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# Economic Policy Implications of World Demographic Change

*By Richard Johnson*

Demographic changes over the next 50 years will affect the world economy in many ways. Some of these effects will be beneficial. In developing countries, for example, falling birthrates will enable women to supply more paid labor and families to invest more in the education of each child. Other demographic changes will cause economic problems. In developed countries, population aging is likely to imply government pension systems cannot continue with their current rules. Population growth in developing countries could also change patterns of world trade and thereby reduce the wages of some workers in developed countries.

Economists have argued that policy changes are needed to maximize the rewards of some demographic changes and reduce the negative impacts of others. For example, governments of developing countries may need to create more flexible labor markets if their increased female workforce is to find employment. The governments of many developed countries need to plan how much they will support the high number of retirees expected in the future and communicate this plan to workers.

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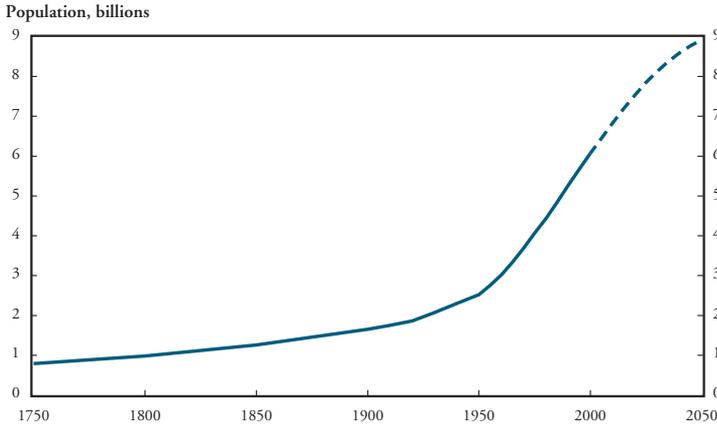
This article describes aspects of predicted world demographic changes that are likely to pose challenges for economic policy and explores how policy could react to these changes. The first section summarizes a forecast of world demographic changes up to 2050. The second section discusses the economic effects of demographic changes in developing countries, and the third section considers such effects in developed countries. The fourth section examines the effects of demographic changes on world trade and capital flows. The article concludes that the economic effects of such changes will depend heavily on future government policy. In particular, the effect of population growth in developing countries will depend on whether their governments' policies encourage economic growth. Government policy in developed countries will affect the size and distribution of problems created by population aging but will not be able to remove these problems altogether.

## **I. SUMMARY OF THE UNITED NATIONS' 2002 WORLD POPULATION FORECAST**

The most widely used population forecasts are those produced by the United Nations. This section summarizes the latest U.N. forecast for world population change to 2050. It concentrates on two aspects of this forecast, the rate of population growth and the dependency ratio, the ratio of people of non-working age to those of working age. These aspects of demographic change are likely to have important economic effects. In general, the forecasts for developing countries follow one pattern, while those for developed countries follow another. An appendix to this article considers the reliability of long-term population forecasts.

### *Population growth*

The United Nations expects world population to grow rapidly between 2000 and 2050. Over this period it predicts the world's population will grow from 6.1 to 8.9 billion, or by 47 percent (Chart 1). While the forecast is for rapid population growth, growth would in fact be slower than that observed between 1950 and 2000. Slower growth reflects

*Chart 1***WORLD POPULATION, ESTIMATES FOR 1750 TO 2000  
AND FORECAST TO 2050**

Source: United Nations (1999, 2003a)

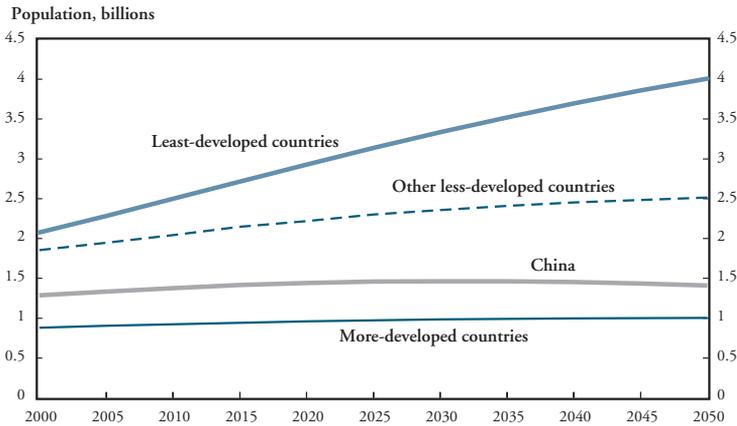
a decrease in the fertility rate—the number of births per woman’s lifetime. Due to continued declines in world fertility rates, the U.N. expects the world’s population to start decreasing steadily later this century.

Chart 2 shows the U.N.’s population forecast by countries’ level of economic development. This article defines a country’s level of economic development by its GDP per capita in 2000, a different definition than that used by the U.N.<sup>1</sup> The developed countries are defined as those with per capita GDP above \$10,000 per year. The less developed countries are those with per capita GDP between \$500 and \$10,000 per year, while the least developed countries are those with per capita GDP below \$500 per year.

The U.N. predicts, in general, that the more economically developed a country is today, the slower its population will grow. The population of the developed countries, for example, is expected to rise fairly little between 2000 and 2050, from 0.9 to 1 billion. This slow rise reflects the fact that more developed countries have lower fertility rates. The difference in fertility rates has a greater effect on population growth than higher life expectancies in more developed countries.

Chart 2

## WORLD POPULATION, FORECAST FOR 2000-2050, BY LEVEL OF DEVELOPMENT IN 2000



Source: United Nations (2003a)

Countries with lower per capita GDP, in contrast, are expected to grow fairly rapidly. Excluding China, the population of the less developed countries is expected to rise from 1.9 to 2.5 billion. The population of the least developed countries, including India and much of Africa, is expected to grow very rapidly between 2000 and 2050, from 2.1 to 4 billion. Rapid population growth is predicted in Africa, despite the effects of HIV/AIDS (see box on next page).

There are some exceptions to the generalization that the U.N. expects slower population growth in more developed countries. For example, the U.N. expects the U.S. population to grow strongly, from 285 million in 2000 to 409 million in 2050, largely due to immigration. The U.N. also predicts rapid population growth in most predominantly Muslim countries, including the richer OPEC members.

In contrast, the U.N. expects slow population growth in China and population declines in many of the former Soviet states, including Russia. While China is a less developed country, the U.N. expects its population to grow only marginally from 2000 to 2050, from 1.3 to 1.4 billion. Thus, China's population forecast is similar to that for

## THE EFFECT OF HIV/AIDS ON AFRICA'S POPULATION AND ECONOMY

A cursory reading of newspapers might suggest that HIV/AIDS will reduce Africa's population. In fact, the U.N. only expects population to decline in some countries in southern Africa, where the disease is most prevalent. Some countries further north, such as Uganda, have had considerable success in reducing rates of HIV infection. Due to this success, and high fertility rates throughout Africa, the continent is forecast to experience very rapid population growth. The U.N. predicts Africa's population will grow by 127 percent, or over 1 billion, between 2000 and 2050.

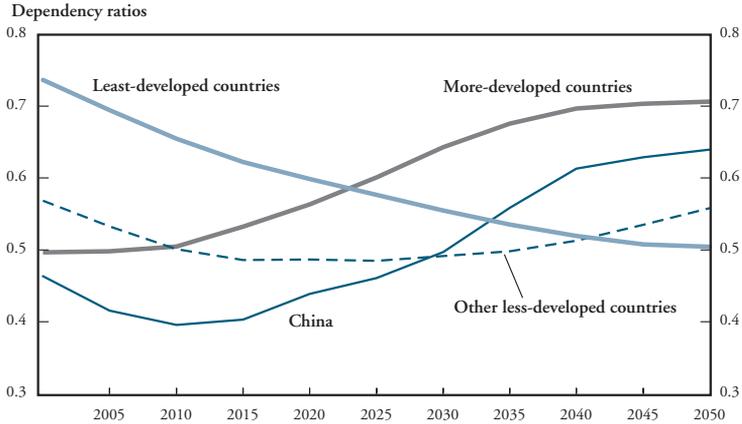
Trends in total population, however, reflect only part of the impact of HIV/AIDS. In some countries in southern Africa where population is expected to rise, life expectancies at birth are expected to fall below 35 years between 2000 and 2010. The number of orphans is growing in these worst-affected countries, where currently around 10 percent of children below 15 years of age have lost at least one of their parents (Grassley and Timaeus).

High rates of HIV/AIDS infection are likely to reduce GDP through several channels. Higher mortality will lead to slower labor-force growth, reduced average levels of worker experience, and lower educational attainment, since orphanhood raises the probability that children will drop out of school. Studies of countries with high infection rates typically estimate the disease will reduce annual rates of GDP growth by one to two percentage points (U.N. 2003b). Surprisingly, some studies also find that HIV/AIDS will slightly raise rates of per capita GDP growth, since reduced labor-force growth will mean each surviving worker has more capital to work with and is thus more productive. By contrast, other studies find that the disease will reduce growth of per capita GDP.

In summary, HIV/AIDS is likely to restrain growth in Africa's population and reduce growth of its GDP. The overall demographic forecast for the continent, however, is for rapid population growth.

developed countries. The former Soviet states' low per capita GDP implies that they, like China, are less developed countries. Despite these exceptions, overall, predicted rates of population growth are negatively correlated with countries' current levels of development.

Chart 3

DEPENDENCY RATIOS OF WORLD REGIONS,  
FORECAST 2000-2050

Note: Dependency ratio = (population under 15 + population over 64)/population 15 to 64.

Source: United Nations (2003a)

*Dependency ratios*

The forecasts of dependency ratios to 2050 also differ greatly according to each country's level of development. The dependency ratio is commonly defined as the ratio of people under age 15 and over age 64 to those age 15-64. A higher dependency ratio could increase the burden that children and retirees place on people of working age, both through tax-financed transfers and within-family care. Dependency ratios are expected to fall in the least developed countries, remain stable in the less developed countries, rise in China, and rise sharply in the developed countries (Chart 3).

Both the rise in dependency ratios in the more developed countries and the fall in dependency ratios in the least developed countries reflect falling fertility rates and rising life expectancies. The same phenomena affect the dependency ratio differently in these two groups of countries because they have been occurring for different lengths of time. For example, an increase in a country's life expectancy from 50 to 55 increases its supply of workers and reduces its dependency ratio, but an increase from 70 to 75 increases its number of dependents and its dependency

ratio. Similarly, a fall in fertility rates initially reduces the number of children and thus dependents. After a longer period, however, a fall in fertility rates also reduces the number of workers. Thus, trends in fertility and life expectancy imply that eventually all countries will experience the rising dependency ratios that the more developed countries currently face.

Overall, despite some exceptions, the U.N.'s population forecasts imply rapid population growth and falling dependency ratios in the developing countries and slow population growth and rising dependency ratios in the developed countries. Because these forecasts differ, the next two sections focus on the economic effects of demographic change in developing countries and developed countries, respectively.

## II. DEMOGRAPHIC CHANGE IN DEVELOPING COUNTRIES

Over time, economists have moved away from the theory that population growth is economically harmful. History shows that population and living standards usually grow at the same time. A puzzle for theory, however, is why many developing countries' economies have grown slowly in the recent past. Many economists believe that government institutions and policies are responsible for some countries' slow growth, and thus that institutional reforms would increase economic growth in these countries. At the same time, economists believe a declining share of children in the population can bring several economic benefits, but only to countries with appropriate economic policies. Thus, the economic effects of demographic change in developing countries appear highly contingent on these countries' future institutions and policies.

### *Population growth in economic theory*

The theory that population growth reduces living standards was most famously proposed by Thomas Malthus in 1798. He argued that growth in output per person was largely impossible, because humans reproduced faster than they could increase economic output. For this reason, he was an early advocate of birth control. Most developing

countries have policies to lower their rates of population growth (U.N. 2001), which suggests their governments have some sympathy for the idea that rapid population growth is harmful.

Today, economists generally believe Malthus' model has little relevance to modern economies, however, because it contains no role for capital or technology in allowing output to grow. Instead, most economists now believe population growth has a neutral or positive effect on living standards. This view is based primarily on the neoclassical growth model, which recognizes that capital and technology are also important in the production process. In this model, the same level of output per worker can be sustained for a labor supply of any size, so long as investment is sufficient to keep the ratio of capital to workers constant.<sup>2</sup> In addition, advances in technology will increase output per person.

Whether Malthus' view or the neoclassical model is correct is an empirical question. Since the Industrial Revolution, in roughly 1800, both populations and living standards have increased rapidly in the United States and Europe. Living standards have also grown rapidly in parts of East Asia over the last 50 years. These experiences support the neoclassical model, with the level of technology increasing rapidly over time. Thus, most economists think that the neoclassical model is roughly correct and that population growth need not prevent living standards from growing rapidly.

Malthus' prediction that living standards will not improve over time does, however, describe the recent experience in some countries. For example, real per capita GDP has fallen fairly steadily in many African countries since 1974 (Artadi and Sali-i-Martin). The same is true in many OPEC countries since 1980.<sup>3</sup> Many of these countries also expect rapid population growth to 2050.

Economists disagree as to whether weak economic performance in Africa and some other countries suggests Malthus' view is roughly correct in these countries. Sachs (2001) argues that unfavorable geography makes slow economic growth the natural condition of many poor countries. For example, landlocked countries face high costs of engaging in international trade, and malaria may deter investment in some equatorial countries. In contrast, Rodrik, Subramainiam, and Trebbi argue that weak market institutions and poor governance largely explain why

some countries' economic growth has been slow. It is difficult to establish statistically which of the "geographic" and "institutional" theories best explains slow growth in poor countries. However, Sachs (2001) agrees that institutions have some effect on rates of economic growth.

### *Economic effects of population growth*

Population growth tends to be concentrated in poor countries, and its economic effects will depend on the relative importance of geography and institutions. Under the geographic theory, population growth is likely to reduce average living standards in poor countries unless they receive large transfers from developed countries. However, this view appears to be a minority view among economists and policymakers. The heavy emphases on institutional performance in the World Bank's 2003 Development Report and in the Bush administration's Millennium Challenge Account—a new foreign aid program—suggest the majority view is that countries' economic performance will depend more on the quality of their markets and governments.

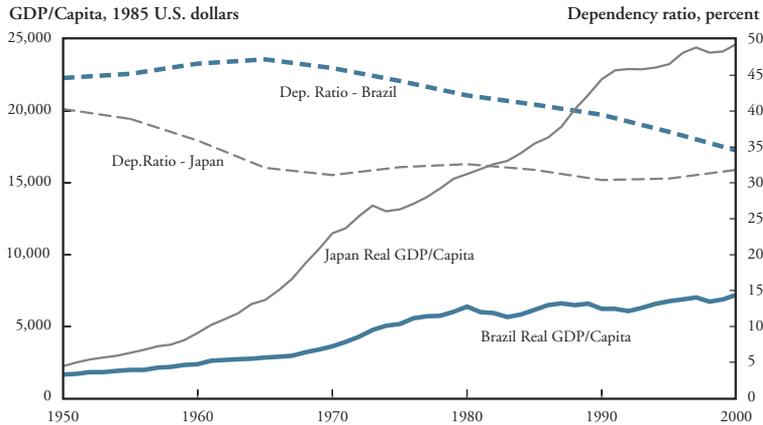
The dependence of a country's economic performance on the quality of its institutions has both positive and negative implications. A positive implication would be that some countries could improve their economic performance with little outside aid, much as China has done since turning toward markets and trade in 1979. A negative implication would be that little economic growth can be expected in countries where political instability is endemic. Population growth in these countries could thus prevent living standards from growing and lead many citizens to attempt to migrate to richer countries. The U.N. expects the populations of some of the least politically stable countries, such as the Democratic Republic of Congo, Liberia, and Somalia, to more than double between 2000 and 2050. Therefore, increasing the quality of governance in these countries will become an increasingly important, if difficult, task.

### *Economic effects of declining dependency ratios*

A declining share of children in the population, and thus a declining dependency ratio, may temporarily increase rates of economic growth in many developing countries. Thus, the effect of the decline in

## Chart 4

## DEPENDENCY RATIOS AND GDP PER CAPITA, BRAZIL AND JAPAN, 1950-2000



Source: United Nations (2003a), Center for International Comparisons

dependency ratios as birthrates fall is often called the “demographic dividend.” Falling birthrates would allow women to spend less time caring for children and thus to spend more time in the paid labor force. A movement of women into the labor force would temporarily increase rates of growth in the labor force and thus in measured economic output. Economies could also benefit in less direct ways from a lower share of children in the population. For example, smaller family sizes would allow parents to invest more in the education of each of their children. Bloom and Williamson attribute a third of East Asia’s growth in income per capita from 1965 to 1990 to the demographic dividend.

The impetus to economic growth from declining dependency ratios, however, appears also to depend on government policy. Many Latin American countries experienced declining dependency ratios during the past 40 years without enjoying the rapid economic growth of East Asian countries. For example, between 1950 and 2000, the dependency ratios of Japan and Brazil both fell by about 10 percentage points. Yet growth in per capita GDP was much faster in Japan, where it averaged 5.4 percent per year, than in Brazil, where it averaged 2.9

percent (Chart 4). Bloom, Canning, and Sevilla argue that recurrent financial crises and high trade tariffs reduced the size of Latin America's demographic dividend from its falling dependency ratios.

### *Policy responses to demographic change in developing countries*

The appropriate policy response to population growth in poor countries will depend on why many of these countries' economies have grown slowly in the past. If unfavorable geography is the primary cause of slow growth, improving living standards in many poor countries may require large subsidies from developed countries and investments in technologies to overcome, say, tropical diseases (Sachs 2003). Policies to reduce population growth in poor countries might also be consistent with a pessimistic view of their potential for economic growth. While the World Bank does not advocate restricting population growth as a policy goal, it does advocate greater access of women to education, which often is associated with reduced population growth.

In contrast, if poor institutional performance is responsible for many developing countries' poor economic growth, institutional reform might allow populations and living standards to grow at the same time. For example, the IMF (2003b) stresses that reducing government corruption, enforcing private property rights, and limiting the power of political leaders would increase rates of economic growth in many developing countries. Developing countries may also need to increase the flexibility of their labor markets if a large increase in the number of female workers is to lead to greater employment overall.

If institutions and policies are crucial to economic prospects in poor countries, policymakers in developed countries may wish to encourage some poor countries to change their policies. Such encouragement could take the form of making aid conditional on good governance and economic freedom. For example, the Bush administration has proposed that its new Millennium Challenge Account would only give aid to countries scoring highly on World Bank indexes of governance quality (Kaufman, Kraay, and Mastruzzi). Such conditions may, however, suffer from a lack of credibility. Governments of very poor countries may doubt that developed countries will

*Table 1*  
**POPULATION INCREASE IN THE G-8 COUNTRIES,  
 U.N. FORECAST 2000-2050**

	<i>Population (millions)</i>		<i>Percent change</i>
	<b>2000</b>	<b>2050</b>	
U.S.	285	408.7	43.4
Canada	30.8	39.1	27
UK	58.7	66.2	12.7
France	59.3	64.2	8.3
Germany	82.3	79.1	-3.8
Japan	127	109.7	-13.6
Italy	57.5	44.9	-22
Russia	145.6	101.5	-30.3

Source: United Nations (2003a)

carry out their threats of withholding aid. Such a lack of credibility would reduce incentives for governments in poor countries to perform better.

### **III. DEMOGRAPHIC CHANGE IN DEVELOPED COUNTRIES**

Compared with developing countries, developed countries face a very different set of demographic changes and resultant economic pressures. All developed countries expect their dependency ratios to increase over the next 50 years. Some also expect their populations to decline. Rising dependency ratios are likely to make government pension and health insurance systems insolvent unless public policies change. Some economists have also suggested that rising dependency ratios might cause stock prices to fall. A variety of solutions to the problems of government pension and health insurance systems have been proposed. All solutions are likely to reduce the income of some generations of workers. The issue of declining stock prices has received less attention, in part because this prediction has been strongly contested.

*Table 2*DEPENDENCY RATIOS IN THE G-8 COUNTRIES, 2000  
AND FORECAST FOR 2050, PERCENT

	2000	2050	Increase
U.S.	51.7	61	9.3
Canada	46.2	69.8	23.6
UK	53.6	65	11.4
France	53.4	73.3	19.9
Germany	46.8	75.7	28.9
Japan	46.6	98.4	51.8
Italy	47.9	90.1	42.2
Russia	43.9	70.9	27.1

Note: The dependency ratio is defined as the population under age 15 plus the population over age 64 divided by the population age 15-64.

Source: United Nations (2003a)

*Demographic change in the G-8 countries*

Overall, the population of the more developed countries is expected to increase slightly between 2000 and 2050, but expected growth rates vary widely across countries. For example, Table 1 shows the U.N.'s population forecast for the G-8 countries, which are the seven largest developed economies, plus Russia. (Although Russia was a less developed country in 2000, it is included in Table 1 since its size and political importance may make its demographic forecast of interest.) The predicted changes in population range from a 43 percent increase in the United States to a 30 percent decrease in Russia. Germany, Italy, and Japan are also expected to lose population by 2050, though more slowly than Russia. These population declines reflect low birth rates, which also tend to increase dependency ratios.

The U.N. expects dependency ratios to increase by 2050 in developed countries overall. Rich countries have rising dependency ratios both because their birthrates have fallen and because their life expectancies have risen over time. Table 2 shows the expected increase in dependency ratios in each of the G-8 countries. The expected increases range from a fairly modest nine percentage points in the United States to

Table 3

### RATES OF NET IMMIGRATION TO G-8 COUNTRIES, FORECAST FOR 2000-2005

	Net immigrants, thousands	Net immigrants per thousand inhabitants
U.S.	1,200	4.1
Canada	155	4.9
UK	143	2.4
France	75	1.3
Germany	211	2.6
Japan	54	.4
Italy	64	1.1
Russia	50	.3

Note: The dependency ratio is defined as the population under age 15 plus the population over age 64 divided by the population age 15-64.

Source: United Nations (2003a)

a massive 52 percentage points in Japan. A comparison of Tables 1 and 2 shows that countries with slower population growth, such as Japan, Italy, and Germany, tend to have larger increases in their dependency ratios.

While net immigration to developed countries could restrain the rises in their dependency ratios, the U.N.'s forecast already assumes some migration to these countries. Table 3 shows the U.N.'s forecast of immigration rates to the G-8 countries in 2000-05. The U.N. expects immigration rates to stay close to these figures through 2050. Canada and the United States have the highest immigration rates relative to their populations. Japan and Russia, however, allow very little immigration, which contributes to their sharply rising dependency ratios and declining populations.

#### *Economic effects of demographic change*

The forecast decline in population in some developed countries may have both economic benefits and disadvantages. Benefits might include lower levels of crowding and congestion. The disadvantages might include higher costs per person of servicing the public debt and of providing public goods, such as national defense. The largest disad-

vantage of population decline, however, is likely to be its tendency to raise dependency ratios and thus cause funding problems for government pension and health insurance systems.

Rising dependency ratios create problems for many government pension systems because these systems are unfunded, meaning they hold few assets and thus must pay benefits directly from incoming taxes. An increasing dependency ratio both reduces incoming revenues and increases the number of pensions to be paid from those revenues. Unless higher tax rates, rapid wage growth, or a high rate of immigration increase revenues, the system will lack the funds to pay the pensions it has promised.

Government health insurance systems are likely to face similar funding problems, since they also typically pay benefits directly from taxes on workers. Population aging will reduce the growth rate of the labor force and thus of tax revenues. It is also likely to greatly increase demands for government spending on healthcare, since older people consume a relatively large share of medical care. For these reasons, in the long run the U.S. Medicare program is expected to represent a greater share of U.S. GDP and to face greater funding problems than Social Security (Social Security and Medicare Boards of Trustees).

Some economists are also concerned that the retirement of the baby-boom generation could cause a “stock price meltdown.” Theoretical models suggest that, because workers wish to hold many assets as they approach retirement, but fewer after they retire, the retirement of the baby-boom generation could decrease the demand for assets and thus cause asset prices to fall (Abel). However, empirical studies find little effect of demographic changes on asset prices; a host of other shocks appear to be more important (Poterba). Thus, there is no consensus within the economics profession that any such stock-price meltdown will occur.

In addition, some past predictions of asset-price changes based on demographic trends have proven highly inaccurate. For example, in 1989 Mankiw and Weil predicted that demographic change would reduce real house prices in the United States for the next 20 years. This prediction was based on the projected decline in the number of people age 20 to 30, who typically have high demand for housing. The strong rise in housing prices since 1989 suggests that, while demographics may affect house prices, other variables, such as the level of private wealth

and the rate of economic growth, are more important. The inaccuracy of this prediction suggests that forecasts of demographic effects on stock prices may also be unreliable.

### *Policy responses to increasing dependency ratios*

Developed countries might make several policy changes in response to rising dependency ratios. These changes could include liberalizing immigration laws, encouraging higher birth rates, raising taxes on workers, and reducing pension and health benefits. The funding problems of government pension and health insurance systems, however, are expected to be severe. For example, Auerbach, Kotlikoff, and Leibfritz calculated the permanent reductions in all government transfer programs, starting in 1995, that would have been required for taxation at then-current rates to fund all government transfer programs. They found that the United States, Germany, and Japan would have needed to reduce all transfers by 20, 18, and 29 percent, respectively. Italy would have needed to cut transfers by 41 percent, due to the large increase expected in its dependency ratio and its generous government pension system.<sup>4</sup> Problems of this size would be difficult to solve by changing any one policy.

Some developed countries might attempt to increase tax revenues by admitting more young immigrants. For example, Canada admits many immigrants and attempts to admit only those immigrants likely to pay the most net taxes over their lifetimes.<sup>5</sup> A policy of paying for pensions through higher immigration, however, would face some problems. Stabilizing dependency ratios would require very heavy immigration. For example, the United States would have to increase its number of new immigrants from its current 1.25 million per year to 12 million per year to maintain its current ratio of people aged 65 and over to people age 15-64 (U.N. 2000). Further, making Social Security payments to these immigrants after they retire would require even heavier immigration later.

A close substitute for higher immigration would be higher birth rates in developed countries. There is indeed some interest in European countries in policies to raise birth rates.<sup>6</sup> However, there is also interest in the same countries in reducing crowding by restricting population growth. Since many European countries expect large increases in the number of old people, large increases in birthrates and populations

would be required to stabilize government pension and healthcare systems. Therefore, the goals of stabilizing the ratio of old to young and restricting population growth are incompatible. As a result, reforms to pension and health insurance systems are likely to be necessary.

Raising taxes on workers could allow governments to pay their future pension liabilities. Such tax increases would hurt workers and increase distortions in labor markets. European countries fear that raising their pension taxes gives incentives for workers to migrate to countries with lower pension taxes. Kotlikoff, Smetters, and Walliser also find that higher tax rates would reduce the national saving rate by redistributing funds from workers, who tend to have high saving rates, to retirees, who tend to have low or even negative saving rates. Many plans to privatize the U.S. Social Security system would also effectively raise taxes, by inviting workers to save more in order to get roughly the same benefits Social Security had previously promised them (Feldstein and Samwick).

Reducing pension benefits, perhaps by raising the age at which they become available, would obviate the need for tax increases. Lower pension benefits would hurt current retirees and older workers but help later generations of workers, who would pay lower tax rates and suffer fewer labor-market distortions. Later generations would also live in an economy with higher private saving, a larger capital stock, and thus higher wages. Analyses of privatization plans typically find that future generations would benefit greatly from reforms that somewhat reduced incomes of initial cohorts of retirees (Kotlikoff, Smetters, and Walliser).

Perhaps because there would be both winners and losers from Social Security reform, economists disagree about the correct response to the current system's problems. Diamond recommends Social Security reforms that maintain the system's current structure. He emphasizes this structure has appealing aspects, such as a low cost of managing workers' contribution records. By contrast, Feldstein and Samwick propose partially replacing Social Security with individual asset-holding accounts. A related approach would be simply to cut benefits and allow individuals to set up their own saving vehicles. If governments chose this option, they would need to tell workers not to expect government support in their retirement, since any such expectation would reduce workers' incentives to save for their own retirement.

In summary, projected dependency ratios mean developed countries are likely either to cut pension and health benefits for older people, raise taxes on workers, or do some of each. Higher immigration and birth rates might alleviate the problems of pay-as-you-go government health and pension systems, but are unlikely to solve them entirely. Analyses of government health and pension systems commonly conclude that the longer tax increases or benefit reductions needed to make these systems sustainable are delayed, the larger they will need to be. Thus, the gains and losses from pension reform will depend both on how pensions are reformed and how soon policymakers act to reform them.

#### **IV. EFFECTS OF WORLD DEMOGRAPHIC CHANGE ON TRADE AND CAPITAL FLOWS**

Differing patterns of demographic change in developing and developed countries may also affect international trade and capital flows. Population growth in developing countries may lead them to export many manufactured goods at low prices. Population aging in developed countries may lead them to lend funds to developing countries. In developed countries, these changes are likely to benefit most citizens but hurt some workers. Policymakers in developed countries may wish to compensate these workers, while retaining the overall benefits of free trade. In developing countries, policymakers may wish to adopt policies that encourage inflows of funds from developed countries.

##### *International effects of population growth in developing countries*

Economic theory predicts that countries with large populations but little physical capital will export labor-intensive goods. Thus, if developing countries' populations grow faster than their capital stocks, they may tend to become heavy exporters of simple manufactured goods such as textiles. This will tend to reduce the prices of these goods and the wages of low-skilled labor worldwide. This theory appears to be a good description of trade between China and the United States.

In contrast to China, however, some populous countries export relatively little. For example, of all world merchandise exports in 2001, 5.6 percent came from China, but only 0.9 percent came from India

(WTO). In the inland areas of both countries, a lack of infrastructure often makes manufacturing for export unprofitable. As each country's infrastructure improves, however, such activity will become profitable further inland, allowing more of each country's population to interact with the world economy. Thus, over the next 50 years, investment in infrastructure in populous developing countries is likely to affect the world economy in much the same way as would a large increase in their populations.

The international effects of population growth in developing countries are likely to be similar to those of China's entry into world trade. An increasing orientation toward trade in developing countries would also bring more low-income workers into contact with the world economy. It is probably too early to assess the actual impact of China's entry into the WTO on world trade. However, in a computer simulation study, Wang found that China's entry would reduce world prices of many manufactured goods. This price reduction would benefit most citizens of developed countries but would reduce the incomes of some manufacturing workers in these countries. The study also found China's WTO entry would benefit many African countries by increasing demand for their exports of primary goods. However, the national income of some Latin American countries, including Mexico, would fall, since the prices of their manufactured exports to the United States would decline. Thus, some countries could lose from population growth or an increased orientation toward trade in developing countries.

### *International effects of population aging*

Economists have used computer models to study the international effects of population aging. In these models, workers save heavily as they approach retirement and sell their assets after retiring. This behavior leads each country's national saving rate to rise as its baby-boom generation approaches retirement and then fall after it retires. Because savers would not wish to hold only domestic assets, a higher national saving rate would lead developed countries to lend funds abroad. For example, in a model which assumes capital can flow throughout the world, the United States, the EU, and Japan all lend heavily to developing countries in 2010 because the baby-boom generations in the

developed countries are saving heavily (Brooks). Later, when the baby boomers have retired and start to sell their assets, all three economies become net borrowers from developing countries.

The predictions of these computer models, however, may not be reliable. Careful analysis of data suggests demographic change has only a small effect on national saving rates (Deaton and Paxson). Saving rates can also change for other reasons. For example, if consumer credit becomes more widely available, consumers may not need to save as much in order to buy durable goods such as cars or houses. Therefore, economists disagree as to whether demographic changes will induce the changes in national saving rates that existing computer studies predict.

Perhaps the most important insight from computer models of capital flows is the potential gain from savers in developed countries investing abroad. In theory, returns to capital will be highest in developing countries, where capital is scarce and wages are low. Investment in developing countries by savers from rich countries would therefore benefit retirees in rich countries and workers in poor countries, and reduce incentives for workers to migrate from poor to rich countries. A diversion of investment away from developed countries, however, would reduce wages for workers in developed countries. In reality, political instability and poor protection of property rights often deter savers from investing in the developing world. Therefore, many of the potential gains from such investment are not realized.

### *Policy responses to international effects of demographic change*

Population growth in developing countries could reduce the wages of some workers in developed countries, which might provoke calls for policy responses. However, these responses may not all be good ones. In particular, in most economic models, tariffs are an inefficient means of reaching any desired distributional goal because tariffs only tax domestic consumers of the imported good (Saez). A more appropriate policy response might be to raise income taxes slightly and use the resulting revenues to help workers hurt by low-wage foreign competition.

The potential gains from investment in developing countries suggest that policymakers in these countries may wish to reduce the risks faced by foreign investors. Policymakers in developing countries could do so

by increasing political stability, by protecting property rights more effectively, and by promising credibly that future tax rates on capital will be low. While such promises may prevent policymakers in developing countries from reaching short-run distributional goals, an increase in investment could raise living standards substantially in the long run.

## V. CONCLUSION

Forecasts of world population include three changes that may have large economic effects. First, many developing countries expect rapid population growth. Second, many developing countries also expect their birthrates to fall. Third, many developed countries and China expect rapid aging of their populations.

Government policies will greatly affect the consequences of demographic change in developing countries. In particular, developing countries can achieve more rapid economic growth, despite high rates of population growth, if their governments create better-functioning markets and protect property rights more effectively. Without such policy improvements, rapid growth in developing countries' populations is likely to lead to continued slow economic growth and increased incentives for migration from poor to rich countries. Falling rates of childbirth can also increase countries' rates of economic growth, especially if these countries remain open to trade and have stable financial markets.

Developed countries have less potential to escape the problems of population aging simply by changing their policies. All plausible reforms to their government pension and health insurance systems would hurt some individuals. However, studies of possible reforms also show that policymakers' approaches to pension reforms will greatly affect the distribution of gains and losses from these reforms and the level of economic output in the long run.

## APPENDIX: HOW RELIABLE IS THE U.N.'S POPULATION FORECAST?

One approach to estimating the accuracy of a prediction is to examine the record of the forecaster making it. The U.N.'s forecasts of the world's population have been highly accurate. Of 11 U.N. forecasts from 1957 to 1996 of the world's population in 2000, all were too high, but the average error was only 2.8 percent (National Research Council). The U.N.'s forecasts of individual countries' populations have been less accurate. In the same 11 forecasts, absolute errors in projected country populations averaged just 4.8 percent in five-year projections but 17 percent in 30-year projections. Errors have been larger for predictions further in the future and for less developed countries. In developed countries, the U.N. and national statistics agencies have forecast the size of working-age populations fairly accurately but the size of very young and very old populations much less accurately (Keilman). These differences arose because demographers underestimated declines in fertility rates and the extent of increases in longevity.

Another method of assessing the accuracy of a forecast is to examine the plausibility of its underlying assumptions. The assumed fertility rate, or the average number of times women give birth during their lifetimes, is important in determining long-run population growth. In developed countries, the average number of births per lifetime necessary to prevent population decline without immigration—the “replacement level” of fertility—is around 2.1. Fertility rates have fallen dramatically in many developed countries during the last 50 years, and in general the U.N. expects fertility rates to continue to decline. Perhaps anomalously, however, the U.N. predicts that fertility rates will rise in the countries where they are lowest today, so that all countries will have fertility rates of at least 1.85 in 2050. For example, fertility rates in Germany, Japan, and Russia are expected to rise from around 1.2 now to 1.85 in 2050. If recent downward trends in fertility were not reversed to such an extent, the U.N.'s projections would overstate future fertility rates and, in turn, overstate population in countries where fertility rates are at present very low.

The reliability of a forecast may also be assessed by comparing it to other forecasts. The U.S. Census Bureau's forecasts of the world's population to 2050 provide a useful comparison with the U.N.'s projections.

Overall the Census Bureau's 2003 forecasts are very similar to the U.N.'s. The Census Bureau predicts a world population in 2050 of 9.1 billion, less than 2 percent higher than the U.N. It expects growth rates to differ across regions similarly to the U.N. and also assumes fertility rates will rise substantially in the lowest-fertility countries. There are some large differences between the Census Bureau and U.N. forecasts of the populations in 2050 of the countries with the fastest population growth between 2000 and 2050, but these do not appear to follow any consistent pattern. Indeed, past experience has shown that population growth in fast-growing poor countries is particularly hard to predict. Thus, a comparison of the U.N. and Census Bureau forecasts does not identify any aspect of the former as being controversial but reinforces the sense that population forecasts for fast-growing, developing countries may turn out to be either considerably too high or too low.

## ENDNOTES

<sup>1</sup>GDP data are taken from IMF (2003a) and the World Bank. These sources omit GDP data for some countries. This paper assumes that Afghanistan, Iraq, Liberia, North Korea, and Somalia are least-developed countries and that small European states such as Andorra and Monaco are more developed countries. The U.N.'s definitions of more, less, and least developed are based on a country's level of development in 1950. This results in some anomalies relative to current levels of development. For example, the U.N. defines the Ukraine as a developed country and South Korea as less developed, despite South Korea having GDP per capita 15 times as high as the Ukraine in 2000.

<sup>2</sup>Other more recent models imply that faster population growth increases rates of technological advance, since larger markets create greater incentives for new inventions (Kremer, 1990).

<sup>3</sup>IMF data (IMF 2003a) show that per capita GDP was lower in 2003 than in 1980 in OPEC members Algeria, Nigeria, Saudi Arabia, Venezuela, Kuwait, Qatar, and the United Arab Emirates.

<sup>4</sup>These estimates assume that labor productivity rises by 1.5 percent per year in all countries; were productivity to rise faster, smaller cuts in benefits would be needed.

<sup>5</sup>Canadian immigration law sets a threshold of points above which applicants are admitted, and allocates points to applicants according to their proficiency in English and French, their education, work experience, and age. Candidates have two points deducted for each year that their age falls under 21 or exceeds 44.

<sup>6</sup>In a response to a U.N. survey, the governments of many developed countries stated in 2001 that it was their policy to encourage higher birth rates (U.N. 2001).

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