Economics *and* Rapid Change:

The Influence of Population Growth

By Richard P. Cincotta and Robert Engelman

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Summary

For more than a decade, since the 1986 release of a seminal report by the U.S. National Research Council, discussion of the impact of population growth on economic change in developing countries has languished within both the demographic and economic fields. While the linkage between demographic and economic dynamics is undeniably complex, some recent findings stand out.

Despite lack of clear evidence for this relationship in previous decades, new data make clear that during the 1980s, on average, population growth dampened the growth of per capita gross domestic product, the primary measuring unit of economic growth. The negative effects of rapid population growth appear to have weighed most heavily on the poorest group of countries in the developing world during the 1980s and also throughout the two previous decades.

More positively, declines in human fertility in the 1970s and 1980s almost certainly helped fuel explosive economic growth during the 1980s and early 1990s in such East Asian countries as South Korea, Taiwan, Singapore, the former Hong Kong Territory, Thailand, Indonesia and Malaysia. Several economic studies link the rapid growth in domestic savings experienced in these countries to an increase in the proportion of working adults to dependent children. National studies in various regions provide substantial evidence that smaller families, later childbirths and parents' enhanced capacity to plan their families— factors that slow population growth through declines in fertility—create opportunities at both household and national levels that have positive implications for education, health, and labor and capital markets.

Population affects the course of national economic development. But so do modern institutions such as competitive markets, flexible public policies and well-run government programs, which help economies adjust to the rapid changes produced by population growth. Adjustment has its costs, however.

This paper draws attention to the long-term consequences of even those institutional adjustments that successfully cope with stresses related to population growth. The authors conclude that the long-term costs of these adjustments are most often paid by groups and interests to which institutions respond inadequately or not at all: the presently marginalized, future generations, and the natural resources on which present and future societies depend.

Introduction

The question considered here—how does population growth affect the direction and magnitude of economic change today as world population approaches 6 billion—is germane to a key argument invoked to defend international population assistance programs since their inception in the early 1960s. According to what could be called the *demographic-economic argument*,* developing countries are likely to enhance their prospects for economic development if their population growth slows. As national populations move toward *replacement-level fertility*—an average of slightly more than two children per woman—both governments and families should improve their capacities to invest in the health of each child, the education of each student and the output of each worker. For those developed countries supporting international population assistance programs, the return on this investment should come in increased trade and overseas investment opportunities, a proliferation of stable and democratic allies, a slower growth in pressures exerted on some aspects of the global environment, reduced disaster relief and immigration, and— eventually—an end to foreign aid itself.

In the skeptical 1990s, notions so bold, simplistic and optimistic as this have little currency. The old argument nonetheless remains plausible. The best testimony in its favor comes from the emerging industrial powers of East and Southeast Asia: South Korea, Taiwan, Thailand and Singapore (each below replacement fertility), and following close behind them, Malaysia and Indonesia. In each of these countries, policies and programs favoring greater access to voluntary family planning began in the 1960s,[1] ultimately contributing to smaller family size and a reduction in the proportion of children relative to working age adults. In each, fertility decline coincided with or preceded a transition to sustained growth in economic productivity.

Such examples alone cannot prove the demographic-economic argument. The causal questions remain. How do high fertility, population growth and increased densities of population affect economic development? And how much does fertility decline matter to a developing country's economic future?

Objectives

This essay has three objectives, each designed to improve understanding and promote discussion. The first is to briefly review recent findings of economic research on the relationship between population growth and economic development. These we organize by major categories of economic activity, indicators of how goods, services and opportunities are distributed; and by categories of *assets*, material or nonmaterial resources of utility and value. Our second objective is to review an economic perspective on population growth that has dominated the field for the past decade. The scholarly literature on this issue labels this view, which stresses the mixed and ambiguous impacts of population growth on economic change, *revisionism*. Here we briefly outline the conclusions of this school of thought as expressed in an overview of the population-economic links published in 1986 by the U.S. National Research Council.[2] In addition,

we discuss more recent studies that tend to support the thesis that population growth affects economic change and that point to the need for further research.

Our third objective is to challenge some of the assumptions that underlie the revisionist view. Here we focus on modern *institutions*, which are socially organized structures, laws or customs such as competitive markets, property rights, and government policies and programs. Current revisionist literature rightly celebrates the capacity of modern institutions to adapt to change and other stresses. We argue here that this perspective nonetheless still lacks an understanding of precisely how institutions facilitate economic adaptation to growth and to the subsequently expanded demands of a larger economy.[3] We note that adaptation to recent population growth has been costly. Often it has been gained at the expense of long-term human health status and environmental assets, and sometimes with an increase in social inequity. And we suggest that two inherent characteristics of institutions—*limitation* and *bias*—are responsible. We argue that these institutional shortcomings, which can be reduced but never eliminated in humanly imperfect economies, merit consideration when projecting the likely economic impacts of current and future population growth.

In brief, two arguments dominate this paper: One, the body of economic research supports the claim that slowing population growth tends to have positive economic impacts in modern developing countries. Two, economic research fails to capture all the economic benefits of lower rates of population growth because it does not account for the high cost of adjustment—even successful adjustment—that modern institutions make in response to ever higher population size and accompanying stresses.

Why Population Matters—In Economic Terms

How exactly does population growth matter to developing economies? Or, as an economist would pose the question, how does each aspect of population growth—fertility and family size, the proportion of children relative to working-age adults (expressed as the *youth dependency ratio*), human density and changes in aggregate economic demand—affect the way societies manage productive assets and allocate the goods and services derived from them?

Clearly, no single answer will do. At one time or another, economists have suspected that population dynamics influence economic growth, employment and poverty, and the management of assets. The three principal categories of assets are *physical* (human-built infrastructure related to economic activity), *natural* (natural resources and the services they provide, including waste material and energy cycling), and *human* (health and educational status of citizens). In this section, we briefly summarize conclusions drawn from recent research related to each category of asset. Obviously, there is variation among countries, variation in the nature and quality of studies from which conclusions are drawn, and some uncertainty associated with each conclusion.

Unlike laboratory scientists, economists cannot conduct controlled experiments. Their work relies on surveys involving standard economic statistics—and on expectations from the theories of their discipline. Using these, economists try to identify patterns over time and through comparisons that shape their conclusions. Studies of a single country

often produce valuable insights, but it can be hazardous to generalize by applying the lessons learned to other countries. The problem of generalization is solved where strong patterns of population-related impact emerge from multi-country comparisons. However, such patterns are hard to discern among variations in data quality, history, culture, geography and shocks related to political events or natural disasters. Where information is scarce or hard to measure, economists lean heavily on theory to guide them.

The following statements briefly outline what most economists researching demographic change presently accept to be relationships through which high fertility, population growth and increased human density relate to economic well-being in the developing world. In each case, we will try to provide some indication of the degree of certainty and the limits to which these ideas can be applied.

On Economic Growth

Recent research by economists Allen Kelley and Robert Schmidt indicates that during the 1980s population growth, on average, acted as a brake on economic growth as measured by the growth rate of per capita *gross domestic product*, or GDP.[4] (This is a standard measure of a nation¹s total output of goods and services by residents and domestic business, excluding net income from foreign assets and that paid to foreign creditors. *Gross national product*, or GNP, includes both these figures, which in many economies come close to canceling each other out. This is why GDP and GNP are often roughly equal.)[5] Results of this extensive analysis suggest that the relationship between population growth and depressed economic performance is strongest among the poorest nations of the developing world, and that the effect on this group extends back through the 1960s and 1970s. The growth of gross domestic product can be constrained by high dependency ratios, which result when rapid population growth produces large proportions of children and youth relative to the labor force. Because governments and families spend far more on children than the children can quickly repay in economic production, especially as modern schooling and health care replaces child labor, economists expect consumption related to children to retard household savings, increase government expenditure and ultimately cut into the growth of GDP.

In many countries experiencing rapidly growing population, and thus growing dependency ratios, the influx of young people into the job market exceeded the jobs created during the 1980s. According to the UN Development Programme, “in many cases [in the developing world] lots of employment was being created, but not fast enough to match the rapid growth in the labor force.”[6]

Despite the logic of this relationship, signs of adverse effects on GDP from population growth did not emerge in multi-country comparisons of population and economic growth during the 1960s or 1970s, except in the poorest of the developing countries. The GDP downturns noted during the 1980s could have been amplified by global debt burden and recession. Or it could represent, at least in part, a delayed effect of the high fertility of these earlier decades.[7] In fact, economists are unsure if the relationship between population and GDP growth that existed in the 1980s is continuing into the 1990s or will continue into the 21st century.[8]

On Employment and Poverty

With some notable exceptions, economists are increasingly convinced that there are links from high fertility and resulting population growth on the one hand to persistent poverty and wage stagnation in developing countries on the other. High fertility and population growth appear to promote the transmission of poverty across generations. Simultaneously, they widen the gaps in income and health status that separate the poor from the upper and middle classes.[9]

Because of disproportionately high levels of fertility among the lowest income groups in developing countries, population growth is likely to depress wages at the bottom end of the pay scale.[10] A related concern, difficult to test, lies in the possibility that large numbers of low-skill, low-wage laborers in some developing countries can slow the adoption of more efficient, labor-saving technologies. Examples from the newly industrializing countries of Asia suggest that when wage growth and relative income equality combine with investments in education and technology, greater opportunities for sustained economic growth emerge.[11]

On Savings and Investment in Physical Assets

In Industrial economies, the savings that households deposit in banks are a source—often the most important one—of investments in the private sector. While the 1986 National Research Council review found little evidence to substantiate links between fertility and national savings rates, later studies document evidence that declining fertility does indeed stimulate savings.[12] Economists now credit a significant part of economic growth achieved among the newly industrialized economies of Asia to wise applications of domestic savings that were generated largely by households. Though debate continues, the connections between fertility, the ability of families to save, and the investments that banks make in physical assets are—because of the East Asian examples—more substantially documented than had been the case in 1986.[13]

On the Conservation of Natural Assets

Economists acknowledge that population growth has impaired the productivity of renewable natural resources and their provision of environmental services. *Renewable* resources are those such as fresh water from rainfall, soil, and fisheries that can be harvested and used up to certain thresholds without impairing their long-term viability. *Environmental services* may include the pollination of crops by bees and other animals, pest control provided by species rich ecosystems, mineral nutrient absorption and cycling in healthy soils, water catchment and filtration, and flood prevention. Forces associated with population growth are most threatening to the environmental products and services that renewable natural resources provide when property rights are hard to assign or maintain. Fisheries, forest products, rangelands, freshwater resources, the atmosphere and genetic diversity are each renewable natural resources sensitive to human-induced pressures. By contrast, most economists find the economic impacts of population growth on *nonrenewable* natural resources, such as petroleum and minerals, likely to be less

strong than once assumed. Economists base their conclusions on trends in energy research and the ways markets and governments have responded to changes in supply—raising prices, thus stimulating more efficient use, conservation, and often substitution when scarcities approach.

On Investments in Human Assets

At the family level, the capacity to plan the number and timing of childbirths can dramatically affect household economic well-being through improved maternal and child health, and more productive use of time, human energy and income.[14] Women stand to increase earnings the most, although their low status in many societies often limits this opportunity. Research conducted in many developing countries demonstrates that children in large families tend to be less well-nourished over the long term,[15] which can undermine school performance and, hence, future earnings potential.[16]

In general, economists conclude that parents with fewer offspring are able to invest more in each child than those with larger families. Studies show that, on average, children from smaller families attain higher levels of schooling. These findings are strongest in those developing countries that have experienced substantial economic and social transformation in recent decades, including many in Southeast Asia and Latin America. However, it is more difficult to demonstrate such changes in educational attainment in many countries in Africa and South Asia, where students draw upon large extended families for school fees and other assistance.[17] Notably, family size does not appear to influence school enrollment. Enrollment appears more closely related to the commitment of governments to universal education.[18] And for girls, the cultural background of parents is likely to affect the percentage of school enrollments.

High proportions of school-age children, characteristic of countries experiencing rapid population growth, undoubtedly put pressure on existing school and health care facilities. When school enrollments and average educational attainment increase rapidly, governments can expect upward pressure on national education budgets. In the absence of even more rapid growth in government revenues or major shifts in government spending priorities, this tends to depress public education expenditures per student. Yet most developing countries *do* shift priorities, continuing to make substantial gains in schooling and health despite the budgetary pressures.[19] Clearly, something must be sacrificed. One cross-national study found that teachers' salaries appear to have suffered as school enrollments grew rapidly in the developing world during the 1960s and 1970s.[20] It is not clear that developing countries can sustain these trends—rising enrollments, higher average educational attainments, increased public health care service—without sacrificing other priorities as their populations continue to grow.

The rate of population growth and the size of annual growth increments matter. Even in the case of countries that can adjust to their present rates of population growth, economists recognize that it takes time and effort for government and other institutions to expand urban infrastructure, provide new and better health and educational services, successfully integrate technology, enforce environmental regulations and expand trade. Developing countries in which population growth eases through declines in birthrates

will be more likely to increase per capita economic growth rates and will have more time to generate needed jobs.[21]

The Debate: Population Growth and Institutions

The debate over the economic impacts of contemporary human population growth is not just about people, but about modern institutions and their capacities to deal with rapid social and ecological change. Institutions mediate relationships between people. They convey signals, channeling human activity by facilitating or rewarding some behaviors while obstructing or punishing others. In economic terms, institutions manipulate *transaction costs*—the costs of defining, establishing and maintaining property rights. Reducing transaction costs increases the ratio of benefits to costs, making it more likely that the desired transactions occur. Raising transaction costs makes these transactions less likely.

The most fundamental institutions—markets, law, property rights—evolved with human culture. Others were forged more deliberately as products of state policies and reforms.[22] These include codes and norms for savings and finance systems, systems of formal education, transportation and communications networks, public health systems, and international trade. Like valves in a hydraulic system, an economy's institutions regulate how resources, goods, services and opportunities reach people—and, critically, which people they reach. When modern macro-level institutions function well, they can impart flexibility to an economy and transmit widespread benefits. How each nation fares as it undergoes the changes and stresses brought about by population growth depends, at least in part, upon the nature of its institutions.

The study of institutions has a long history in economics. Classical economists of 18th and 19th century Europe provided extensive commentary and critique on the institutions of their day, including those involved in governance, trade, labor practices (wage labor, servitude and slavery), tenancy, colonialism and theocratic power. However, interest in the broad spectrum of institutions waned toward the end of the 19th century with the emergence of early neoclassical economic theory, a mathematical treatment of relationships principally related to a single institution, the market. Over the past two decades, however, interest in institutions has re-emerged. Now, more than ever, social scientists credit modern institutions with a fundamental role in the formation and stability of nation states. Many economists see institutions, when linked to technology and human creativity, as the principal engines of economic growth during this past century[23] and a source of economic resilience. By this view, institutions permit economies to adapt to social and environmental change, such as those to which population growth contributes.[24]

Schools of Thought

How well have institutions helped societies adjust to rapid change? Scholars disagree. Beginning around the late 1960s, *neo-Malthusians*—analysts and commentators who share the notion expressed by 18th century economist Thomas Robert Malthus that population growth inevitably collides with limiting resources—projected a pessimistic view of the coming impacts of population growth. They asserted that society's institutions would be unable to adjust economies to the changes and pressures that rapid

population growth and high human density would ultimately wreak on the environment and social fabric.[25] The opposite view, that institutions can faultlessly handle these changes if allowed to operate without restriction, is shared by two groups of scholars, *neoliberals* and *distributionists*,[26] whose opinions are otherwise separated by the width of the political spectrum. Neoliberals—Julian Simon is among the most prominent—argue that population growth is not a problem and that discussion of it only distracts attention from real problems. A narrow set of evolved institutions—the market, private property rights and supportive laws—coupled with technological progress and creativity, provide all the necessary tools for adjusting. Distributionists, too, argue that concerns about population growth distract from the critical issues. Distributionists maintain that state institutions promoting poverty alleviation and equity are the key to successful adjustment. Both schools assert that the positive economic outcomes resulting from their own brand of institutional mediation reduce the demand for children.

In the midst of this debate the revisionists emerged during the 1980s. Revisionists conclude that to adjust adequately to population growth, populous countries must have a broad array of functional modern institutions. Institutions that function smoothly make it possible for some of the initial adverse effects of population growth to be "ameliorated or even reversed in the long run."[27] But when institutions function poorly, revisionists warn of the likely economic risks population growth can pose. Such risks—including depressed levels of output per worker, failures to meet society's goals for allocating goods and services, and stagnation or deterioration of assets—occur in the poorest countries where institutions have yet to reach maturity. Regardless of national income, population growth can degrade renewable natural assets where property rights are inadequate or nonexistent. For revisionists, the *institutional thesis* just described explains much of what economists have been observing over the past four decades of rapid population growth in the developing world.

In the following sections we argue that revisionism itself can be revised, or at least fine tuned. We do not challenge the revisionists' basic claim that institutional development is a key determinant of how well an economy can adjust to population growth. Social scientists, however, have long been engaged in research to discern *how* institutions work and *for whom* they work best. Their conclusions have implications for the ways in which key aspects of population growth—family size, increments of young people, human density and contributions to aggregate demand for goods and services—affect the way in which societies manage productive assets and allocate the goods and services derived from them.

The Revisionist Perspective

The National Research Council's second economic review of population growth in the developing world,[28] published in 1986, stirred considerable controversy. Economists consider it a revisionist document,[29] a break from the traditional arguments that previously structured the population debate. To the surprise of many, the committee of authors declined to declare alarm over the roughly 82 million people being added[30] to the developing world annually. Neither, however, did the committee argue that rapid population growth was irrelevant to poverty or economic development. Instead, the 1986

National Research Council review on population growth presented decidedly middle of the road conclusions.

The review supported the idea that rapid population growth could have negative economic consequences. Slowing population growth, it stated, would likely ease rates of degradation of certain renewable natural resources, such as air, water, forests and many species of plants and animals. Lowering fertility would also help families spare the time and money for more adequate health care, nutrition and education for their children, while making it easier for governments to increase spending for each child in both health and education. And fertility decline in developing countries could, through various wage-related effects, help reduce income disparities between social classes.[31]

However, the 1986 review also noted that research had demonstrated only a few of the negative economic impacts that population growth was expected to produce. In particular, economists had not uncovered a significant statistical relationship—not even simple correlations—between growth in population and growth in gross domestic product. Nor did national statistics demonstrate a consistent relationship between declines in fertility and household or government savings. Nor were developing country governments falling hopelessly behind in providing education and health, despite the clear pressures of population growth.

National statistics demonstrated what was already obvious to most economists: developing countries experiencing rapid population growth were taking deliberate steps to accommodate that growth and counter its adverse effects. The degree to which modern institutions had developed in these countries appeared to heavily influence the likelihood of their economic success. Rather than erect a solid barrier to economic development, the review concluded, continued population growth would merely make existing problems more difficult to solve, and "exacerbate the ill effects of a variety of inefficient policies."[32] "On balance," the National Research Council concluded guardedly, "slower population growth would be beneficial to economic development for most developing countries."[33]

Supporters of U.S. family planning assistance had hoped the study would strongly confirm their own concerns and counter rising political opposition during the Reagan administration. For them, the mixed conclusions of the 1986 review were more than a setback; they were an intellectual rebuff. Even today, more than a decade after its publication, international donor organizations are reluctant to fund economic research on the impacts of population growth.

After the Review

Much has transpired during the 11 years since the review. In the past decade, economists have seen vast improvements in the quality and quantity of available data. Demographic and economic conditions have changed, creating a wider range of fertility and economic outcomes among developing countries. These changes have stimulated further evolution of the debate on population and economic dynamics. An extensive analysis of cross-country data drawn from the 1980s shows that, on average, population growth dampened per capita economic growth[34] despite the apparent absence of the same effect in the two previous decades.[35] The study indicates that the negative effect

associated with population growth in the 1980s was most significant in the least developed countries.

In addition, there is growing evidence of significant *feedbacks*. These relationships interact back and forth from economic well-being at the family level to assets at the national economy level. In these feedback systems (or *complex systems*),[36] institutional function assumes a pivotal role. And, as in all feedback systems, it is difficult and somewhat arbitrary to distinguish between cause and effect. That difficulty sets the stage for endless debate.

Taken together, recent studies suggest that fertility decline and slowed population growth figured importantly in feedback systems—strongly mediated by sound institutions—that were responsible for the ascent of the high performing East Asian economies. Research in the poorest countries describes a reverse effect: feedback systems that have perpetuated economic stagnation and decline. While expanding the revisionists' world view, the concept of feedback systems does not upset the basic institutional thesis that underlies it. In fact, several noted economists argued, during the years approaching the 1994 International Conference on Population and Development (ICPD), that demographic-economic feedback systems have important policy implications[37] and deserve more attention from researchers.[38]

Revisionists continue to contend that strong, modern institutions can soften the impact of population growth¹s negative effects on economic productivity. Population growth appears most detrimental and most difficult to surmount in the poorest, least-developed countries, where modern institutions have yet to realize their potential to organize society and economies. Nicholas Eberstadt expresses this conclusion: "[P]opulation growth is clearly a form of social change; nations and governments that cope poorly with change are unlikely to deal adeptly with the disequilibria that more rapid rates of population growth necessarily bring."[39]

Feedbacks: Economic Ascent

Influenced by a decade of research on the high performing East and Southeast Asian economies,[40] some revisionists appear prepared to accept a stronger role for fertility decline in economic development. Where highly successful programs improved access to family planning services begun early in the 1960s,[41] rapid declines in fertility have more recently provided a set of demographic opportunities: slower growth in the student population, smaller family size, a lower dependency ratio (at least initially), and a slowed rate of labor force growth. However the final step, transforming demographic opportunity to economic growth, is an institutional task. In East and Southeast Asia—where fertility decline coincided with an enterprising business sector, government policies that encouraged savings, public investment and a well-developed education system—economic growth was strong.[42]

Consider, for example, South Korea. In improving the educational status of its people, this country has perhaps taken the best advantage of demographic change. As fertility declined and income grew, both household and government educational investments per child rose sharply.[43] By maintaining educational expenditures at about the same proportion of the national budget between 1970 and 1989, real government

expenditures per primary school student in South Korea more than quadrupled. Had the share of Korean school-age children grown at the rate of that of Kenya, the South Korean government would have had to spend 5.6 percent of its budget to accomplish universal schooling, rather than the 2.6 percent actually spent.[44]

A second major component of new Asian economic growth, investments in physical assets, was largely fueled by domestic household savings. And the rising rate of these savings as a percentage of gross domestic product can arguably be traced to a coupling of growth in household income and a decline in family size.[45] While ongoing debates over the proper model for this relationship will likely continue, it is clear that an impressive growth in savings and investment followed closely behind the fertility declines in each of the most rapidly developing countries of Asia.[46] Lagging behind Latin American countries in savings in 1965, the high performing Asian economies were fully 20 percentage points ahead by 1990. Savings now exceed total domestic investment, making these countries net capital exporters.[47]

According to the World Bank, slowed growth of the labor force—caused by a decline in fertility—was among the factors behind the adoption of high technology in the rapidly growing Asian economies. By the 1980s, an early demographic transition reduced labor force growth in these countries well below that of other regions. That, coupled with the increased demand of these vibrant economies for labor, drove wages upward. Aware that other developing countries would eventually edge them out of industries requiring only low-skilled, low-wage labor, policymakers among the newly industrialized Asian economies responded by promoting a shift to highly technical and capital intensive industries.[48] The strategy succeeded, making good use of earlier proactive educational policies.[49]

In all of this evolution, Rockefeller Foundation population sciences director Steven Sinding has argued, explicit population policies consciously designed by governments to reduce fertility were "embedded in mutually reinforcing economic development policies, such as primary, secondary and eventually even tertiary education (especially of girls), and policies that improved income distribution. These strategies were informed by a knowledge of the mutual interdependence of population policies" with these other policies.[50]

Intriguingly, declining rates of labor force growth and the resulting growth in older populations may offer a substantial challenge for modern societies that have completed the demographic transition.[51] Social security programs, of course, depend on taxation of the labor force in order to provide for the health and security of the aged. While orthodox economic theory tends to place high confidence in the adaptability of modern institutions, ironically some economists are pessimistic about this adaptability in the case of stationary populations and rising proportions of older people.[52]

Feedbacks: Economic Stagnation and Decline

Revisionists have long maintained that rapid population growth and high fertility have had their greatest negative repercussions when national institutions have been ineffectual, particularly in the poorest countries of the developing world. Recent research provides deeper insight, suggesting that population growth tends to reinforce a downward

economic spiral affecting national institutions and essential assets. In short, non-functioning institutions—poorly developed markets, ineffectual government programs and policies—fail to protect, manage and build basic assets in an environment of growing need. In turn, degradation of assets can, in some cases, cripple emerging institutions when market and policy solutions are needed most. For example, in many developing countries output growth and job formation lag seriously behind the growth rates of their poorly skilled labor forces. And it is often financially and politically difficult for governments to invest in human assets at the levels needed to build workable institutions and healthy, literate labor forces. Yet it is these human assets, not just lower production costs relative to the developed countries, that have attracted foreign investment to the "miracle" countries of East Asia as well as to several in Latin America.[53]

Recently, several major studies have concluded that the degradation of natural resources is frequently an active component of economic feedback cycles perpetuated by population growth and poorly developed institutions. In sub-Saharan Africa, where traditional land tenure institutions have failed to adapt to changing economic and demographic conditions, increased human density has contributed to the degradation of forest, rangeland and water resources.[54] Where modern institutions have been too weak to manage resource allocation, scarcities induced by population growth and inequitable distribution have led to local disputes and sometimes violent conflict.[55] In Haiti, breakdowns of civil society and its policing power over property rights from the late 1980s to the early 1990s permitted the demands for basic necessities of a densely packed and impoverished population to lead to the dismantling of the country¹s forests.[56]

In a series of country case studies of South Asian, African and Latin American countries, researchers concluded that population growth often figures in a complex mix of causal factors driving natural resource scarcities that, when left unresolved by weak institutions, have led to conflicts within nations.[57] Such civil disturbances allow further depletion of assets, exacerbate divisions in society, inhibit commerce and discourage foreign investment.

Twenty sub-Saharan African nations seem caught in a downward spiral, each with a high fertility rate—and each with lower average per capita income today than 20 years ago.[58] Breaking the loop requires additional investment, both in the private and public sectors, that must be wisely targeted and sustained. But very little capital flows into the poorest countries—for population-related health programs or anything else. While private loans and investment flows to all developing countries grew from $5 billion to $173 billion between 1970 to 1994, three quarters of that sum went to just 10 countries.[59] By contrast, the poorest countries receive only about one percent of world private investment and conduct less than one percent of world trade. Official development assistance is playing a diminishing role in capital flows to developing countries. This assistance fell by nine percent, in real terms, between 1985 and 1993.[60]

Policy Implications

Though probably inclined to accept the positive economic effects that fertility decline and slower population growth can have in the long run, revisionists seem relatively confident that the majority of developing economies will manage to adjust to

larger and denser populations. Their confidence is highest for parts of South Asia and Latin America where countries are enjoying economic recovery (following recession in the 1980s) amidst promising democratic reforms, market liberalization and declining fertility. The outlook is quite different for the poorest countries, particularly those in sub-Saharan Africa, where high fertility continues to raise economic concerns. Still heavily dependent on domestic natural resources and agricultural output and short on foreign exchange, many countries—such as Pakistan and Haiti,[61] as well as many in sub-Saharan Africa[62]—are experiencing rapid depletion and degradation of freshwater supplies, arable land and forests. Even if resource depletion ended, the already low per capita availabilities of natural resources in some of these countries are projected to shrink to between one-half and one-third of their present levels by 2050 as a result of population growth.

That said, most revisionists do not consider expansion of access to family planning a substitute for either direct investments or policy reforms in each economic sector.[63] Rather, these economists tend to see investments in family planning as complementary to institutional strengthening and an important health intervention. Moreover, the quality of institutions has much to do with the outcomes of population programs and policies in developing countries.

Where adaptive institutions are in place—as in parts of Asia and increasingly in Latin America—a growing number of economists recognize opportunities for positive *demographic-economic feedbacks*. Conversely where institutions are weak, revisionists expect few of the benefits of fertility decline to be reflected any time soon in national economic statistics. Historical evidence suggests that fertility decline requires a sound institutional framework to boost economic growth over the short run. However, establishment of effective family planning programs in the poorest countries has long-term economic implications. Here too, the Asian example offers lessons. Establishing the foundations for eventual economically significant fertility decline—organizing reproductive health services, disseminating information, and overcoming obstacles to access—takes several decades.

This was the case for East and Southeast Asia where investments in family planning made as early as the 1950s and 1960s proved essential. Once services were established, however, remarkable progress in fertility decline occurred in a single generation. When developing countries of East and Southeast Asia began investing in family planning, in the early 1960s, their own fertility rates (excluding Japan's) were comparable to today's averages in sub-Saharan Africa.[64] In 1960, average levels of human development in East and Southeast Asia (using the UN's Human Development Index) were considerably below those estimated for sub-Saharan Africa[65] today—demonstrating, at least, that the presence of poverty and weak institutions need not impede the early introduction of family planning service programs.

The Costs of Adjusting to Growth

The evolution of institutions and the human capacities applied to them are major contributing factors to modern economic growth and development.[66] Modern institutions are adaptive. They can and do adjust to resolve the acute and potential scarcities

incurred[67] as a direct or indirect result of population growth and increased per capita consumption. In particular, competitive markets and supportive government policies promote the structural changes that allow economic activity to increase in scale. Moreover, modern institutions are among the means by which creative solutions and technologies are applied to new problems that population growth and increased density often generate, in concert with other aspects of growth and change.

However, the revisionist institutional thesis—whereby major institutions are seen as valves controlling flows in the economic system—conceives of relationships between institutions and society as mechanical, rather than as the evolutionary processes that they are. The thesis overlooks a large body of social science research that finds even highly evolved institutions to be humanly imperfect. Researchers observe two persistent sources of problems.

First, each institution is limited by its history, its present structure and the circumstances surrounding it. Such *institutional limitations*—some temporary, others long-term—make it difficult to reduce obstacles to economic activity. (These obstacles are known as *transaction costs*.) Revisionists call attention to some of these intrinsic weaknesses, particularly market failures associated with assets that are *common property*, particularly where property rights are ill-defined or difficult to uphold. Institutional limitations are more widespread than is generally acknowledged, and institutions are especially limited in their abilities to protect natural assets and long-term human health under conditions of high population density.

The second problem is *institutional bias*. This is the tendency of institutions to favor some economic actors and some types of assets over others. These economic actors may be larger or more powerful and may exercise control over the institution. Or they may simply have the most direct and immediate stake in the economic processes mediated by the institution. In many ways, institutional bias is beneficial. It tends to reduce transaction costs, promoting activities that facilitate economic adjustment to population growth. But as it does this, bias produces a cost burden on assets and economic actors outside the original transaction. These *spillover costs*, or *negative externalities*,[68] are collateral penalties that are easily overlooked in the course of economic decisions.

Two points made here, and explained more thoroughly below, receive insufficient attention in the economic literature. First, institutional limitations often grow more serious under conditions of high population density. And second, the assets most neglected in institutional transactions, or more damaged by their spillover costs, tend to be those that are inadequately understood, ineffectively conveyed or poorly represented by the institution itself.

Institutional Limitations

To encourage an economic activity, institutions reduce transaction costs that impede its achievement. For example, it would be excessively expensive for most people to obtain the necessities of life if competitive market systems did not encourage retail outlets and provide financial capital and labor, or if policies did not facilitate communications and transportation networks. But having evolved to solve past problems,

institutions such as land tenure agreements, market arrangements and government regulation may now be inadequate, yet remain resistant to change. Institutional performance is also limited by such current events as economic recession, political turmoil or natural disasters. Inadequate technology, weak leadership or a lack of creativity also constrain institutional performance. Classical economist John Stuart Mill concluded that while "governments or nations can in some measure determine what institutions shall be established, they cannot arbitrarily determine how these institutions shall work."[69] The pricing of fresh water serves as an example of this.

The market has proved to be a useful means to address freshwater allocation and quality problems. But water resource managers must cross at least three major hurdles to successfully bring this resource into the marketplace: They must establish property rights over watersheds, accurately meter flows and charge equitably for each unit of water. Most attempts to price water, however, run into strong opposition, often fueled by cultural opposition to water pricing or organized by interest groups whose members face substantial costs.[70] Once they overcome opposition, pricing schemes often falter when faced with impediments to establishing watershed rights, to constructing and maintaining metering networks, or collecting revenues. These transaction costs typically rise with population size and density—not just within the water consumption area, but as population grows within the catchment area as well.

Numerous urban centers—many in the developed world, including New York City—still lack water metering. In the case of New York, whose residents pay flat fees for access to water, suburban development upstream from the city's reservoirs threatens the quality of its drinking water. Because of intense suburban development in watersheds affecting about 10 percent of the city's water, New York has already invested about $600 million in new filtration facilities. To secure its future supply and maintain water quality in the remaining watersheds, the city's government is committed to spending at least $500 million, divided equally for land acquisition and upgrading wastewater treatment in distant communities.[71] New York's situation is not unique. Eventually nearly all growing urban centers will have to protect the naturally vegetated ecosystems that comprise their watersheds, or pay substantial sums to filter water that nature once filtered free of charge.

While advances in public health services are truly remarkable, this institution is still limited in its abilities to protect human health assets. Public health systems have been only marginally effective in controlling the spread and moderating the costs of emerging infectious diseases under contemporary conditions of high human density and physical mobility.[72] The re-emergence of tuberculosis and the continuing HIV/AIDS pandemic could be ominous precursors of coming technological and institutional challenges. AIDS has already reduced average life expectancies in several sub-Saharan African countries, in Brazil and in Haiti,[73] despite continuing increases in life expectancy among those the human immunodeficiency virus has spared.

Demographer Geoffrey McNicoll points out that despite evidence institutional limitations are a growing problem, unrealistic expectations for institutions underlie most recent assessments of the economic impacts of population growth. "A good part of mainstream economics, and an even larger part of standard demography," he notes, "suppose that institutions adapt as required or can be redesigned at will."[74]

Institutional Bias

In a perfect economy, current and future costs and benefits of such adjustments would be assessed and communicated. Optimal activities could be calculated. And if important assets were jeopardized, institutions would encourage solutions that carefully weighed all of society's interests. Obviously, this is not our world. Ours are imperfect economies with biased institutions—a concept that requires further consideration here.

Competitive markets and good policies play an important role in assessing, communicating and protecting the values of society's productive assets—in some sense, representing those assets and those people whose livelihood the assets support. Some social scientists observe, however, that the performance of these institutions is biased.[75] Each institution favors some assets, while failing to protect others. There are several reasons for this bias. Information about values of some types of assets, present and future, is incomplete or unavailable. Also, the structures of institutions often allow them to deal more effectively with some types of assets than with others. And each institution can be used by groups within society whom that structure primarily serves. "Institutions," economist Douglass North points out, "are not necessarily...created to be socially efficient; rather they...are created to serve the interests of those with the bargaining power to devise new rules."[76]

For example, the marketplace provides opportunities to satisfy needs, express wants and to use one's talents. But it favors consumers with cash or good credit, and producers with access to capital and political influence. Competitive markets often discriminate against small firms, even when these are innovative. High interest rates tend to favor assets that produce short-term profits over those that require lengthy periods of investment, although the latter may ultimately prove more socially and economically beneficial. Lack of quality in government health and school facilities does not affect the elite and middle classes who are able to pay privately for those services. The best legal representation goes, as well, to the wealthy. Good policies can make corrections, but even well-intentioned government intrusions into the marketplace can distort pricing and lower economic incentives. And policies are just as the word infers: political and subject to the interests and ideologies of those in power. Modern democracies, though vast improvements over totalitarian regimes, have not succeeded in freeing their institutions from these influences. Public expenditures should counter trends that discriminate against the poor, but fall short, often despite good intentions.[77]

These distortions and exclusions leave a discernible trail across the social science literature. Each discipline uses its own terms to describe situations where institutions are ineffective or inaccessible. For anthropologists, the poor and politically powerless are *marginalized*—pushed to the margins of economic and government concern. Accordingly, the hundreds of millions in this category are forced to rely on meager, uncertain sources of income, and are driven to avoid risk rather than to secure profit.[78] Lacking purchasing power, information and capital, the marginalized live outside the core of commerce and choice. They tend to be underrepresented in government, ignorant

of their rights and obstructed from exercising them, with limited access to legal means of protecting property.[79]

In addition, political scientists and sociologists point to what they call an *informal economy*—in some developing countries comprising over 40 percent of the total economic activity—that operates outside of the policies that regulate formal markets, protect the health and rights of laborers, and levy taxes.[80] In the pursuit of policies for sustainable development, environmental economists are concerned about future generations. These too are agents outside the scope of institutions who are unable to influence government or affect market transactions determining the fate of assets that may or may not be passed down to them. In addition, environmental economists report that basic environmental services go unpriced or underpriced.[81] And because species and ecosystems are not human, they are intrinsically underrepresented in government and in courtrooms.[82] Human, natural and physical assets outside borders generally suffer a similar lack of representation, or are not considered in decisions because of restricted flows of information.

Bias occurs when institutions selectively ignore costs. Ignoring costs is easiest when losses affect assets to which those institutions have not assigned a high relative value. In the market place, valuation is achieved through pricing. Undervalued assets are left unpriced or priced below their realistic worth to society. In policy and matters of property rights, value is associated with political representation. Those lacking a political voice have little impact on how government programs develop or deplete their assets, or how well the legal system protects them from costs that spill over onto their assets during others' transactions.

In countries attempting to accommodate population growth, institutional bias assumes an important role. If an institution can ignore costs incurred during each growth-related transaction, there is a perceived increase in the benefit-to-cost ratio for those activities. Thus encouraged, transactions proceed. Adjustment to a larger, denser population occurs, although these adjustments may be unwise and ultimately harmful to important assets.

Spillover costs from such a process are likely to erode the assets and prospects of the poor and powerless, and to deplete the services the environment offers to economies. Where essential assets are irreparably damaged, affordable replacement technologies must be substituted. Such a selective process tends to act divisively, promoting economic growth on one hand, while widening the economic and environmental disparities of a nation on the other.

Biologist Robert May hypothesizes that such a selective process is undermining health and local environments.[83] He calls attention to a 20th century trend toward accommodating population and per capita income growth through highly productive technological substitutes for natural assets, such as synthetic fertilization, aquaculture, hydropower and irrigation systems. Each substitute solves an immediate and pressing problem. But each increases long-term health risks and requires incremental sacrifices in environmental quality and biodiversity. May fears a slow and steady accommodation to population growth over the next few centuries, increasingly sacrificing the natural world to successfully adjust to the expanding human one, leading to what he calls the "Blade

Runner Scenario" (after a futuristic film set in bleak and lawless 21st century Los Angeles). As in the film, people in future generations might live long and even physically healthy lives in functional but spiritless human systems, devoid of natural diversity and the goods and services the replaced ecosystems once supplied. Born into these systems, people might live completely unaware of the natural world's former splendor and the quality of life it once supported at virtually no cost.

In the short term, there may appear to be little or no alternative to these substitutions and similar adjustments, regardless of the long-term consequences. Over the long term, however, there is little doubt that the necessity for these high-cost institutional adjustments would ease as population size approached relative stability.

Adjusting to Population Growth: The Case of India

If institutions were more broadly representative, would adjustment to population growth be more difficult? While there are many examples with which to test this idea, India provides a well-documented case. The country's per capita GDP in purchasing power parity dollars (an economic measurement standard used in all GDP figures below)[84] averaged 3.2 percent annual growth from 1983 to 1992,[85] while its population grew from 735 million to 883 million during the period. One means by which Indian engineers have helped agricultural production adjust to population growth is through irrigation projects, relying initially on international loans. Large dam construction has submerged hundreds of millions of dollars worth of Indian assets in soil, forest productivity and biodiversity. Statistics on the Sardar Sarovar Projects, a dam and canal system under construction costing over $1 billion, provide some insight.

The reservoir behind the Sardar Sarovar Dam, which is only one element of a multi-dam effort planned for the Narmada River watershed in central India, will submerge 37,000 hectares (143 square miles) and will require an additional 80,000 hectares (309 square miles) for its canals. An estimated 100,000 people will be forced to relocate, and an additional 140,000 farmers will lose land to the major canals. Of course, by liquidating these assets, policymakers will augment the productivity of other, more distant agricultural lands in central and western India for some 50 to 100 years.

In a World Bank-sponsored assessment of the Sardar Sarovar Projects, reviewers found compensation and resettlement for ousted and affected farmers inadequate. They concluded that coastal fisheries near the mouth of the Narmada, upon which thousands of people now depend, would likely "suffer severe losses or be eliminated completely."[86] Despite ongoing construction on the project (which the World Bank refused to refinance), the overall pace of large irrigation projects during the past decade has slowed as Indian organizations representing ousted farmers have learned how to impede construction (or amplify its costs) through the Indian court system and the international and Indian press. However, to be successful, those costs must compete with the short-term political and economic benefits afforded by large-scale irrigation projects. And those short-term benefits keep growing, for India's current population of 970 million adds 18.5 million people every year, a population the size of Sri Lanka's.

India faces a similarly difficult task providing education for its growing population. While engineering graduates from India's technical universities compete

capably with those of North American and European nations, most of India's public primary schooling—attended exclusively by the lower economic classes—remains woefully inadequate.[87] And as recently as 1993, only 68 percent of all Indian children (and only 54 percent of girls) ages 6 to 14 were attending school.[88]

Pressures on the education budget are great. To some observers, prioritizing advanced education during the 1970s and early 1980s, when colleges received from 20 to 25 percent of the Indian government's education budget, paved a technological path for Indian economic growth. To others, basic literacy and health—particularly for women—should have received India's most urgent attentions.[89] Underwriting universal literacy, primary education and health care is an enormously expensive long-term undertaking in a country where 61 percent (over 590 million people) remain *capability poor*—living in families that lack the basic capabilities for economic mobility, including decent levels of nutrition, health and female literacy.[90]

But what if the poor had been proportionally represented in the policies of the Indian government? Quite likely, the government would have invested in primary education and health care for all. Equally likely, it never would have made investments that now accelerate overall GDP but leave the poor and marginalized behind. One can argue about how the Indian economy might now be performing, 50 years after independence, had this occurred. Doubtless, India would be markedly different.

In economic terms, India continues to accommodate population growth. In social terms, the poorest pay the price. Policies favoring some 15 to 20 percent of India's populace are rapidly building a modern country—a second India—inside a larger, much poorer, more rapidly growing population. In the long run, this may be a misstep. According to the UN Development Programme, developing countries that have attempted similar trickle-down strategies in the past have failed to sustain economic growth. Countries with similarly slow rates of change in human development[91] and large income disparities, such as Brazil and Egypt,[92] also experienced periods of moderate to high per capita GDP growth through the 1970s and for some years in the 1980s. Since then, neither country has been able to sustain appreciable growth. From 1983 to 1992, Brazil's per capita GDP on average declined by 0.7 percent annually, while Egypt's GDP on average rose by just 0.8 percent annually. India could face this dilemma in the coming decade.

Slowing Fertility, Enabling Institutions, Fostering Economies

Improving our understanding of how institutions operate in modern societies organizes and gives meaning to much of the evidence concerned with population and economic change. The thesis that institutions mediate this relationship helps explain how some developing countries appear to adjust economically to population growth, and why others—usually the poorest countries—do not. It also helps explain the problem of common property that degrades in the face of growing population pressures. Where

institutions fail to protectively mediate access to public assets, as in the case of some renewable natural resources, “more people” is virtually synonymous with “more use.”

Second, analyses of institutionally mediated feedback systems are likely to play a increasingly visible role in revisionist analyses of population growth. In fact, the hypotheses underlying these analyses have been discussed for some time. Since the 1960s, some analysts have argued that fertility decline leads to economic opportunities for developing countries—through lower dependency ratios, greater investments in children, and increased savings and investment.[93] What is new—and revisionist—is the recognition of how critical good policy instruments and vibrant competitive markets are to converting those economic opportunities into economic assets. The fact that the newly industrialized Asian economies, with their proactive policies and history of trade, were first among the developing world to realize these dividends seems consistent with the institutional thesis.

While acknowledging that the revisionists’ institutional thesis provides an improved explanation of economic dynamics in the developing world, there is more work to be done. Few economists have joined their colleagues in other social sciences in grappling with the issue of institutional bias. Economists already recognize population’s impacts in cases when markets fail to protect assets, and that population growth can exacerbate poorly conceived policies. They also recognize that population growth exerts pressure on institutions to resolve or mitigate scarcities. Taken as a whole, however, economists too rarely recognize that institutional bias and its attendant spillover costs are an integral part of otherwise successful efforts to resolve problems of scarcity relating to population growth. Nor do many recognize that spillover costs tend to exact their greatest toll on the assets of the poor and powerless, along with those of the natural environment, for which representation and information are lacking.

An improved institutional thesis would recognize bias. It would grant that even successful adjustment to population growth has costs, potentially high ones. Recognizing bias, however, does not excuse it. Developing and developed countries alike must, and eventually will, improve their institutions to some extent. Countries can reduce spillover costs associated with population growth by promoting the evolution of institutions that are more broadly representative and more responsive to long-term concerns, and by encouraging a slower growing and ultimately stabilized population.

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22. Carl Menger, Problems of Economics and Sociology (Urbana, IL: University of Illinois Press, 1963), original published in 1883, trans. by Francis J. Nock, cited in Geoffrey McNicoll, "Institutional Analysis of Fertility," in Population, Economic Development and the Environment: The Making of Our Common Future, ed. Kerstin Lindahl-Kiessling and Hans Landberg (Oxford: Oxford University Press, 1994), 201. Carl Menger categorized institutions as either organic institutions, which evolved culturally, or pragmatic institutions, which were created to address explicit political and social needs of the nation state.

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25. The neo-Malthusian paradigm synthesizes: (a) classical economic concerns posed by the rapid increase in human populations and their consumptive demands upon limiting resources, and (b) a body of evidence, gathered principally during the latter half of the 20th century, indicating that the present scale and nature of human activity are rapidly degrading the productive potential of Earth’s natural resources. For the latter evidence, neo-Malthusian scholars draw on the theoretical and empirical experience of the environmental sciences. Neo-Malthusians assume that certain processes--i.e., human fertility, technological progress and institutional change--are severely time-lagged, or partly or wholly outside the economic system (exogenous) and therefore constrained in their responses to economic signals. See: Carole L. Jolly, “Four Theories of Population Change and the Environment,” Population and Environment 16, no. 1 (1994): 61-90.

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28. The National Research Council published its first review of research on rapid population growth in the developing world in 1971, six years after the initiation of the U.S. population assistance program. The 1971 review consists of two volumes, as does the 1986 NRC review: one volume of commissioned papers on various subjects, the other a summary of the findings. Kelley and Schmidt point out that while the individual papers (vol. 1) were largely cautious concerning future economic impacts of population growth, and mindful of the shortage of data at the time, the summary volume (vol. 2), in fact, features stronger concerns about growing populations in the developing world. See: National Research Council, Rapid Population Growth: Consequences and Policy Implications, 2 vols. (Baltimore, MD: Johns Hopkins University Press, 1971); Allen C. Kelley and Robert Schmidt, “Toward a Cure for the Myopia and Tunnel Vision of the Population Debate: A Dose of the Historical Perspective,” in The Impact of Population Growth on Well-Being in Developing Countries, ed. Ahlburg, Kelley, and Mason, 11-35.

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31. National Research Council, Population Growth and Economic Development, 1986, 86-87.

32. National Research Council, 1986, 91.

33. National Research Council, 1986, 90.

34. Kelley and Schmidt, “Population and Income Change.” The authors’ analysis uses economic output data from national accounts that were adjusted for purchasing power parity to be comparable across countries and over time (p. 13). In addition, the authors eliminated 36 countries from the original 135 available in the Penn World Tables because of missing data or concerns about their reliability, extensive dependency on oil or mineral resources, and dependency on remittances. For information on The Penn World Table see: Robert Summers and Alan Heston, “The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950-1988,” Quarterly Journal of Economics 106, no. 2 (1991): 329-368.

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36. Complex systems are systems that can be described mathematically by non-linear systems of equations that involve negative and positive feedbacks. Positive feedbacks are effects that tend to destabilize the system. Negative feedbacks stabilize it. In a system of feedbacks of both types, the state of the system tends to exhibit many possible partially stable (meta-stable) states. The system may often move between those states in fashions that are difficult to predict. Positive feedback dynamics can often be entered by varying any one or all of the variables in the loop--a dynamic that is germane to economic systems and confusing to economists who have been educated to use statistical models focused on correlation and cause-and-effect. On the other hand, the dynamics of a single variable within a complex feedback loop may be such that it impedes any change in the system.

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Reference Bureau (PRB), World Population Data Sheet 1997 (Washington, DC: PRB, 1997); listed with 1997 estimated total fertility rates in parentheses.] Taiwan (1.8), Singapore (1.7), South Korea (1.7) and Hong Kong 1.2 (from 1996 data sheet). Following close behind them in economic achievement is the second set, the "rapidly industrializing countries of Southeast Asia": Thailand (1.9), Malaysia (3.3) and Indonesia (2.9). The World Bank's analysis also includes Japan (1.5). See: World Bank, East Asian Miracle.

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61. Preeg, The Haitian Dilemma, 1996.

62. Cleaver and Schreiber, 1994.

63. Kelley and Schmidt, “Toward a Cure for the Myopia and Tunnel Vision of the Population Debate,” 1994.

64. United Nations, World Population Prospects, The 1994 Revision.

65. UNDP, 1996.

66. Douglass C. North, Structure and Change in Economic History (New York: W. W. Norton, 1981); Richard A. Easterlin, Growth Triumphant (Ann Arbor, MI: University of Michigan Press, 1996), 55-65.

67. Xenos points out that prices are assigned to goods and services at the margin only when a perception of some degree of their scarcity arises. While market forces

mitigate severe, acute scarcity by mobilizing supply to address demand, suppliers will not completely resolve that scarcity because it would eliminate profits. See: Nicholas Xenos, Scarcity and Modernity (New York: Routledge, 1989).

68. For a more detailed discussion of negative externalities associated with population growth see: Birdsall and Griffin.

69. John Stuart Mill, Principles of Political Economy, With Some of Their Application to Social Philosophy (London: J.W. Parker, 1848) quoted in McNicoll, "Institutional Analysis of Fertility."

70. Terry L. Anderson, "Water, Water Everywhere but Not a Drop to Sell," in The State of Humanity, ed. Julian L. Simon (Oxford: Blackwell, 1995), 425-433.

71. According to the Trust for Public Lands, New York City originally targeted some 80,000 acres for acquisition, but has since decided not to set upper limits on the acquisition program. The goal of this plan is to protect watersheds feeding the city's reservoirs from development, and to preserve the naturally vegetated status of these ecosystems. See: Trust for Public Lands (TPL), Protecting the Source: Land Conservation and the Future of America's Drinking Water, Report, (San Francisco: TPL, 1997).

72. Garrett states that nearly one half billion passengers were projected to board airline flights in 1996. And, according to a composite of information from the U.N. High Commissioner for refugees and Worldwatch Institute, in 1994 at least 10 million people immigrated, an additional 30 million were involved in domestic rural to urban migration, and some 23 million were displaced by war or social unrest. See: Laurie Garrett, "The Return of Infectious Disease," Foreign Affairs 75, no. 1 (1994): 69-70.

73. U.S. Department of Commerce, Bureau of the Census, World Population Profile: 1996 by Thomas M. McDevitt, Report WP/96, 45-46 (Washington, DC, 1996).

74. McNicoll, "Institutional Analysis of Fertility," 203.

75. Irma Adelman, et al., "Institutional Change, Economic Development, and the Environment," Ambio 21, no. 1 (1992): 106-110.

76. Douglass C. North, Institutions, Institutional Change and Economic Performance (Cambridge: Cambridge University Press, 1995), 16.

77. For example, in Africa 22 percent of all educational budgets goes to college-level education, yet only 2 percent of primary school students ever move to this level. Source: World Bank, World Bank Development Report, 1990 (Washington, DC: World Bank, 1990), 33-34. This spending may provide a shortcut to better governmental and financial organizations, but it nonetheless favors the rich over the poor. Similarly, increases in gross domestic product favor investments in curative health care over preventative public health that would reach a broader segment of society. And, paradoxically, during land reform the granting of title deeds to individuals and legal use rights to groups has often been manipulated by local elites and wealthy speculators, leaving the poor landless or short of resources, and promoting resource exploitation. See: Narpat S. Jodha, "The Decline of Common Property Resources in Rajasthan, India," Overseas Development Network Paper, no. 22c (London: Overseas Development

Institute, 1988); John G. Galaty, "This Land is Yours: Social and Economic Factors in the Privatization, Sub-Division and Sale of Maasai Ranches," Nomadic Peoples 30 (1992): 26-40; Maria C. Cruz, et al., Population Growth, Poverty, and Environmental Stress: Frontier Migration in the Philippines and Costa Rica (Washington, DC: World Resources Institute, 1992).

78. Sutti Ortiz, "Expectations and Forecasts in the Face of Uncertainty," Man 14 (1979): 64-80.

79. Jeanne E. Arnold, "Social Inequality, Marginalization, and Economic Process," in Foundations of Social Inequality, ed. T. Douglas Price and Gary M. Feinman (New York: Plenum, 1995), 87-103.

80. Manuel Castells and Alejandro Portes, "World Underneath: The Origins, Dynamics, and Effects of the Informal Economy," in The Informal Economy: Studies in Advanced and Less Developed Countries, ed. Alejandro Portes, Manuel Castells, and Lauren A. Benton (Baltimore, MD: The Johns Hopkins University Press, 1989), 11-37.

81. David W. Pearce, "Economics of the Environment," in A Guide to Modern Economics, ed. David Greenaway, Michael F. Bleaney, and Ian M. T. Stewart (London: Routledge, 1996), 174-200.

82. Christopher D. Stone, Should Trees Have Standing?: Toward Legal Rights for Natural Objects (Palo Alto, CA: W. Kaufmann, 1974); Robyn Eckersley, "Liberal Democracy and the Rights of Nature: The Struggle for Inclusion," Environmental Politics 4, no. 4 (1995): 169-198.

83. Robert May, Knowledge and Ignorance: Patterns of Investment in Understanding Biodiversity, Resources for the Future Seminar Series (Washington, DC: Smithsonian Institution, 22 October 1996).

84. We obtained estimates of per capita GDP (corrected to reflect "purchasing power parity") for India, Egypt and Brazil from the Penn World Table (Mark 5.6). In this version, the maximum range of data available for any country is 1950 to 1992. The GDP per capita measure used here was the variable (RGDPCH) recommended for inter-temporal time series. See: Summers and Heston, "The Penn World Table (Mark 5)": 329-368.

85. India's sustained per capita GDP growth during this period is broken only by negative growth in 1991, the year of India's foreign exchange reserve crisis.

86. Bradford W. Morse and Thomas R. Berger, executive summary of "Sardar Sarovar Projects: Independent Review," STEPS Quarterly (India) 2, no. 3 & 4 (1992): 28-34.

87. Statistical evidence of impediments to India achieving universal primary education include a persistently high and climbing student-to-teacher ratio of 48:1 (data for 1993, UNESCO), whereas in almost all South American countries the ratio is now below 30:1. Poor attendance of teachers in public school classrooms is commonly acknowledged in India, particularly in rural areas in the northern states. Colletta and Sutton state that historically, there have been strong differences in enrollments in primary education based upon gender, caste and household income, and a tendency to under-fund

primary education. Educational expenditures as a percentage of gross national product (3.7 percent in 1992, data from UNESCO) or as a total of government expenditures (11.5 percent in 1992) are in the low-to-medium range of values when compared with other developing countries experiencing similar rates of population growth. Source of data: United Nations Educational, Scientific and Cultural Organization (UNESCO), UNESCO Statistical Yearbook, 1995 (Lanham, MD: Bernan Press, 1995), 4-13. Also see: Nat J. Colletta and Margaret Sutton, Achieving and Sustaining Universal Primary Education: International Experience Relevant to India, Policy, Planning and Research Working Paper, WPS 166 (Washington, DC: World Bank, 1989).

88. International Institute for Population Studies (IIPS), National Family Health Survey (MCH and Family Planning), India 1992-93 (Bombay: IIPS, 1995), 50.

89. Ashish Bose, India's Population Policy--Changing Paradigm (Delhi: B.R. Publishing, 1996) 183-185.

90. UNDP, Human Development Report 1996, 27.

91. The U.N. Development Programme measures human development using the human development index (HDI). The HDI is calculated using a formula based on three indicators: life expectancy at birth; educational attainment (adult literacy and combined enrollment ratios); and standard of living as measured by real GDP per capita in purchasing power parity dollars (PPP$). See: UNDP, 1996, 106.

92. UNDP, 1996, 82.

93. Ansley J. Coale and Edgar M. Hoover, Population Growth and Economic Development in Low-Income Countries: A Case Study of India's Prospect (Princeton: Princeton University Press, 1958), 304-320.