source: Calculations based on data from IDEA (2001); United Nations, *World Population Prospects 1998*.

the old (65+) tend to be the most supportive of public transfers and tend to place a higher priority on public spending over deficit reduction than 25- to 64-year-olds. The group with least demand for redistribution, and hence the most susceptible to calls for lower taxes, is the 25-64 age group. Those aged 35-54, often raising families and presumably in need of the most after-tax disposable income, are at the heart of that age group. In Canada, during the mid-

1990s, the entire baby-boom generation (those born between 1947 to 1966) passed the age of 30 marker.¹¹ In 1998 the boomers totalled 9.9 million people, or 32.4 percent of the Canadian population (Foot and Stoffman 2000). That means that one-third of the population are boomers and for that reason alone, when they become interested in a particular idea (e.g., reducing taxes or the deficit) the rest of society has to take notice.

TABLE 2
Voter Turnout and Age Structure Across Countries

	<i>Dependent Variable: Average Voter Turnout in 1990s</i>	
	<i>Mean (1)</i>	<i>OLS (2)</i>
Secondary school enrolment ratio in 1990 (%)	52.5	0.33 (3.25)
GDP per capita in 1990 (\$000)	5,551	-1.60 (-2.58)
Mature population in 1990 (%)	18.29	18.28 (4.58)
Mature population in 1990 (%) ²	358.14	-0.45 (-4.41)
R ²	—	0.573
Observations	52	52

Note: The dependent variable is average voter turnout amongst voting age population in the 1990s expressed as a percentage (mean=64.9). The t-statistics are in parentheses. Mature populations are defined as proportion of the population aged 40–59.

Source: Calculations based on data from Penn World Tables Mark 5.6; Institute for Democracy and Economic Assistance (2001); United Nations, *World Population Prospects 1998*.

TABLE 3
Probability of Political Participation and Political Orientation by Age in Canada

	<i>Age</i>					
	<i>18–24 (%)</i>	<i>25–34 (%)</i>	<i>35–44 (%)</i>	<i>45–54 (%)</i>	<i>55–64 (%)</i>	<i>65+ (%)</i>
Voted in last federal election	59.0	86.1	87.0	91.5	94.5	92.2
Government should reduce inequality	53.6	43.8	44.5	41.9	40.3	47.4
Deficit reduction major priority	40.7	49.5	51.7	47.8	56.1	42.3

Source: Calculations based on Lipset and Meltz (1997).

Social Conflict Channels

A second politico-economic model has been advanced by Alesina and Perotti (1993, 1996). Here the link between inequality and growth does not depend on fiscal policy, but rather inequality fuels political and social discontent, which can take on varied forms from riots and coups to increased crime. The creation of socio-political instability, in turn, reduces investment and ultimately hinders economic growth.¹²

Although this channel seems better suited to unequal developing economies, it has also been confirmed in studies of the effect of urban inequalities on productivity in the US. Benabou (1996), for example, shows that disparities in the ratio of suburban to urban incomes can lower output and wages in an entire metropolitan region. He also shows that in metropolitan areas where there is greater income inequality, average household income is lower even amongst the most affluent.

The US-based criminological literature also demonstrates that poverty and inequality are powerful predictors of homicide, violent crime, and other forms of non-political unrest (Kennedy *et al.* 1998). Time-series evidence reveals that the hollowing out of America's urban core during the 1970s and 1980s was partly induced by growing inner-city crime and a flight of workers and jobs to the suburbs (South and Crowder 1997). The channel linking such social problems, especially violence and homicide, to greater income inequality involves the concept of social capital (e.g., trust and civic participation), which is undermined by large gaps between the rich and poor. In a study by Kawachi *et al.* (1997) income inequality across US states was strongly correlated with violent crime ($r = 0.76$) as well as measures of social capital, such as per capita group membership ($r = -0.40$) and lack of social trust ($r = 0.73$).

In other contexts, there is evidence that greater inequality impairs a national government's ability to adopt optimal policies to cope with major exter-

nal shocks (Rodrik 1998, pp. 1-27). Cooperation from various stakeholders is essential for the undertaking of successful macroeconomic stabilization and such consensus is often facilitated by a greater degree of income equality (Bruno and Easterly 1998). In short, progressive policies and their consequent social stability meet with a wider consensus in a fairly homogenous society, but face stronger opposition in an unequal one.

Social Conflict Channels and Age Structure

Widespread social discontent is responsive to labour market incentives and this crucial insight needs to be incorporated into models of instability and growth. In a standard time allocation model, paid employment is the alternative to protest or crime. Therefore, private and social forms of discontent (e.g., property crime or public protest) should respond to changes in wages and unemployment probabilities. Wages and employment rates, in turn, rise steeply over the life cycle which may explain why the propensity to engage in crime has a decidedly negative age-based association.¹³

The likelihood of committing a violent crime — a form of private discontent popular in many US states — peaks when a person reaches their mid-to-late-20s and then declines continuously. Though levels of crime differ markedly across countries, the inverse relationship between age and violent crime is quite robust. So strong is this demographic relationship in fact, that most epidemiological data linking crime to any other exogenous cause have to be standardized for age (Kennedy *et al.* 1998).

The age distribution of crime could be related to deviant attitudes, as some of the criminology literature attempts to argue, or it may be a labour market phenomenon responding to wages and the probability of being employed as noted above. Examining the period of highest crime in the US — the 25-year period from 1965 to 1990 — reveals that it was a time when the last leg of the baby boom passed through its late teens and early twenties. It was also

a time when wages fell substantially for young men (Katz and Murphy 1992). Both effects reinforced each other, as large younger age cohorts pushed wages down, thus lowering the opportunity cost of crime, while at the same time the tail end of the baby boom entered into their peak crime participation years (Grogger 1998).

The effects of these patterns of deviance on economic performance have not been estimated with any degree of accuracy. However, persuasive examples abound. In Japan there was violent labour unrest in the late 1950s and early 1960s (Kenney and Florida 1988) a time when nearly 36 percent of the Japanese population was aged 15–34. In the US, the abandonment of inner cities that occurred during the 1980s and early 1990s was strongly attributed to rising crime rates (South and Crowder 1997) but it also coincided with a period in which 15- to 34-year-olds comprised 35 and 32 percent of the population respectively. Attaching an economic value to the social disruption brought about by youth crime and popular unrest is difficult. The Los Angeles riots and the social disruption that struck major American cities in the early 1990s had an appreciable economic cost.¹⁴ DiPasquale and Glaeser (1999) estimated the costs of one day of rioting to be \$440 million in Los Angeles alone.

Agency Cost Models

The link between agency cost models and growth theory appears in several works by Joseph Stiglitz (Furman and Stiglitz 1998; Greenwald and Stiglitz 1986a). According to Stiglitz, inequalities in income and wealth require principals (owners of assets) to delegate the use of their assets to subordinates (agents). Since most transactions are undertaken with imperfect and incomplete information, it is very costly to specify a perfect contract in which all the actions of the agent are accounted for in each contingency. Even if such a contract were specified, it would be difficult to monitor and enforce. This is the heart of the principal-agent problem that creates agency costs. Agency costs and the steps taken

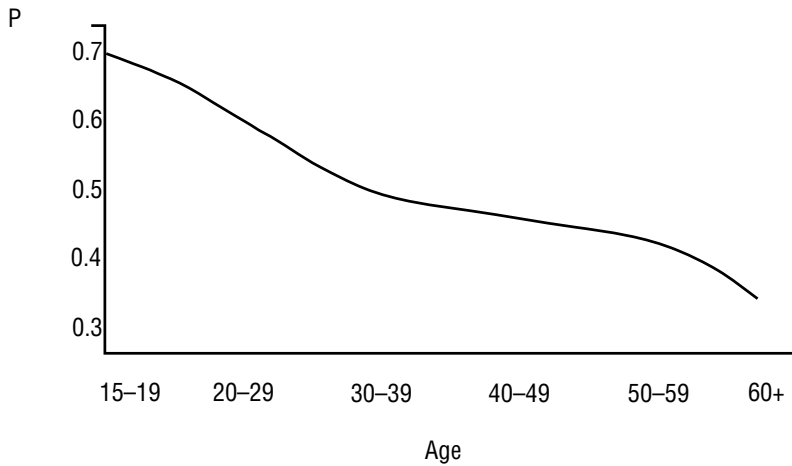
to mitigate them (like closer monitoring) negatively affect output in a number of ways.¹⁵ If inequality, in turn, positively affects agency costs then it will also be the case that economic performance will be impaired as well.

Though the elements of the above channel that lead from higher inequality to lower growth are difficult to test, there is evidence that agency costs do impair economic performance.¹⁶ Within, as well as across, advanced economies there is evidence that low wages and higher monitoring costs are systematically related (D. Gordon 1996).¹⁷ The micro-foundation for this relationship occurs when principals pay a lower wage, thereby decreasing the cost of shirking to the agent (a worker in this case). Consequently, in the presence of imperfect information and low pay for workers, effort has to be sustained by monitoring agents more closely.

Agency Cost Models and Age Structure

How can considerations of age structure complement the agency cost channel? First, there is evidence that monitoring costs are higher in establishments employing younger workers. This is related to the opportunity cost of shirking which is lower for young workers, both because they earn a lower wage and because they possess less firm-specific capital. Figure 4 uses micro-data from the Canadian General Social Survey on Work and Retirement (Cycle 9) and shows a discernible negative relationship between the probability of being highly supervised at work and the age of a worker.¹⁸ For example, workers aged 15–19 are 20 percent more likely to be supervised closely than comparable 50-year-olds. Evidence in the US also shows that larger younger working-age cohorts put downward pressure on wage levels (Macunovich 1998). This observation — combined with the contention that low-wage growth among bottom earners leads firms to a misallocation of labour in the form of overstaffing in low-skill occupations (R. Gordon 1996) — produces an age-based channel for increased agency costs that also includes wage dispersion.

FIGURE 4
The Probability of Being Highly Supervised as a Function of Age



Source: Calculations based on Canadian General Social Survey, Cycle 9: Work and Retirement.

The argument at the macro level is straightforward: in a country with plenty of young workers relative to older ones, unskilled and semi-skilled labour is in abundant supply. Firms faced with such a relaxed labour constraint have a lower incentive to substitute youth labour (which is cheap) with new technology (which is expensive). Such a production technology lowers labour productivity, widens wage dispersion and increases agency costs, as cheap labour has to be monitored more closely.

Capital Market Imperfections and Human Capital Spillovers

Perhaps the most direct channel linking distribution to performance is the one that begins with the tautological observation that the poor have fewer resources than the rich, and thus may never fully exploit their productive potential. Stated formally, productive opportunities vary along a wealth distribution which inhibits low-wealth agents from

investing in their most productive activities, despite having similar underlying capacities and effort functions. Education would presumably offer the easiest way out of poverty for highly-skilled/low-income agents. Unfortunately, human capital cannot act as collateral, meaning that poor agents are often credit-constrained and are therefore unable to meet the minimum fixed cost (e.g., the tuition fee or the opportunity cost in forgone wages) needed to undertake such an investment.

The likelihood of credit constraints harming efficiency would be reduced if capital markets were perfect. But capital markets, even in advanced economies, are far from perfect. Just as lending is pro-cyclical (e.g., rather than offering a life-line during downturns, debts are called back during bad times) it is also pro-collateral in that the more money you inherit the more you can borrow. Second, even with no borrowing constraints, the absence of

insurance markets through which individuals can diversify themselves of risk reduces an individual's willingness to invest in education through loans, even when they are available. Therefore, if financial markets are imperfect and borrowing is difficult or impossible, then those who inherit a large initial endowment of wealth and do not need to borrow are better able to invest in human capital. If the number of these people is relatively small, then an unequal distribution of wealth and income will adversely affect the aggregate amount of investment in human capital, thus impairing economic performance.

The intuition above is drawn from Galor and Zeira (1993). Other researchers working within the financial imperfection paradigm, most notably Durlauf (1994) and Benabou (1994), have since shown how inequality can persist across generations and how this same inequality can affect subsequent economic growth. Benabou (1996), for example, uses a rather simple model to demonstrate how small differences in education, preferences, or initial endowments of wealth, when combined with imperfect borrowing markets, lead to a high degree of stratification. Stratification makes inequality in education and income more persistent across generations, and this social polarization leads to the formation of ghettos and large pockets of poverty. These areas can be very inefficient, both from the Pareto criteria and for growth in long-run aggregate output. Benabou (1994) suggests a simple way of capturing the interdependence between rich and poor agents, by expressing individual output or marginal product as a function of both personal ability and neighbourhood-wide average levels of human capital.

The implication of this rather simple model is rather profound, as it implies that egalitarian distributions of income raise general levels of human capital, such that individual productivity may differ even if personal ability is the same. In other words, two people of equal ability are not equally as productive simply because of the environment in which they work and/or live.¹⁹ From the perspective of a

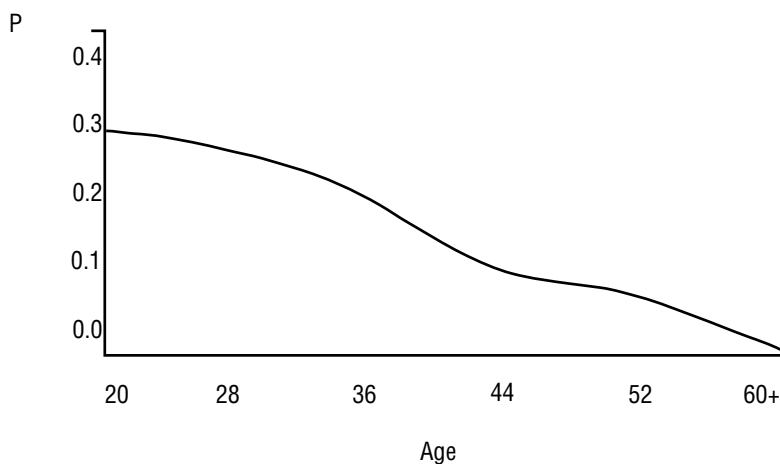
given workplace, one can see how complementarities in the labour market — for example, the combination of well-educated managers coupled with workers with low levels of training — may not be Pareto efficient and can lead to possible conflicts. In a dynamic setting, imperfect capital markets prevent successive generations from improving their human capital requirements and over time can lead to the formation of ghettos and poverty traps.

Capital Market Imperfections and Age Structure

The link between age structure and capital market imperfections rests upon a well-known empirical regularity. Borrowing constraints are more binding the younger one is (Jappelli 1990). Figure 5 shows the probability of being liquidity-constrained as a function of age. As an operational definition, "credit-constrained" refers to the likelihood of having a request for credit rejected by a major financial institution. In the US, the probability of being liquidity-constrained is roughly 25 percent until one is 30 years old and then declines until it approaches zero in later years. If we use this stylized fact, we begin to see how some countries have managed to combine lucky demographics with sound policies, in that their economic take-off coincided with a period when one of their initial conditions was a high saver-to-borrower ratio.

Japan, for example, had a relatively large mature working-age population from the late 1970s onward, which meant that the young and more impoverished in Japan faced lower borrowing constraints during this period than did those living in countries that experienced large baby booms after World War II (see note 9). Countries such as Canada faced the opposite problem in the late 1970s and early 1980s, in that they had a small number of savers relative to borrowers exacerbating the stringency of loan provision and pushing up interest rates (Foot and Stoffman 2000). Figure 6 shows the relationship between the preferred bank lending rate and age structure across these four economies. We see how a greater percentage of consumers in their peak

FIGURE 5
The Probability of Being Liquidity-Constrained as a Function of Age



Source: Calculations from Jappelli (1990, p. 229).

liquidity-constrained years (15–34) is positively related to the preferred bank-lending rate. Japan experienced its relative credit crunch in 1960, whereas in Canada, Australia, and the US the ratio of borrowers to lenders was greatest in the early 1980s and early 1990s, corresponding to the years when prime lending rates were highest and when domestic output fell.

The fact that national lending rates tend to be higher when there is a greater percentage of the population in their peak liquidity-constrained years (ages 15–34) has serious implications for central bank policies and the equity-efficiency debate — especially in Canada as it relates to tuition for higher education, which is slowly mirroring privatized systems south of the border.²⁰ As is evidenced in the US, even the provision of loans will not compensate for the risk that is associated with investing in education as a way out of poverty. Hence, with higher costs, postsecondary participation rates in

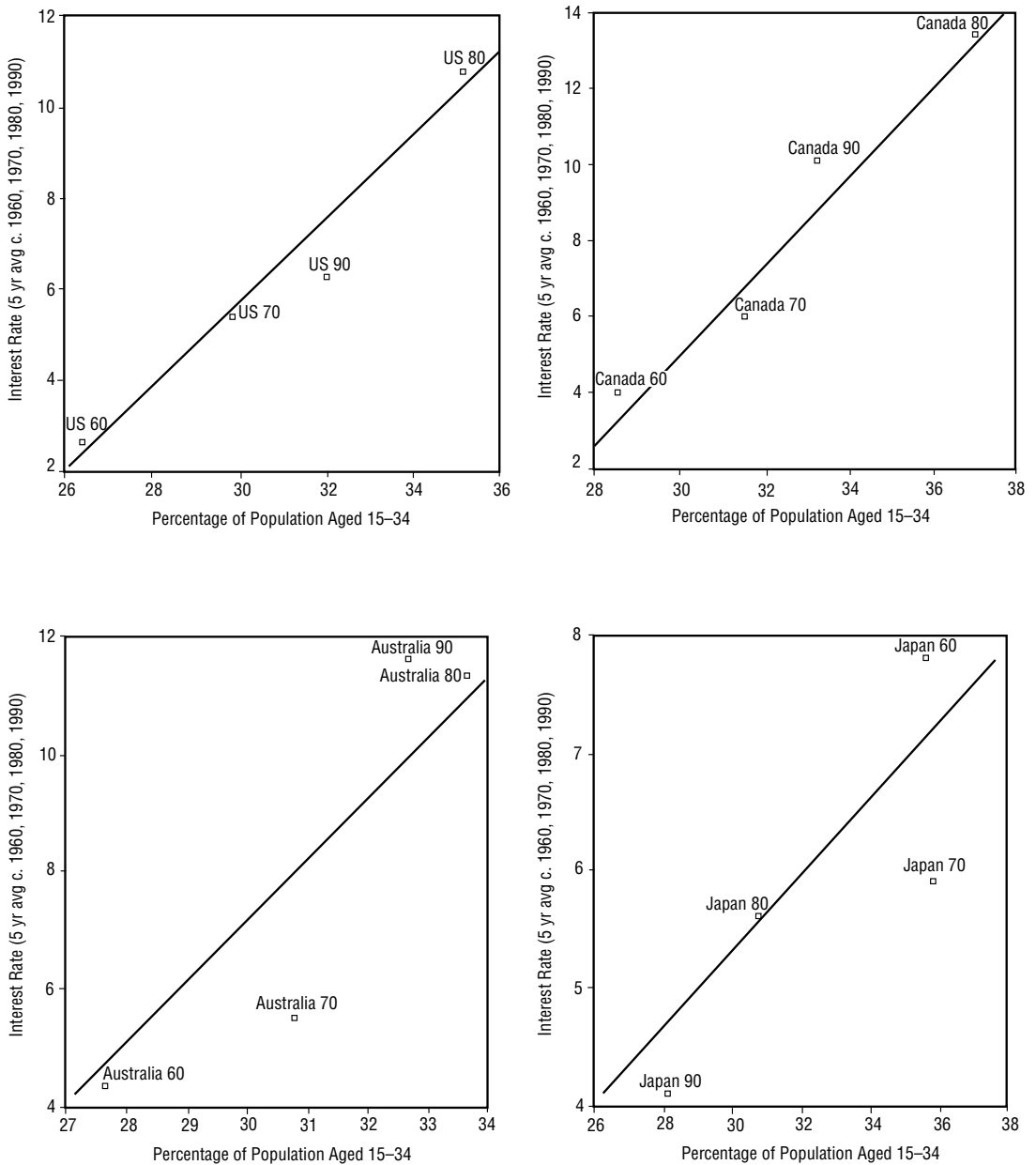
Canada can be expected to fall in line with those of the United States. Eventually, this will lead to an increase in the wage premium associated with additional years of schooling which, holding all else constant, will exacerbate the inequality of income.

Human Capital Spillovers and Age Structure

A final demographic channel has implications for personnel functions within firms. It was argued earlier that within-firm inequality can have negative consequences for productivity because it leads to a combination of social and productive friction at the workplace. A large ratio of younger to older workers within a firm can produce similar effects, although the channels are more speculative and will be discussed only in a very stylized fashion here.

In the absence of a job-security rule for older workers (such as the tenure system in academia) firms with performance-based payment and promotion systems will increasingly be faced with the

FIGURE 6
Preferred Lending Rates and Age Structure: United States, Canada, Australia and Japan



Source: Calculations based on United Nations, *World Population Prospects 1998*; and nominal interest rate data from the International Monetary Fund (IMF) Database.

problem of ensuring that competition among employees does not inhibit cooperation and the sharing of productive knowledge. Already we know that workers differ in their preference for performance-based systems of promotion. In Figure 7 the probability P of favouring meritocracy over seniority is displayed for different age categories of workers in Canada. Not surprisingly it shows that P declines as workers get older.

Since the key to most firm-level performance is striking the proper balance between cooperation and competition, having employees share ideas about how to work more efficiently is good. However, having employees drag down the productivity of colleagues in order to win promotional tournaments in environments where cooperation is essential, is not beneficial. Age dispersion within an organiza-

tion can, therefore, not only bifurcate the earnings distribution but it can also have negative consequences for cooperation in the presence of strong individual performance incentives. This is the case when older workers are either uninsured against job loss — perhaps arising when the passing on of valuable information to younger colleagues is seen as a threat — or if there is no stringent screening mechanism in place to weed out “hawkish” personality types from the more “dovish.”²¹

AGE STRUCTURE AND MODELS OF INEQUALITY AND GROWTH: A SUMMARY

What can we conclude from our summary of the inequality-growth relationship and its connection to demography? Our paper began by noting that age

FIGURE 7
The Probability of Favouring Meritocracy over Seniority as Function of Age



Source: Calculations based on Lipset and Meltz (1997). Probability estimates based on controls for income and education.

structure has a straightforward, though indirect, connection to economic growth in that inequality tends to be lower in older populations — defined here as countries where the proportion of people aged 40–59 is relatively high. We then focused on the more interesting connection between age structure and four modern transmission mechanisms linking inequality to growth. In each of the four cases we found that a demographic channel linked age structure to economic growth. These findings are summarized below:

- The opportunity cost of time plays a role in theories of social unrest and agency cost models in that the probability of being unemployed declines over a person's life cycle, thus lowering the opportunity cost of work alternatives. Two work alternatives — the propensity to shirk or to cause social unrest (see Figure 4) — have notable demographic determinants that decline as individuals get older. These behaviours increase monitoring costs and negatively affect growth, and though their attribution in the literature to income inequality we feel is correct, we argue that these channels should be expanded to include demographic antecedents and interaction effects as well.
- The mainstream fiscal policy/median voter approach fails to predict the low political participation amongst the poor and young, and the consequent low taxation and high inequality equilibrium that is observed in some countries. This empirical regularity, however, was captured in our amended fiscal policy model (see Figure 2) whereby the poor and the young may be unwilling to tax high income (older) segments of the population in order to finance their public-good requirements if they expect to move into higher marginal tax categories later in life (Benabou 1998). Alternatively, our own demographic explanation emphasized the low levels of political participation among the relatively poor and young (see Table 3), rather than their reduced desire for redistribution, as the cause of the failure of the median voter model to account for relatively less redistribution and lower growth in unequal societies.
- Credit-constraint models demonstrate how initial disparities in income and wealth are perpetuated over time and how they inhibit the realization of the productive potential of a society. What is missing from these models is a channel demonstrating why these inequalities form in the first place. One could argue that initial endowments in talent and skill are one cause. A more plausible channel from our perspective is the timing of secular growth cycles and the set of age-related initial conditions present at the start of the growth process. A relatively older working-age population lowers inequality and (all else being equal) creates a higher saver-to-borrower ratio that relaxes borrowing constraints (see Figures 6 and 7). By allowing individuals of equal ability — but who are poor or too young to borrow — to access capital, societies generate greater levels of investments in productive activities such as education, training, and/or entrepreneurship.
- Finally, we demonstrated how firm performance could be harmed by inequality, in that workplace heterogeneity (e.g., workers of low skill working alongside those with high skill) can lower productivity. This is because workers of equal ability and skill are not equally productive in all environments. Environments characterized by wide income disparities fare relatively poorly when compared to more egalitarian settings because of the social disruptions that occur when inequality is too high. This notion was extended to include bifurcated age distributions within firms, which under certain conditions can increase frictions between young and older workers. Increased wage *and* age dispersion within firms, in the presence of strong individual incentive-based pay systems, can potentially engender responses ranging from the relatively benign (information hoarding) to the pathological (co-worker sabotage).

CONCLUSION

This paper is concerned with the inverse relation between income inequality and economic growth. The approach used was straightforward. We began by describing four models linking inequality to slower growth. We then showed how demographic explanations complemented each of the mainstream accounts. We assumed that age structure had an obvious, though indirect effect on economic growth through its impact on income distribution. But independent of its effect on income distribution, our review of theory suggests that age structure has a direct impact on economic performance through its effect on credit constraints, the stock of human capital, and agency costs. Stylized evidence and illustrations demonstrated how national age structures heavily weighted with younger working-age cohorts could induce effects as diverse as lower political participation, greater social unrest, and higher borrowing costs.

These conclusions have both positive and normative implications. From a positive perspective, they help explain the divergent growth paths of many countries with otherwise similar initial economic and social conditions. From a normative point of view, rather than objecting to income inequality solely on the basis of equity criteria, the research stream surveyed in this paper suggests that considerable efficiency losses can be incurred if a country allows large disparities of income to persist for long periods of time. Appropriate government interventions, which are sensitive to these age-based mechanisms, can therefore achieve more equality and faster economic growth simultaneously.

NOTES

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¹One dissenting voice is Forbes (2000), who recently criticized these cross-country results using a new dataset. A more subtle result is provided by Barro (1999) who finds that the negative effect of inequality on growth is significant for poorer countries but vanishes above a certain GDP per capita threshold.

²Demographic age structure is a better exogenous (explanatory variable) than income distribution since it is primarily determined by fertility rates 20 to 65 years previously.

³The inverse relationship between mature populations and inequality is found in similar scatterplots for 1960, 1970, and 1990 and in regressions where we control for country-fixed effects, education, and levels of economic development.

⁴The percentage of the working-age population is the appropriate demographic variable when one is looking at the impacts of income distribution on economic growth, since income earnings peak at these ages. This is true regardless of whether one considers 40- to 59-year-olds as a percentage of the working-age population or the total population. Note, however, that this would not be the case if one were examining the demographic impact of the effect of wealth distribution on economic performance, since much of the wealth in any population is owned by the 60+ population.

⁵Even from an empirical perspective, the equity-efficiency trade-off was questioned much earlier. See Osberg (1984).

⁶Leightner's model is slightly different in that it does not treat inequality as we generally do, namely as the distribution of income among the population. Rather, he examines the inequality of factor shares between capital and labour.

⁷During the 1970s and 1980s, macroeconomists lost interest in issues of distribution. During a 1987 symposium devoted to the issue of the productivity and economic growth slowdown, not one paper mentioned income distribution as a possible determinant. Moreover, all the participants ignored one of the major events of this century, the baby boom. See Fischer (1988).

⁸There has been very little systematic work (theoretical or empirical) done on the determinants of political participation and voter turnout.

⁹There is, of course, a simultaneity problem in that the two variables (market income and age) march hand in hand, and so it is hard to disentangle the effects of each.

¹⁰Several countries stand out and do not follow the pattern mentioned above. Switzerland, in particular, has a very low voter turnout despite being one of the oldest countries in the OECD. This apparent anomaly can be explained by the fact that these are data for national elections and in Switzerland the national government has much less power than in other countries such as the UK. Other particularly notable outliers such as the US and Japan can be explained by other country-specific effects such as lack of automatic voter registration in the US and a postwar electoral system that gives the incumbent Japanese political party huge advantages.

¹¹It is important to note that Canada's baby boom was the largest in the western world. In fact, only three other western countries — the United States, Australia, and New Zealand — had large booms after the war (Foot and Stoffman 2000).

¹²Criminologists have long seen this connection as well. In the sociological literature, it is termed "relative deprivation theory." In an early study, Blau and Blau (1982) discovered that in the US, income inequality in a standard metropolitan area (SMA) substantially raised its rate of criminal violence.

¹³Note that this same logic can be applied to the opportunity cost of shirking at the firm level, which rises with the wage (which itself is correlated positively to age). Generalizing, we can say that the opportunity cost of shirking rises with age.

¹⁴Of course, it also led to several responses on the part of authorities; major federal public outlays for crime control and substantial investments in inner-city redevelopment have produced what some have called an "urban renaissance" in the US.

¹⁵For details, see Furman and Stiglitz (1998).

¹⁶Within lower income economics that are dominated by agricultural activity, output per acre is 16 percent higher on owner-occupied land than on sharecropped land.

Sharecropping contracts are widespread and "solve" the problem of costly monitoring by ensuring the tenant has an incentive to work. However, by imposing in effect a marginal tax rate (of between 30–90 percent in some cases) these contracts lead to an under-supply of effort and under-investment in the land. If there was a more equal distribution of assets (land and wealth) the result could be an improvement in agricultural productivity (Furman and Stiglitz 1998).

¹⁷Using an economy-wide index of supervisory intensity, R. Gordon (1996) found that the ratio of administrative and managerial workers over the sum of clerical, service, and production workers in his sample of 12 economies was negatively related to average wage levels: in other words remuneration and supervisory intensity are traded off. For more on the Canadian pattern between supervisory burdens and wages, see Gomez and Wald (2001).

¹⁸The inverse relationship between monitoring and age of worker remains after controlling for wage levels and a host of demographic and firm-level controls (Gomez and Wald 2001).

¹⁹Evidence of these positive social interaction effects abounds. One of the most interesting studies (from a Canadian perspective) by Idson and Kahane (2000), examines the effects on individual hockey players of playing on teams with low variance in average talent versus ones with higher variance. The results confirm that "team mates" matter however able individuals are. Wayne Gretzky may have been the best hockey player in the world, but he was better when he played with Mark Messier and Paul Coffey in Edmonton than when he played with Chris Kontos and Dale Degray in Los Angeles.

²⁰Interestingly, if one compares interest rate policies in Canada and the United States in the early 1990s one finds that despite facing near identical demographic pressures, Canada's interest rate was on average 4.5 percentage points higher from 1988 to 1992. This also coincided with the John Crow era in Canada and the early Greenspan era in the US. A tentative conclusion is that Canada could have managed with lower interest rates, as in the US. For more on this debate see Fortin (1999, 2000).

²¹The intuition here is more rigorously formalized in Lazear (1998).

REFERENCES

- Aghion, P., E. Caroli and C. García-Peñalosa. 1999. "Inequality and Economic Growth: The Perspective of the New Growth Theories," *Journal of Economic Literature* 37(4):1615-60.
- Alesina, A. and D. Rodrik. 1992. "Distribution, Political Conflict, and Economic Growth," in *Political Economy, Growth, and Business Cycles*, ed. A. Cukierman. Cambridge, MA: MIT Press, pp. 23-49.
- _____. 1994. "Distribution Politics and Economic Growth," *Quarterly Journal of Economics* 109:456-90.
- Alesina, A. and R. Perotti. 1993. "Income Distribution, Political Instability, and Investment," NBER Working Paper No. 4486. Cambridge, MA: National Bureau of Economic Research.
- _____. 1996. "Income Distribution, Political Instability, and Investment," *European Economic Review* 40(6):1203-28.
- Barlow, R. 1994. "Population Growth and Economic Growth: Some More Correlations," *Population and Development Review* 20(3):503-29.
- Barro, R. 1991. "Economic Growth in a Cross Section of Countries," *Quarterly Journal of Economics* 106:407-43.
- _____. 1999. "Inequality, Growth and Investment," NBER Working Paper No. 7038. Cambridge, MA: National Bureau of Economic Research.
- Benabou, R. 1994. "Human Capital, Inequality and Growth: A Local Perspective," *European Economic Review* 38(4):817-27.
- _____. 1996. "Unequal Societies," NBER Working Paper No. 5583. Cambridge, MA: National Bureau of Economic Research.
- _____. 1998. "Social Mobility and the demand for Redistribution: The POUM Hypothesis," NBER Working Paper No. 6795. Cambridge, MA: National Bureau of Economic Research.
- _____. 2000. "Unequal Societies: Income Distribution and the Social Contract," *American Economic Review* 90(1):96-129.
- Blau, J. and P. Blau. 1982. "The Cost of Inequality: Metropolitan Structure and Violent Crime," *American Sociological Review* 47 (February):114-29.
- Bruno, M. and W. Easterly. 1998. "Inflation Crises and Long-Run Growth," *Journal of Monetary Economics* 41(1):3-26.
- Deininger, K and L. Squire. 1996. "A New Data Set Measuring Income Inequality," *World Bank Economic Review* 10(3):565-91.
- DiPasquale, D. and E. Glaeser. 1999. "Incentives and Social Capital: Are Homeowners Better Citizens?" *Journal of Urban Economics* 45:354-84.
- Durlauf, S. 1994. "Spillovers, Stratification and Inequality," *European Economic Review* 38(4):836-46.
- Easterlin, R. 1987. *Birth and Fortune*. Chicago: University of Chicago Press.
- _____. 1968. *Population, Labour Force, and Long Swings in Economic Growth*. New York: National Bureau of Economic Research.
- Fair, R.C. and K.M. Dominguez. 1991. "Effects of Changing U.S. Age distribution on Macroeconomic Equations," *American Economic Review* 81 (5):1276-94.
- Ferreira, F. 1995. "Roads to Equality: Wealth Distribution Dynamics with Public-Private Capital Complementarity," LSE-STICERD Discussion Paper No. TE/95/286. London: London School of Economics.
- _____. 1999. "Inequality and Economic Performance: A Brief Overview to Theories of Growth and Distribution." At <www.worldbank.org/poverty/inequal/index.htm>.
- Fischer, S. 1988. "Symposium on the Slowdown in Productivity Growth," *Journal of Economic Perspectives* 2(4):3-7.
- Foot, D.K. and D. Stoffman. 2000. *Boom, Bust & Echo: Profiting from the Demographic Shift in the 21st Century*. Toronto: Stoddart Publishing.
- Forbes, K. J. 2000. "A Reassessment of the Relationship Between Inequality and Growth," *American Economic Review* 90 (4):869-87.
- Fortin, P. 1999. "The Great Canadian Slump, a Rejoinder to Freedman and Macklem," *Canadian Journal of Economics* 32 (4):1082-92.
- _____. 2000. "Macroeconomic Unemployment and Structural Unemployment," *Canadian Public Policy/Analyse de Politiques* 26(1):S126-S130.
- Furman, J. and J.E. Stiglitz. 1998. "Economic Crises: Evidence and Insights from East Asia," *Brookings Papers on Economic Activity* (2):1-114.
- Galor, O. and J. Zeira. 1993. "Income Distribution and Macroeconomics," *Review of Economic Studies* 60:35-52.
- Gomez, R. and S. Wald. 2001. "Is There an Inverse Relationship between Supervision and Wages? Evidence from the Canadian General Social Survey," Working Paper. Toronto: University of Toronto.

- Gomez, R. and N. Meltz. 2001. "The Zero Sum Illusion: Industrial Relations and Modern Economic Approaches to Growth and Income Distribution." Paper presented at the IRPP-CSLS Conference, Ottawa, January.
- Gordon, D. 1996. *Fat and Mean: The Corporate Squeeze of Working Americans and the Myth of Managerial Downsizing*. New York: Free Press.
- Gordon, R. 1996. "Problems in the Measurement and Performance of Service Sector Productivity in the US," NBER Working Paper No. 5519. Cambridge, MA: National Bureau of Economic Research.
- Greenwald, B.C. and J.E. Stiglitz. 1986a. "Imperfect Information, Credit Markets and Unemployment," NBER Working Paper No. 2093. Cambridge, MA: National Bureau of Economic Research.
- _____. 1986b. "Externalities in Economies with Imperfect Information and Incomplete Markets," *Quarterly Journal of Economics* 101(2):229-64.
- Grogger, J. 1998. "Market Wages and Youth Crime," *Journal of Labor Economics* 16(4):756-91.
- Gupta, G. 1984. "Income Distribution," *Southern Economic Journal* 51:459-68.
- Harrod, R. 1939. "An Essay in Dynamic Theory," *Economic Journal* 49:14-33
- Higgins, M. and J.G. Williamson. 1999. "Explaining Inequality the World Round." Cambridge, MA: Harvard University. Unpublished paper.
- Idson, T.L. and L.H. Kahane. 2000. "Team Effects on Compensation: An Application to Salary Determination in the National Hockey League," *Economic Inquiry* 38(2):345-57.
- Institute for Democracy and Economic Assistance (IDEA). 2001. Website at <www.idea.int>.
- Jappelli, T. 1990. "Who is Credit Constrained in the U.S. Economy?" *Quarterly Journal of Economics* 105 (1):219-34.
- Kaldor, N. 1956. "Alternative Theories of Distribution," *Review of Economic Studies* 23(2):94-100.
- Katz, L.F. and K.M. Murphy. 1992. "Changes in Relative Wages, 1963-1987: Supply and Demand Factors," *Quarterly Journal of Economics* 107(1):35-78.
- Kawachi, I., B.P. Kennedy, K. Lochner and S.D. Prothrow. 1997. "Social Capital, Income Inequality and Mortality," *American Journal of Public Health* 87:1491-98.
- Kenney, M. and R. Florida. 1988. "Beyond Mass Production: Production and the Labour Process in Japan," *Politics and Society* 16(1):121-58.
- Kennedy, B., I. Kawachi, S.D. Prothrow, K. Lochner and V. Gupta. 1998. "Social Capital, Income Inequality, and Firearm Violent Crime," *Social Science and Medicine* 47(1):7-17.
- Keynes, J. M. 1936. *The General Theory of Employment, Interest and Money*. London: Macmillan Press.
- _____. 1937. "Economic Consequences of Declining Population Growth," *Eugenics Review* 29 (April):13-17.
- Klein, L. 1947. "Theories of Effective Demand and Employment," *Journal of Political Economy* 55:138-77.
- Kuznets, S. 1955. "Economic Growth and Income Inequality," *American Economic Review* 34(1):1-28.
- Lazear, E.P. 1998. *Personnel Economics for Managers*. New York: Wiley.
- Leightner, J. 1992. "The Compatibility of Growth and Increased Inequality," *The Journal of Development Studies* 29:49-71.
- Lipset, S.M. and N.M. Meltz. 1996. "Comparative Study of Attitudes Towards Work and Labour Unions in the United States and Canada: Survey Results." Unpublished paper.
- _____. 1997. "Canadian and American Attitudes Toward Work and Institutions," *Perspectives on Work, The IRRA's 50th Anniversary Magazine*, 1(3):14-19.
- Lloyd-Ellis, H. 2003. "On the Impact of Inequality on Productivity Growth in the Short and Long Term: A Synthesis," *Canadian Public Policy/Analyse de Politiques* 29(January):S65-S86.
- Lucas, R. 1993. "On the Mechanics of Economic Development," *Journal of Monetary Economics* 22 (1):3-42.
- Macunovich, D.J. 1998. "Relative Cohort Size and Inequality in the United States," *American Economic Review* 88(2):259-64.
- Malberg, B. 1994. "Age Structure Effects of Economic Growth," *Scandinavian Economic History Review* 42(3):279-95.
- Mankiw, G. 1995. "The Growth of Nations," *Brookings Papers on Economic Activity* 1:275-323.
- Osberg, L. 1984. *Economic Inequality in the U.S.* New York: M.E. Sharpe.
- Perotti, R. 1994. "Income Distribution and Investment," *European Economic Review* 38:827-35.
- Persson, T. and G. Tabellini. 1992. "Growth, Distribution, and Politics," in *Political Economy, Growth, and Business Cycles*, ed. A. Cukierman. Cambridge, MA: MIT Press, pp. 3-22.
- _____. 1994. "Is Inequality Harmful for Growth?" *American Economic Review* 84:600-22.

- Rodriguez, F. 1998. "Inequality, Redistribution and Rent-Seeking." PhD Dissertation, Harvard University.
- Rodrik, D. 1998. "Where Did All the Growth Go? External Shocks, Social Conflict, and Growth Collapses," NBER Working Paper No. 6350. Cambridge, MA: National Bureau of Economic Research.
- Rosenston, S. and J. Hansen. 1993. *Mobilisation, Participation and Democracy in America*. New York: Macmillan.
- Solow, R. 1956. "A Contribution to the Theory of Economic Growth," *Quarterly Journal of Economics* 70(1):65-94.
- South, S.J. and K.D. Crowder. 1997. "Residential Mobility between Cities and Suburbs: Race, Suburbanization, and Back-to the-City Moves," *Demography* 34:525-38.
- Stack, S. 1984. "Income Inequality and Property Crime," *Criminology* 22(2):229-57.
- Temple, J. 1999. "The New Growth Evidence," *Journal of Economic Literature* 37:112-56.
- Tilak, G. 1991. "Comparative Development Indicators," in *Essays on Poverty, Equity and Growth*, ed. T. Psacharopoulos. New York: World Bank and Pergamon Press, pp. 360-79.

