The Region

Federal Reserve Bank of Minneapolis

2003 Annual Report

The Industrial Revolution

Past and Future

Robert E. Lucas Jr.

Volume 18 Number 1
May 2004
ISSN 1045-3369

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Federal Reserve Bank of Minneapolis
P.O. Box 291
Minneapolis, MN 55480-0291

e-mail: letters@mpls.frb.org
Web: minneapolisfed.org

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Message from the President

One of the most vexing questions in economics today is that which began a revolution in economic thought over two centuries ago: Why are some nations rich and others poor? When Adam Smith addressed that problem in his monumental work, *An Inquiry into the Nature and Causes of the Wealth of Nations*, the world was still in the early throes of what we now call the Industrial Revolution. But even then the fault lines between prosperous and poor countries were splitting. In language that parallels the current debate, Smith wrote in 1776 of nations "so miserably poor" that the young, old and infirm often met death for lack of basic necessities; meanwhile, some people in "thriving nations" were so wealthy they didn't have to work, and even a laborer of "the lowest and poorest order" enjoyed a life far better than a citizen of a poor country could ever attain.

Since then, the chasm has only widened. As Bob Lucas states up front in the following essay: "We live in a world of staggering and unprecedented income inequality." From there Bob describes the problem and offers a nice bit of economic history before presenting a framework for the consideration of possible solutions. I won't spoil the pleasure of reading the following essay by summarizing its main themes, but suffice to say that Bob describes the Industrial Revolution as being in a state of transition that can be understood, in part, by a careful review of issues related to human capital, with particular insight gleaned from an examination of birthrates.

Just as Smith was not alone in asking such questions and suggesting answers—in many respects his greatest contribution was to coalesce existing ideas into a coherent whole—likewise, a great many thinkers have made contributions over the years. The same holds true today. Economists and policymakers in universities and institutions throughout the world are grappling with the question of economic growth across countries, including economists within the Federal Reserve System and this Federal Reserve Bank. After all, one of the Fed's primary responsibilities is to establish monetary policy conducive to stable economic growth—the better we understand the nature of economic growth, the better we can do our job.

As Bob has stated in the past—once you start thinking about differences in economic growth, it's difficult to think of anything else. Whether you are familiar with the current debate about economic growth or are a relative newcomer, I am sure you will benefit from Bob's take on the subject, and that you will look at the world in a new way. We welcome your comments.

Gary H. Stern
President

The Industrial Revolution

Past and Future

Robert E. Lucas Jr.
John Dewey Distinguished Service Professor of Economics, University of Chicago
Adviser, Federal Reserve Bank of Minneapolis

We live in a world of staggering and unprecedented income inequality. Production per person in the wealthiest economy, the United States, is something like 15 times production per person in the poorest economies of Africa and South Asia. Since the end of the European colonial age, in the 1950s and '60s, the economies of South Korea, Singapore, Taiwan and Hong Kong have been transformed from among the very poorest in the world to middle-income societies with a living standard about one-third of America's or higher. In other economies, many of them no worse off in 1960 than these East Asian "miracle" economies were, large fractions of the population still live in feudal sectors with incomes only slightly above subsistence levels. How are we to interpret these successes and failures?

Economists, today, are divided on many aspects of this question, but I think that if we look at the right evidence, organized in the right way, we can get very close to a coherent and reliable view of the changes in the wealth of

nations that have occurred in the last two centuries and those that are likely to occur in this one. The Asian miracles are only one chapter in the larger story of the world economy since World War II, and that story in turn is only one chapter in the history of the industrial revolution. I will set out what I see as the main facts of the economic history of the recent past, with a minimum of theoretical interpretation, and try to see what they suggest about the future of the world economy. I do not think we can understand the contemporary world without understanding the events that have given rise to it.

I will begin and end with numbers, starting with an attempt to give a quantitative picture of the world economy in the postwar period, of the growth of population and production since 1950. Next, I will turn to the economic history of the world up to about 1750 or 1800, in other words, the economic history known to Adam Smith, David Ricardo and the other thinkers who have helped us form our vision of how the world works. Third, I will sketch what I see as the main features of the initial phase of the industrial revolution, the years from 1800 to the end of the colonial age in 1950. Following these historical reviews, I will outline a theoretical structure roughly consistent with the facts. If I succeed in doing this well, it may be possible to conclude with some useful generalizations and some assessments of the world's future economic prospects.

The world economy in the postwar period

Today, most economies enjoy sustained growth in average real incomes as a matter of course. Living standards in all economies in the world 300 years ago were more or less equal to one another and more or less constant over time. Following common practice, I use the term *industrial revolution* to refer to this change in the human condition, although the modifier *industrial* is slightly outmoded, and I do not intend to single out iron and steel or other heavy industry, or even manufacturing in general, as being of special importance. By a country's average real income, I mean simply its gross domestic product (GDP) in constant dollars divided by its population. Although I will touch on other aspects of society, my focus will be on economic success, as measured by population and production.

Our knowledge of production and living standards at various places and times has grown enormously in the past few decades. The most recent empirical contribution, one of the very first importance, is the Penn World Table project conducted by Robert Summers and Alan Heston.[1] This readily available, conveniently organized data set contains population and production data on every country in the world from about 1950 or 1960 (depending on the country) to the present. The availability of this marvelous body of data has given the recent revival of mathematical growth theory an explicitly empirical character that is quite different from the more purely theoretical investigations of the 1960s. It has also stimulated a more universal, ambitious style of theorizing aimed at providing a unified account of the behavior of rich and poor societies alike.

As a result of the Penn project, we now have a reliable picture of production in the entire world, both rich and poor countries. Let us review the main features of this picture, beginning with population estimates. Over the 40-year period from 1960 through 2000, world population grew from about 3 billion to 6.1 billion, or at an annual rate of 1.7 percent. These numbers are often cited with alarm, and obviously the number of people in the world cannot possibly grow at 2 percent per year forever. But many exponents of what a friend of mine calls the "economics of gloom" go beyond this truism to suggest that population growth is outstripping available resources, that the human race is blindly multiplying itself toward poverty and starvation. This is simply nonsense.

There is, to be sure, much poverty and starvation in the world, but nothing could be further from the truth than the idea that poverty is increasing. Over the same period during which population has grown from 3 billion to 6.1 billion, total world production has grown much faster than population, from $6.5 trillion in 1960 to $31 trillion in 2000. (All the dollar magnitudes I cite, from the Penn World Table or any other source, will be in units of 1985 U.S. dollars.) That is, world production was nearly multiplied by five over this 40-year period, growing at an annual rate of 4 percent. Production per person—real income—thus grew at 2.3 percent per year, which is to say that the living standard of the average world citizen more than doubled. Please understand: I am not quoting figures for the advanced economies or for a handful of economic miracles. I am not excluding Africa or the communist countries. These are numbers for the world as a whole. The entire human race is getting rich, at historically unprecedented rates. The economic miracles of East Asia are, of course, atypical in their magnitudes, but economic growth is not the exception in the world today: It is the rule.

Average figures like these mask diversity, of course. Figure 1 shows one way to use the information in the Penn World Table to summarize the distribution of the levels and growth rates of population and per capita incomes in the postwar world. It contains two bar graphs of per capita incomes, one for 1960 and the other for 1990 (not 2000). The horizontal axis is GDP per capita, in thousands of dollars. The vertical axis is population. The height of each bar is proportional to the number of people in the world with average incomes in the indicated range, based on the assumption (though, of course, it is false) that everyone in a country has that country's average income. The figure shows that the number of people (not just the fraction) in countries with mean

[1] A good description is available in: Robert Summers and Alan Heston, "The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950–1988." *Quarterly Journal of Economics,* 105 (1991): 327–368. The latest versions of the tables are available at pwt.econ.upenn.edu.

incomes below $1,100 has declined between 1960 and 1990. The entire world income distribution has shifted to the right, without much change in the degree of income inequality, since 1960. At the end of the period, as at the beginning, the degree of inequality is enormous. The poorest countries in 1990 have per capita incomes of around $1,000 per year compared to the U.S. average of $18,000: a factor of 18. This degree of inequality between the richest and poorest societies is without precedent in human history, as is the growth in population and living standards in the postwar period.

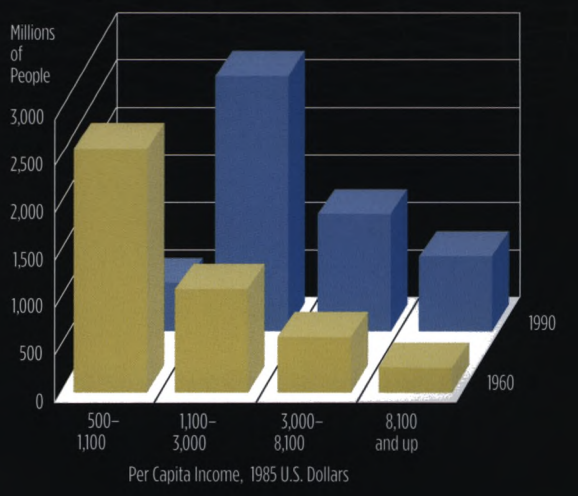
A great deal of recent empirical work focuses on the question of whether per capita incomes are converging to a common (growing) level, or possibly diverging. From Figure 1 it is evident that this is a fairly subtle question. In any case, it seems obvious that we are not going to learn much about the economic future of the world by simple statistical extrapolation of events from 1960 to 1990, however it is carried out. Extrapolating the 2 percent population growth rate backward from 1960, one would conclude that Adam and Eve were expelled from the garden in about the year 1000. Extrapolating the 2.2 rate of per capita income growth backward, one would infer that people in 1800 subsisted on less than $100 per year. Extrapolating forward leads to predictions that the earth's water supply (or supply of anything else) will be exhausted in a finite period. Such exercises make it clear that the years since 1960 are part of a period of transition, but from what to what? Let us turn to history for half the answer to this question.

Comparison to earlier centuries

The striking thing about postwar economic growth is how recent such growth is. I have said that total world production has been growing at over 4 percent since 1960. Compare this to annual growth rates of 2.4 percent for the first 60 years of the 20th century, of 1 percent for the entire 19th century, of one-third of 1 percent for the 18th century.[2] For these years, the growth in both population and production was far lower than in modern times.

[2] The sources for these and many other figures cited in this section are given in Chapter 5 of my *Lectures on Economic Growth* (Cambridge: Harvard University Press), 2002.

Figure 1
Income Distribution



Moreover, it is fairly clear that up to 1800 or maybe 1750, no society had experienced sustained growth in per capita income. (Eighteenth century population growth also averaged one-third of 1 percent, the same as production growth.) That is, up to about two centuries ago, per capita incomes in all societies were stagnated at around $400 to $800 per year. But how do we know this? After all, the Penn World Tables don't cover the Roman Empire or the Han Dynasty. But there are many other sources of information.

In the front hall of my apartment in Chicago there is a painting of an agricultural scene, a gift from a Korean student of mine. In the painting, a farmer is plowing his field behind an ox. Fruit trees are flowering, and mountains rise in the background. The scene is peaceful, inspiring nostalgia for the old days (though I do not know when the painting was done or what time period it depicts). There is also much information for an economist in this picture. It is not difficult to estimate the income of this farmer, for we know about how much land one farmer and his ox can care for, about how much can be grown on this land, how much fruit the little orchard will yield and how much the production would be worth in 1985 U.S. dollar prices. This farmer's income is about $2,000 per year. Moreover, we know that up until recent decades, almost all of the Korean workforce (well over 90 percent) was engaged in traditional agriculture, so this figure of $2,000 ($500 per capita) for the farmer, his wife and his two children must be pretty close to the per capita income for the country as a whole. True, we do not have sophisticated national income and product accounts for Korea 100 years ago, but we don't need them to arrive at fairly good estimates of living standards that prevailed back then. Traditional agricultural societies are very like one another, all over the world, and the standard of living they yield is not hard to estimate reliably.

Other, more systematic, information is also available. For poor societies—all societies before about 1800—we can reliably estimate income per capita using the idea that average living standards of most historical societies must have been very near the estimated per capita production figures of the poorest contemporary societies. Incomes in, say, ancient China cannot have been much lower than incomes in 1960 China and still sustained stable or growing populations. And if incomes in any part of the world in any time period had been much larger than the levels of the poor countries of today—a factor of two, say—we would have heard about it. If such enormous percentage differences had ever existed, they would have made some kind of appearance in the available accounts of the historically curious, from Herodotus to Marco Polo to Adam Smith.

To say that traditional agricultural societies did not undergo growth in the living standards of masses of people is not to say that such societies were stagnant or uninteresting. Any schoolchild can list economically important advances in technology that occurred well before the industrial revolution, and our increasing mastery of our environment is reflected in accelerating population growth over the centuries. Between year 0 and year 1750, world population grew from around 160 million to perhaps

700 million (an increase of a factor of four in 1,750 years). In the assumed absence of growth in income per person, this means a factor of four increase in total production as well, which obviously could not have taken place without important technological changes. But in contrast to a modern society, a traditional agricultural society responds to technological change by increasing population, not living standards. Population dynamics in such a society obey a Malthusian law that maintains product per capita at $600 per year, independent of changes in productivity.

How then did these traditional societies support the vast accomplishments of the ancient civilizations of Greece and Rome, of China and India? Obviously, not everyone in these societies was living on $600 per year. The answer lies in the role and wealth of landowners, who receive about 30 percent to 40 percent of agricultural income. A nation of 10

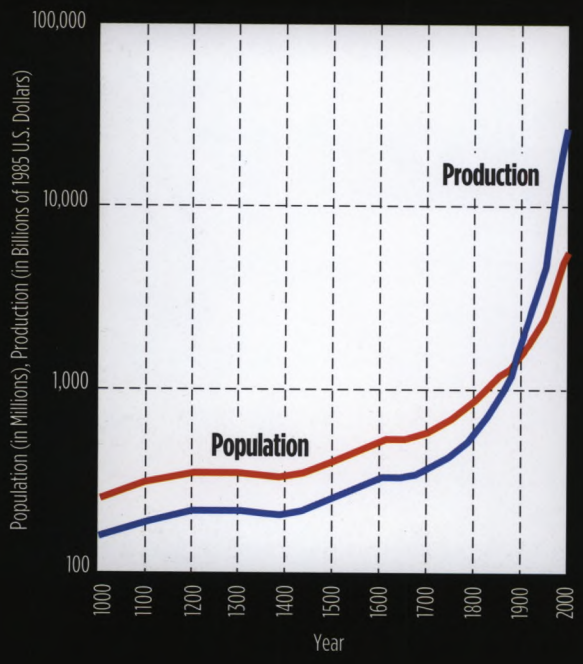
[I]n contrast to a modern society, a traditional agricultural society responds to technological change by increasing population, not living standards.

million people with a per capita production of $600 per year has a total income of $6 billion. Thirty percent of $6 billion is $1.8 billion. In the hands of a small elite, this kind of money can support a fairly lavish lifestyle or build impressive temples or subsidize many artists and intellectuals. As we know from many historical examples, traditional agricultural society can support an impressive civilization. What it cannot do is generate improvement in the living standards of masses of people. The Korean farmer plowing his field in the painting in my hallway could be in any century in the last 1,000 years. Nothing in the picture would need to be changed to register the passage of the centuries.

If the living standard in traditional economies was low, it was at least fairly equally low across various societies. Even at the beginning of the age of European colonialism, the dominance of Europe was military, not economic. When the conquistadors of Spain took control of the societies of the Incas and the Aztecs, it was not a confrontation between a rich society and a poor one. In the 16th century, living standards in Europe and the Americas were about the same. Indeed, Spanish observers of the time marveled at the variety and quality of goods that were offered for sale in the markets of Mexico. Smith, Ricardo and their contemporaries argued about differences in living standards, and perhaps their discussions can be taken to refer to income differences as large as a factor of two. But nothing remotely like the income differences of our current world, differences on the order of a factor of 25, existed in 1800 or at any earlier time. Such inequality is a product of the industrial revolution.

Figure 2

World Population and Production



The beginnings of the industrial revolution

Traditional society was characterized by stable per capita income. Our own world is one of accelerating income growth. The course of the industrial revolution, our term for the transition from stable to accelerating growth, is illustrated in Figure 2, which plots total world population and production from the year 1000 up to the present. I use a logarithmic scale rather than natural units, so that a constant rate of growth would imply a straight line. One can see from the figure that the growth rates of both population and production are increasing over time. The vertical scale is millions of persons (for population)

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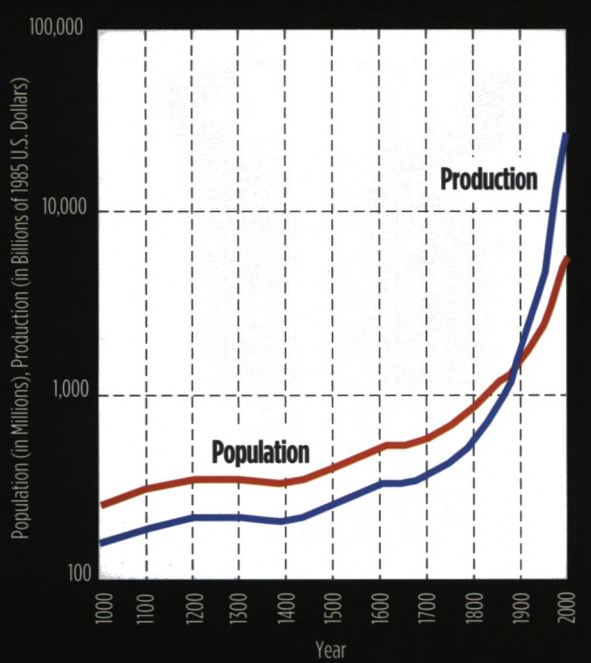

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and billions of 1985 U.S. dollars (for production). The difference between the two curves is about constant up until 1800, reflecting the assumption that production per person was roughly constant prior to that date. Then in the 19th century, growth in both series accelerates dramatically, and production growth accelerates more. By 1900 the two curves cross, at which time world income per capita was $1,000 per year. The growth and indeed the acceleration of both population and production continue to the present.

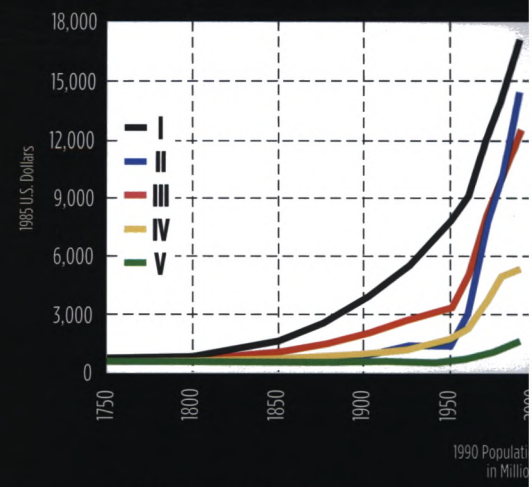
Of course, the industrial revolution did not affect all parts of the world uniformly, nor is it doing so today. Figure 3, based on per capita income data estimated as I have discussed, is one way of illustrating the origins and the diffusion of the industrial revolution. To construct the figure, the countries (or regions) of the world were organized into five groups, ordered by their current per capita income levels. Group I—basically, the English-speaking countries—are those in which per capita incomes first exhibited sustained growth. Group II is Japan, isolated only because I want to highlight its remarkable economic history. Group III consists of northwest Europe, the countries that began sustained growth somewhat later than Group I. Group IV is the rest of Europe, together with European-dominated economies in Latin America. Group V contains the rest of Asia and Africa.

As shown in Figure 3, per capita incomes were approximately constant, over space and time, over the period 1750–1800, at a level of something like $600 to $700. Here and below, the modifier "approximately" must be taken to mean plus or minus $200. Following the reasoning I have advanced above, $600 is taken as an estimate of living standards in all societies prior to 1750, so there would be no interest in extending Figure 3 to the left. The numbers at the right of Figure 3 indicate the 1990 populations, in millions of people, for the five groups of countries. About two-thirds of the world's people live in Group V, which contains all of Africa and Asia except Japan.

Reading Figure 3 from left to right, we can see the emergence over the last two centuries of the inequality displayed in Figure 1. By 1850 there was something like a factor of two difference between the English-speaking countries and the poor countries of Africa and Asia. By 1900, a difference of per-

Figure 3

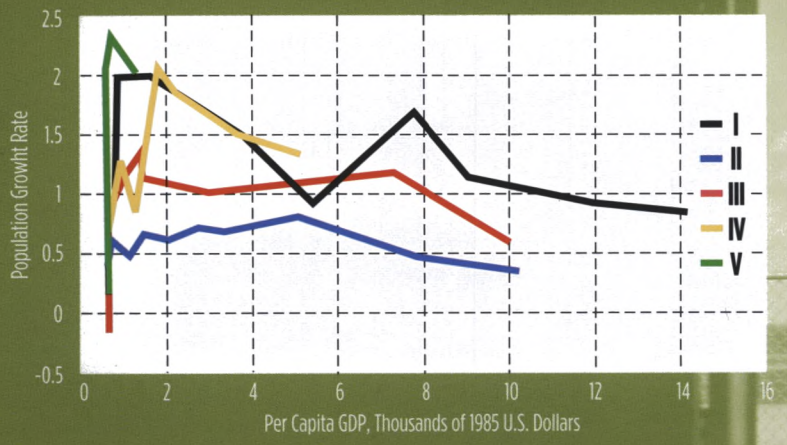
GDP Per Capita, Five Regions



I	UK, USA, Canada, Australia, New Zealand	3
II	Japan	1
III	France, Germany, Netherlands, Scandinavia	1
IV	Rest of Western Europe, Latin America, Eastern Europe, Soviet Union	9
V	Asia (except Japan), Africa	3,5

Figure 4

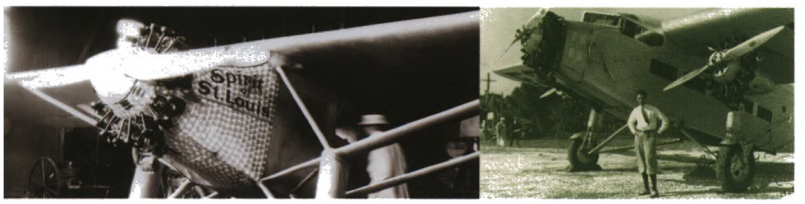
Demographic Transitions



I	UK, USA, Canada, Australia, New Zealand
II	Japan
III	France, Germany, Netherlands, Scandinavia
IV	Rest of Western Europe, Latin America, Eastern Europe, Soviet Union
V	Asia (except Japan), Africa

haps a factor of six had emerged. At that time, the rest of Europe was still far behind England and America, and Japanese incomes were scarcely distinguishable from incomes in the rest of Asia. In the first half of the 20th century, the inequality present in 1900 was simply magnified. The English-speaking countries gained relative to northern Europe, which in turn gained on the rest of Europe and Asia. Notice, too, that per capita income in what I have called Group V, the African and Asian countries, remained constant at around $600 up to 1950. The entire colonial era was a period of stagnation in the living standards of masses of people. European imperialism brought advances in technology to much of the colonized world, and these advances led to increases in production that could, as in British India, be impressive. But the outcome of colonial economic growth was larger populations, not higher living standards.

In the period since 1950, the pattern of world growth has begun to change character, as well as to



accelerate dramatically. What was at first thought to be the postwar recovery of continental Europe and of Japan turned out to be the European and Japanese miracles, taking these countries far beyond their prewar living standards to levels comparable to the United States. (There are some miracles in my Group IV, too—Italy and Spain—that are not seen on the figure because they are averaged in with Latin America and the communist world.) The second major change in the postwar world is the beginning of per capita income growth in Africa and Asia, entirely a post-colonial phenomenon. The industrial revolution has begun to diffuse to the non-European world, and this, of course, is the main reason that postwar growth rates for the world as a whole have attained such unprecedented levels.

If we use growth in per capita income as the defining characteristic of the industrial revolution, then it is clear from Figure 3 that the revolution did not begin before the late 18th century. If we use growth in total product, reflecting improvements in technology, as the defining characteristic, then Figure 2 makes it clear that the beginnings of the revolution must have been centuries earlier (or, that there must have been important, earlier revolutions). What occurred around 1800 that is new, that differentiates the modern age from all previous periods, is not technological change by itself but the fact that sometime after that date fertility increases ceased to translate improvements in technology into increases in population. That is, the industrial revolution is invariably associated with the reduction in fertility known as the *demographic transition*.

Figure 4 provides a rough description of the demographic transitions since 1750 that have occurred and are still occurring. The figure exhibits five plotted curves, one for each country group. Each curve connects 10 points, corresponding to the time periods beginning in 1750 and ending in 1990, as indicated at the bottom of Figure 3. (Note that the periods are not of equal length.) Each point plots the group's average rate of population growth for that period against its per capita income at the beginning of the period. The per capita GDP figures in 1750 can just be read off Figure 3, from which it is clear that they are about $600 for all five groups. Population growth rates in 1750 average about 0.4 percent and are well below 1 percent for all five groups. For each group, one can see a nearly vertical increase in population growth rates with little increase in GDP per capita, corresponding to the onset of industrialization. This, of course, is precisely the response to technological advance that Malthus and Ricardo told us to expect. Then, in groups I to IV a maximum is reached, and as incomes continue to rise, population growth rates decline. In group V—most of Asia and Africa—the curve has only leveled off, but does anyone doubt that these regions will follow the path that the rest of the world has already worn?

Theoretical responses

I have brought the story of the industrial revolution up to the present. Where are we going from here? For this, we need a theory of growth, a system of equations that makes economic sense and that fits the facts I have just reviewed. There is a tremendous amount of very promising research now occurring in economics, trying to construct such a system, and

in a few years we will be able to run these equations into the future and see how it will look. Now, though, I think it is accurate to say that we have not one but two theories of production: one consistent with the main features of the world economy prior to the industrial revolution and another roughly consistent with the behavior of the advanced economies today. What we need is an understanding of the transition.

One of these successful theories is the product of Smith, Ricardo, Malthus and the other classical economists. The world they undertook to explain was the world on the eve of the industrial revolution, and it could not have occurred to them that economic theory should seek to explain sustained, exponential growth in living standards. Their theory is consistent with the following stylized view of economic history up to around 1800. Labor and resources combine to produce goods—largely food, in poor societies—that sustain life and reproduction. Over time, providence and human ingenuity make it possible for given amounts of labor and resources to produce more goods than they could before. The resulting increases in production per person stimulate fertility and increases in population, up to the point where the original standard of living is restored. Such dynamics, operating over the centuries, account for the gradually accelerating increase in the human population and the distribution of that population over the regions of the earth in a way that is consistent with the approximate constancy of living standards everywhere. The model predicts that the living standards of working people are maintained at a roughly constant, "subsistence" level, but with realistic shares of income going to landowners, the theory is consistent as well with high civilization based on large concentrations of wealth.

This classical theory is not inconsistent with the enormous improvements in knowledge relevant to productivity that occurred long before the 18th century, improvements that supported huge population increases and vast wealth for owners of land and other resources. Increases in knowledge over the centuries also stimulated a large-scale accumulation of productive capital: shipbuilding, road and harbor construction, draining of swamps, and breeding and raising of animal herds for food and power. Capital accumulation, too, played a role in supporting ever larger populations. Yet under the Malthusian theory of fertility, neither new knowledge nor the capital accumulation it makes profitable is enough to induce the sustained growth in living standards of masses of people that modern economists take as the defining characteristic of the industrial revolution.

The modern theory of sustained income growth, stemming from the work of Robert Solow in the 1950s, was designed to fit the behavior of the economies that had passed through the demographic transition.[3] This theory deals with the problem posed by Malthusian fertility by simply ignoring the economics of the problem and assuming a fixed rate of population growth. In such a context, the accumulation of physical capital is not, in itself, sufficient to account for sustained income growth. With a fixed rate of labor force growth, the law of diminishing returns puts a limit on the income increase that capital accumulation can generate. To account for sustained growth, the modern theory needs to postulate continuous improvements in technology or in knowledge or in human capital (I think these are all just different terms for the same thing) as an "engine of growth." Since such a postulate is consistent with the evidence we have from the modern (and the ancient) world, this does not seem to be a liability of the theory.

The modern theory, based on fixed fertility, and the classical theory, based on fertility that increases with increases in income, are obviously not mutually consistent. Nor can we simply say that the modern theory fits the modern world and the classical theory the ancient world, because we can see traditional societies exhibiting Malthusian behavior in the world today. Increases since 1960 in total production in Africa, for example, have been almost entirely absorbed by increases in population, with negligible increases in income per capita. Understanding the progress of the industrial revolution as it continues today necessarily entails understanding why it is that Malthusian dynamics have ceased to hold in much of the contemporary world. Country after country has gone through a demographic transition, involving increases in the rate of population growth followed by decreases, as

Robert M. Solow, "A Contribution to the Theory of Economic Growth." *Quarterly Journal of Economics*, 70 (1956): 65–94.

income continues to rise. Some of the wealthiest countries—Japan and parts of Europe—are just about maintaining their populations at current levels. People in these wealthy economies are better able to afford large families than people in poor economies, yet they choose not to do so.

If these two inconsistent theories are to be reconciled, with each other and with the facts of the demographic transition, a second factor needs to work to decrease fertility as income grows, operating alongside the Malthusian force that works to increase it. Gary Becker proposed long ago that this second factor be identified with the *quality* of children: As family income rises, spending on children increases, as assumed in Malthusian theory, but these increases can take the form of a greater number of children or of a larger allocation of parental time and other resources to each child. Parents are assumed to value increases both in the quantity of children and in the quality of each child's life.[4]

Of course, both the quality-quantity trade-off in Becker's sense and the importance of human capital are visible well before the industrial revolution. In any society with established property rights, a class of landowners will be subject to different population dynamics due to the effect their fertility has on inheritances and the quality of lives their children enjoy. Such families can accumulate vast wealth and enjoy living standards far above subsistence. For the histories of what we call civilization, this deviation from a pure Malthusian subsistence model is everything. For the history of living standards of masses of people, however, it is but a minor qualification.

[4] Gary S. Becker, "An Economic Analysis of Fertility." In Richard Easterlin, ed., *Demographic and Economic Change in Developed Countries*. Princeton: Princeton University Press, 1960. See also Robert J. Barro and Gary S. Becker, "Fertility Choice in a Model of Economic Growth." *Econometrica*, 57 (1989): 481–501.

Whatever the importance of human capital accumulation in the original industrial revolution, there is no doubt that rapid improvement in skills is characteristic of its diffusion in the modern world economy.

Similarly, in any society of any complexity, some individuals can, by virtue of talent and education, formal or informal, acquire skills that yield high income, and as the Bachs and the Mozarts can testify, such exceptions can run in families. For most societies, though, income increases due to what a modern economist calls *human capital* are exceptional and often derivative, economically, from landowner wealth.

For a landless family in a traditional agricultural economy, the possibilities for affecting the quality of children's lives are pretty slight. If there is no property to pass on, an additional child does not dilute the inheritance of siblings. Parents could spend time and resources on the child's education in the attempt to leave a bequest of human capital. All parents do this to some degree, but the incentives to do so obviously depend on the return to human capital offered by the society the parents live in. Where this return is low, adding the quality dimension to the fertility decision may be only a

minor twist on Malthusian dynamics. In short, neither the possibility of using inheritable capital to improve the quality of children's lives nor the possibility of accumulating human capital needs to result in fundamental departures from the predictions of the classical model.

But these additional features do offer the possibility of non-Malthusian dynamics, and the possibility has promise because the process of industrialization seems to involve a dramatic increase in the returns to human capital. People are moving out of traditional agriculture, where the necessary adult skills can be acquired through on-the-job child labor. More and more people are entering occupations different from their parents' occupations that require skills learned in school as well as those learned at home. New kinds of capital goods require workers with the training to operate and to improve upon them. In such a world a parent can do many things with time and resources that will give a child advantages in a changing economy, and the fewer children a parent has, the more such advantages can be given to each child.

It is a unique feature of human capital that it yields returns that cannot be captured entirely by its "owner." Bach and Mozart were well paid (though neither as well as he thought he deserved), but both of them provided enormous stimulation and inspiration to others for which they were paid nothing, just as both of them also gained from others. Such *external effects*, as economists call them, are the subject matter of intellectual and artistic history and should be the main subject of industrial and commercial history as well. These pervasive external effects introduce a kind of feedback into human capital theory: Something that increases the return on human capital will stimulate greater accumulation, in turn stimulating higher returns, stimulating still greater accumulation and so on.

On this general view of economic growth, then, what began in England in the 18th century and continues to diffuse throughout the world today is something like the following. Technological advances occurred that increased the wages of those with the skills needed to make economic use of these advances. These wage effects stimulated others to accumulate skills and stimulated many families to decide against having a large number of unskilled children and in favor of having fewer children, with more time and resources invested in each. The presence of a higher-skilled workforce increased still further the return to acquiring skills, keeping the process going. Wouldn't such a process bog down due to diminishing returns to skill-intensive goods? Someone has to dig potatoes, after all. It might, and I imagine that many incipient industrial revolutions died prematurely due to such diminishing returns. But international trade undoubtedly helped England attain critical mass by letting English workers specialize in skill-demanding production while potatoes were imported from somewhere else.

Whatever the importance of human capital accumulation in the original industrial revolution, there is no doubt that rapid improvement in skills is characteristic of its diffusion in the modern world economy. Nancy Stokey estimates that the major stimulus of the North American Free Trade

As a result of the combination of poor countries with very little income growth and wealthy countries with sustained growth, the degree of income inequality across societies has reached unprecedented levels. None of this can persist. This, I think, is the main lesson of the broader history of the industrial revolution, as viewed by modern growth theory.

Agreement to economic growth in Mexico will be not the inflow of physical capital (though that is considerable), but the increased accumulation of human capital that will be stimulated by the higher rate of return the new physical capital will induce.[5] Post-NAFTA Mexico is increasingly an economy that assigns high rewards to training and technological skills.

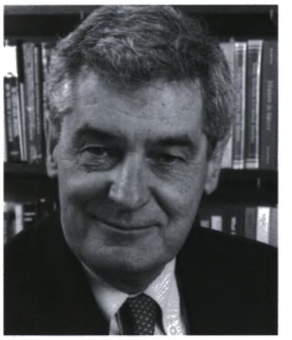
Generalizations from experience

Economically, the 60 years since the end of World War II have been an extraordinary period. The growth rates of world population, production and incomes per capita have reached unprecedented heights. As a result of the combination of poor countries with very little income growth and wealthy countries with sustained growth, the degree of income inequality across societies has reached unprecedented levels. None of this can persist. This, I think, is the main lesson of the broader history of the industrial revolution, as viewed by modern growth theory.

I have interpreted this period as the beginning of the phase of the diffusion of the sustained economic growth that characterizes the European industrial revolution to the former colonies of the non-European world. The rapid growth of non-European nations (and some of the poorer European ones) is mainly responsible for the extraordinarily rapid growth of world production in the postwar era. But enough other societies have been largely left out of this process of diffusion that the degree of inequality among nations remained about the same in 1990 as it was in 1960. As those economies that have joined the modern world catch up to the income levels of the wealthiest countries, their growth rates of both population and income will slow down to rates that are close to those that now prevail in Europe. We have seen these events occur in Japan; they will follow in country after country.

At the same time, countries that have been kept out of this process of diffusion by socialist planning or simply by corruption and lawlessness will, one after another, join the industrial revolution and become the miracle economies of the future. The income growth rates in these catch-up economies may be very high, but as fewer and fewer countries remain in this category, the effect on world averages will shrink. If so, then world population growth will attain a peak and begin shrinking toward less than 1 percent, and world production growth will similarly cease to rise and will fall back toward 3 percent. In other words, we will see a

[5] Nancy L. Stokey. "Free Trade, Factor Returns, and Factor Accumulation." *Journal of Economic Growth*, 1 (1996): 421–448.



About the Author

In this essay, Robert E. Lucas Jr. continues a discussion featured in his 2002 book *Lectures on Economic Growth*, published by Harvard University Press.

In 1995 Lucas received the Nobel Memorial Prize in Economic Sciences. He is a past president of the Econometric Society and the American Economic Association, a fellow of the American Academy of Arts and Sciences and the American Philosophical Society and a member of the National Academy of Sciences.

Go to minneapolisfed.org for:

- An excerpt from *Lectures on Economic Growth*, December 2001 *Region*
- Observations on Lucas' rational expectations paper, December 1995 *Region*
- *Region* interview with Robert Lucas, June 1993

world that, economically, looks more and more like the United States.

What do history and economic theory have to say about factors that will accelerate this process of catching up? What policies for Pakistan or Nigeria would materially affect the likelihood of an economic miracle? For backward economies, dealing on a day-to-day basis with more advanced economies is the central element in success. No successes have been observed for autarchic, produce-everything-ourselves strategies (though such strategies can possibly work well for a few years: think of Russia in the 1920s or India in the 1950s). Trade has the benefit of letting a smaller country's industries attain efficient scale, but I think an even more important factor is the need to get up to world standards, to learn to play in the big leagues. The only way learning and technology transfer can take place is for producers to compete seriously internationally. Learning-by-doing is perhaps the most important form of human capital accumulation.

Macroeconomic policy, however, does not appear to be of central importance to growth. Korea, Brazil and Indonesia have all enjoyed rapid growth under inflationary policies (though others—Argentina, Chile and, again, Brazil—have had the opposite experience). Of course, in all these cases, inflation has arisen from monetary expansion to cover fiscal deficits. Certainly, I do not want to endorse inflation—it is an unnecessary waste of resources with no positive side effects—but this seems to be a largely separate issue from growth. It is always a mistake to think of everything as interconnected (though, of course, everything is, in some sense): I think it is more fruitful to break a problem down into manageable pieces and address the pieces one at a time.

Of the tendencies that are harmful to sound economics, the most seductive, and in my opinion the most poisonous, is to focus on questions of distribution. In this very minute, a child is being born to an American family and another child, equally valued by God, is being born to a family in India. The resources of all kinds that will be at the disposal of this new American will be on the order of 15 times the resources available to his Indian brother. This seems to us a terrible wrong, justifying direct corrective action, and perhaps some actions of this kind can and should be taken. But of the vast increase in the well-being of hundreds of millions of people that has occurred in the 200-year course of the industrial revolution to date, virtually none of it can be attributed to the direct redistribution of resources from rich to poor. The potential for improving the lives of poor people by finding different ways of distributing current production is *nothing* compared to the apparently limitless potential of increasing production. ■

Recommendations for Further Reading

For a good introduction to the way economists today are using theory to measure the importance of different sources of economic growth, see Stephen L. Parente and Edward C. Prescott, *Barriers to Riches* (Cambridge: MIT Press), 2000. I've used this book in class at Chicago, with good success. My students also enjoyed the more anecdotal treatment in William Easterly, *The Elusive Quest for Growth: Economists' Adventures and Misadventures in the Tropics* (Cambridge: MIT Press), 2002. [See review in the September 2003 *Region*.]

Michael Kremer's 1993 paper "Population Growth and Technological Change: One Million B.C. to 1990," *Quarterly Journal of Economics* (107: 681–716) stimulated everyone who thinks about economic growth. So did Lant Pritchett's "Divergence, Big Time" in the 1997 *Journal of Economic Perspectives* (11: 3–18) and Jeffrey D. Sachs and Andrew Warner, "Economic Reform and the Process of Global Integration," *Brookings Papers on Economic Activity*, (1995): 1–118. Though published in professional journals, all of these papers have much to offer the nontechnical reader.

—Robert Lucas

Of the tendencies that are harmful to sound economics, the most seductive, and in my opinion the most poisonous, is to focus on questions of distribution. ...The potential for improving the lives of poor people by finding different ways of distributing current production is *nothing* compared to the apparently limitless potential of increasing production.

Federal Reserve Bank of Minneapolis

2003 Operations Report

Message from the First Vice President

The quickening pace of change in the payments system and the financial industry continued to reverberate through the Federal Reserve System's operations during 2003. The gathering momentum of the shift from paper-based payments to various electronic alternatives was reinforced by the passage of the Check Clearing for the 21st Century Act, or "Check 21" as it has come to be known. This Bank's EPIC project in Montana several years ago helped pave the way for this legislation by demonstrating the operational feasibility of substituting image replacement documents for the original checks.

Responding successfully to the pace of payments system change will require that the Reserve Banks aggressively manage operational costs and streamline operational decision making. Our efforts in this regard must be guided by rigorous analysis and be characterized by operational excellence in light of the Federal Reserve's broad responsibilities and the public trust placed in us.

The Bank's 2003 accomplishments demonstrate how we put these standards into practice on a daily basis.

- The Bank met its 2003 local net revenue targets for Check and for priced services overall. These results are particularly noteworthy given the increase in our targets from 2002, the decline in check volumes and the additional challenges last year related to the conversion of our operations to the new standard check processing environment. More generally, the Bank met its budget objectives across all operations.
- The Bank's check operations were successfully converted to the Federal Reserve System's standard check processing platform. The new system will allow us to better serve our customers and respond to changes in the marketplace for payment services. Under the leadership of Minneapolis staff, the System's five-year project to convert all 37 Reserve Bank check offices to this standard check processing platform was completed in 2003.

2003 by the Numbers

In 2003, the Federal Reserve Bank of Minneapolis processed:

- 6.7 billion ACH (Automated Clearing House) payments worth approximately $16.8 trillion. FedACH is a nationwide system, built and operated by Minneapolis staff on behalf of the entire Federal Reserve System, that provides the electronic exchange of debits and credits.
- 1.0 billion checks worth approximately $890 billion. The Minneapolis office is one of the largest check processing centers in the Federal Reserve System.
- $10.8 billion of excess currency received from financial institutions, destroyed $1.4 billion of worn and torn currency and shipped $11.2 billion of currency to financial institutions.
- 1.2 million savings bond purchase requests and over 142,000 savings bond servicing transactions, and answered more than 288,000 savings bond customer service calls, as one of five savings bond processing centers in the Federal Reserve System.
- Forms, tenders, account maintenance and other customer transactions for 466,000 active *TreasuryDirect* accounts for individuals holding Treasury securities totaling $62.2 billion, as one of three *TreasuryDirect* processing sites nationwide.
- Transaction items worth more than $276 billion through FR-ETA (Electronic Tax Application), a same-day payment mechanism, hosted by the Minneapolis Fed, for businesses paying federal taxes via their financial institutions.

- The Bank's responsibilities for ongoing maintenance and enhancement to the FedACH application grew as a result of initiatives related to FedACH International Transatlantic and Mexico Services, deployment of additional FedACH information services on FedLine Advantage and deployment of FedACH Secure IP solution for quality assurance testing.
- The Bank was selected by the U.S. Treasury to be one of two sites that will provide retail Treasury Services in the future. When the consolidation is complete, the Federal Reserve Bank of Minneapolis and Federal Reserve Bank of Cleveland's Pittsburgh Branch will handle all savings bonds and marketable securities functions assigned to the Federal Reserve.
- During 2003, the Bank assumed responsibility for the Financial Services Policy Committee. The committee, which is chaired by President Stern, is responsible for the overall direction of financial services and related support functions for the Federal Reserve Banks, as well as for providing leadership for the evolving U.S. payments system.

The Bank's accomplishments in 2003 provide a strong foundation to build upon as we prepare to face new challenges in providing financial services, supervising banks and developing monetary policy amid a rapidly evolving economic and financial environment.

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First Vice President

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Linda Hall Whitman
Deputy Chairman

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Victor, Mont.

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Dean Folkvord
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Niel D. Willardson
Senior Vice President
Supervision, Regulation and Credit

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Vice President and Branch Manager

R. Paul Drake
Assistant Vice President and Assistant Branch Manager

December 31, 2003

Auditor Independence

The firm engaged by the Board of Governors for the audits of the individual and combined financial statements of the Reserve Banks for 2003 was PricewaterhouseCoopers LLP (PwC). Fees for these services totaled $1.4 million. To ensure auditor independence, the Board of Governors requires that PwC be independent in all matters relating to the audit. Specifically, PwC may not perform services for the Reserve Banks or others that would place it in a position of auditing its own work, making management decisions on behalf of the Reserve Banks, or in any other way impairing its audit independence. In 2003, the Bank did not engage PwC for advisory services.

Federal Reserve Bank of Minneapolis

Financial Reports

Contents

Federal Reserve Bank of Minneapolis

90 Hennepin Avenue, P.O. Box 291
Minneapolis, Minnesota 55480-0291
Phone 612 204-5000

March 1, 2004

Board of Directors of FRB of Minneapolis
90 Hennepin Avenue, P.O. Box291
Minneapolis, Minnesota 55480

The management of the Federal Reserve Bank of Minneapolis ("FRBM") is responsible for the preparation and fair presentation of the Statement of Financial Condition, Statement of Income, and Statement of Changes in Capital as of December 31, 2003 (the "Financial Statements"). The Financial Statements have been prepared in conformity with the accounting principles, policies, and practices established by the Board of Governors of the Federal Reserve System and as set forth in the Financial Accounting Manual for the Federal Reserve Banks ("Manual"), and as such, include amounts, some of which are based on judgments and estimates of management. To our knowledge, the Financial Statements are, in all material respects, fairly presented in conformity with the accounting principles, policies and practices documented in the Manual and include all disclosures necessary for such fair presentation.

The management of the FRBM is responsible for maintaining an effective process of internal controls over financial reporting including the safeguarding of assets as they relate to the Financial Statements. Such internal controls are designed to provide reasonable assurance to management and to the Board of Directors regarding the preparation of reliable Financial Statements. This process of internal controls contains self-monitoring mechanisms, including, but not limited to, divisions of responsibility and a code of conduct. Once identified, any material deficiencies in the process of internal controls are reported to management, and appropriate corrective measures are implemented.

Even an effective process of internal controls, no matter how well designed, has inherent limitations, including the possibility of human error, and therefore can provide only reasonable assurance with respect to the preparation of reliable financial statements.

The management of the FRBM assessed its process of internal controls over financial reporting including the safeguarding of assets reflected in the Financial Statements, based upon the criteria established in the "Internal Control – Integrated Framework" issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO). Based on this assessment, we believe that the FRBM maintained an effective process of internal controls over financial reporting including the safeguarding of assets as they relate to the Financial Statements.

Federal Reserve Bank of Minneapolis

by	by	by
Gary H. Stern,	James M. Lyon,	Creighton R. Fricek,
President	First Vice President	Principal Financial Officer

PRICEWATERHOUSECOOPERS

PricewaterhouseCoopers LLP
Suite 1300
650 Third Avenue South
Minneapolis MN 55402-4333
Telephone (612) 596 6000
Facsimile (612) 373 7160

Report of Independent Accountants

To the Board of Directors of the
Federal Reserve Bank of Minneapolis

We have examined management's assertion, included in the accompanying Management's Assertion, that The Federal Reserve Bank of Minneapolis ("FRB Minneapolis") maintained effective internal control over financial reporting and the safeguarding of assets as they relate to the financial statements as of December 31, 2003, based on criteria described in *Internal Control - Integrated Framework* issued by the Committee of Sponsoring Organizations of the Treadway Commission. FRB Minneapolis's management is responsible for maintaining effective internal control over financial reporting and safeguarding of assets as they relate to the financial statements. Our responsibility is to express an opinion on management's assertion based on our examination.

Our examination was conducted in accordance with attestation standards established by the American Institute of Certified Public Accountants and, accordingly, included obtaining an understanding of internal control over financial reporting, testing and evaluating the design and operating effectiveness of internal control, and performing such other procedures as we considered necessary in the circumstances. We believe that our examination provides a reasonable basis for our opinion.

Because of inherent limitations in any internal control, misstatements due to error or fraud may occur and not be detected. Also, projections of any evaluation of internal control over financial reporting to future periods are subject to the risk that the internal control may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

In our opinion, management's assertion that the FRB Minneapolis maintained effective internal control over financial reporting and over the safeguarding of assets as they relate to the financial statements as of December 31, 2003, is fairly stated, in all material respects, based on criteria established in *Internal Control - Integrated Framework* issued by the Committee of Sponsoring Organizations of the Treadway Commission.

This report is intended solely for the information and use of management and the Board of Directors and Audit Committee of FRB Minneapolis, and any organization with legally defined oversight responsibilities and is not intended to be and should not be used by anyone other than these specified parties.

March 1, 2004

PricewaterhouseCoopers LLP

PRICEWATERHOUSECOOPERS

PricewaterhouseCoopers LLP
Suite 1300
650 Third Avenue South
Minneapolis MN 55402-4333
Telephone (612) 596 6000
Facsimile (612) 373 7160

Report of Independent Auditors

To the Board of Governors of The Federal Reserve System
and the Board of Directors of The Federal Reserve
Bank of Minneapolis

We have audited the accompanying statements of condition of The Federal Reserve Bank of Minneapolis (the "Bank") as of December 31, 2003 and 2002, and the related statements of income and changes in capital for the years then ended, which have been prepared in conformity with the accounting principles, policies, and practices established by the Board of Governors of The Federal Reserve System. These financial statements are the responsibility of the Bank's management. Our responsibility is to express an opinion on the financial statements based on our audits.

We conducted our audits in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion.

As discussed in Note 3, the financial statements were prepared in conformity with the accounting principles, policies, and practices established by the Board of Governors of The Federal Reserve System. These principles, policies, and practices, which were designed to meet the specialized accounting and reporting needs of The Federal Reserve System, are set forth in the *Financial Accounting Manual for Federal Reserve Banks* and constitute a comprehensive basis of accounting other than accounting principles generally accepted in the United States of America.

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of the Bank as of December 31, 2003 and 2002, and results of its operations for the years then ended, in conformity with the basis of accounting described in Note 3.

March 1, 2004

PricewaterhouseCoopers LLP

Federal Reserve Bank of Minneapolis

STATEMENTS OF CONDITION

(in millions)

	As of December 31, 2003	As of December 31, 2002
Assets		
Gold certificates	$ 224	$ 179
Special drawing rights certificates	30	30
Coin	23	35
Items in process of collection	426	612
Loans to depository institutions	2	7
U.S. government securities, net	15,080	9,991
Investments denominated in foreign currencies	805	343
Accrued interest receivable	113	85
Prepaid expense-Interest on Federal Reserve notes to the U.S. Treasury	—	3
Interdistrict settlement account	—	4,063
Bank premises and equipment, net	143	146
Other assets	19	17
Total assets	$ 16,865	$ 15,511
Liabilities and Capital		
Liabilities:		
Federal Reserve notes outstanding, net	$ 14,155	$ 13,304
Securities sold under agreements to repurchase	573	330
Deposits:		
Depository institutions	564	430
Other deposits	2	1
Deferred credit items	650	713
Interest on Federal Reserve notes due U.S. Treasury	12	—
Interdistrict settlement account	165	—
Accrued benefit costs	49	47
Other liabilities	5	8
Total liabilities	16,175	14,833
Capital:		
Capital paid-in	345	339
Surplus	345	339
Total capital	690	678
Total liabilities and capital	$ 16,865	$ 15,511

The accompanying notes are an integral part of these financial statements.

Federal Reserve Bank of Minneapolis

STATEMENTS OF INCOME

(in millions)

	For the years ended December 31, 2003	2002
Interest income:		
Interest on U.S. government securities	$ 456	$ 306
Interest on investments denominated in foreign currencies	10	6
Interest on loans to depository institutions	—	1
Total interest income	466	313
Interest expense:		
Interest expense on securities sold under agreements to repurchase	4	—
Net interest income	462	313
Other operating income:		
Income from services	45	53
Reimbursable services to government agencies	21	22
Foreign currency gains, net	106	38
U.S. government securities gains, net	—	1
Other income	1	1
Total other operating income	173	115
Operating expenses:		
Salaries and other benefits	87	82
Occupancy expense	8	11
Equipment expense	8	10
Assessments by Board of Governors	22	15
Other expenses	37	42
Total operating expenses	162	160
Net income prior to distribution	$ 473	$ 268
Distribution of net income:		
Dividends paid to member banks	$ 21	$ 19
Transferred to surplus	6	221
Payments to U.S. Treasury as interest on Federal Reserve notes	446	28
Total distribution	$ 473	$ 268

The accompanying notes are an integral part of these financial statements.

STATEMENTS OF CHANGES IN CAPITAL

for the years ended December 31, 2003, and December 31, 2002
(in millions)

	Capital Paid-in	Surplus	Total Capital
Balance at January 1, 2002 (3.6 million shares)	$ 180	$ 118	$ 298
Net income transferred to surplus	—	221	221
Net change in capital stock issued (3.2 million shares)	159	—	159
Balance at December 31, 2002 (6.8 million shares)	$ 339	$ 339	$ 678
Net income transferred to surplus	—	6	6
Net change in capital stock issued (0.2 thousand shares)	6	—	6
Balance at December 31, 2003 (7.0 million shares)	$ 345	$ 345	$ 690

The accompanying notes are an integral part of these financial statements.

Notes to Financial Statements

1. STRUCTURE

The Federal Reserve Bank of Minneapolis ("Bank") is part of the Federal Reserve System ("System") created by Congress under the Federal Reserve Act of 1913 ("Federal Reserve Act") which established the central bank of the United States. The System consists of the Board of Governors of the Federal Reserve System ("Board of Governors") and twelve Federal Reserve Banks ("Reserve Banks"). The Reserve Banks are chartered by the federal government and possess a unique set of governmental, corporate, and central bank characteristics. The Bank and its branch in Helena, Montana, serve the Ninth Federal Reserve District, which includes Minnesota, Montana, North Dakota, South Dakota, and portions of Michigan and Wisconsin. Other major elements of the System are the Federal Open Market Committee ("FOMC") and the Federal Advisory Council. The FOMC is composed of members of the Board of Governors, the president of the Federal Reserve Bank of New York ("FRBNY") and, on a rotating basis, four other Reserve Bank presidents. Banks that are members of the System include all national banks and any state-chartered bank that applies and is approved for membership in the System.

Board of Directors

In accordance with the Federal Reserve Act, supervision and control of the Bank are exercised by a Board of Directors. The Federal Reserve Act specifies the composition of the Board of Directors for each of the Reserve Banks. Each board is composed of nine members serving three-year terms: three directors, including those designated as Chairman and Deputy Chairman, are appointed by the Board of Governors, and six directors are elected by member banks. Of the six elected by member banks, three represent the public and three represent member banks. Member banks are divided into three classes according to size. Member banks in each class elect one director representing member banks and one representing the public. In any election of directors, each member bank receives one vote, regardless of the number of shares of Reserve Bank stock it holds.

2. OPERATIONS AND SERVICES

The System performs a variety of services and operations. Functions include: formulating and conducting monetary policy; participating actively in the payments mechanism, including large-dollar transfers of funds, automated clearinghouse ("ACH") operations and check processing; distributing coin and currency; performing fiscal agency functions for the U.S. Treasury and certain federal agencies; serving as the federal government's bank; providing short-term loans to depository institutions; serving the consumer and the community by providing educational materials and information regarding consumer laws; supervising bank holding companies and state member banks; and administering other regulations of the Board of Governors. The Board of Governors' operating costs are funded through assessments on the Reserve Banks.

In performing fiscal agency functions for the U.S. Treasury, the Bank provides U.S. securities direct purchase and savings bond processing services. In December 2003, the U.S. Treasury selected the Bank as one of two future consolidation sites for these services. An implementation plan is expected to be announced in March 2004. At this time, the Bank has not developed a detailed estimate of the financial effect of the consolidation.

The FOMC establishes policy regarding open market operations, oversees these operations, and issues authorizations and directives to the FRBNY for its execution of transactions. Authorized transaction types include direct purchase and sale of securities, matched sale-purchase transactions, the purchase of securities under agreements to resell, the sale of securities under agreements to repurchase, and the lending of U.S. government securities. The FRBNY is also authorized by the FOMC to hold balances of, and to execute spot and forward foreign exchange ("F/X") and securities contracts in, nine foreign currencies, maintain reciprocal currency arrangements ("F/X swaps") with various central banks, and "warehouse" foreign currencies for the U.S. Treasury and Exchange Stabilization Fund ("ESF") through the Reserve Banks.

3. SIGNIFICANT ACCOUNTING POLICIES

Accounting principles for entities with the unique powers and responsibilities of the nation's central bank have not been formulated by the Financial Accounting Standards Board. The Board of Governors has developed specialized accounting principles and practices that it believes are appropriate for the significantly different nature and function of a central bank as compared with the private sector. These accounting principles and practices are documented in the *Financial Accounting Manual for Federal Reserve Banks* ("Financial Accounting Manual"), which is issued by the Board of Governors. All Reserve Banks are required to adopt and apply accounting policies and practices that are consistent with the Financial Accounting Manual.

The financial statements have been prepared in accordance with the Financial Accounting Manual. Differences exist between the accounting principles and practices of the System and accounting principles generally accepted in the United States of America ("GAAP"). The primary differences are the presentation of all security holdings at amortized cost, rather than at the fair value presentation requirements of GAAP, and the accounting for matched sale-purchase transactions as separate sales and purchases, rather than secured borrowings with pledged collateral, as is generally required by GAAP. In addition, the Bank has elected not to present a Statement of Cash Flows. The Statement of Cash Flows has not been included because the liquidity and cash position of the Bank are not of primary concern to the users of these financial statements. Other information regarding the Bank's activities is provided in, or may be derived from, the Statements of Condition, Income, and Changes in Capital. A Statement of Cash Flows, therefore, would not provide any additional useful information. There are no other significant differences between the policies outlined in the Financial Accounting Manual and GAAP.

Each Reserve Bank provides services on behalf of the System for which costs are not shared. Major services provided on behalf of the System by the Bank, for which the costs were not redistributed to the other Reserve Banks, include: application development and centralized business administration functions for FedACH payment services and the Risk Management Information System, the Check Standardization Project Office, the Electronic Access Customer Contact Center, the Check Image regional archive site, the Financial Services Policy Committee, and the FedMail and FedPhone Leadership Center.

The preparation of the financial statements in conformity with the Financial Accounting Manual requires management to make certain estimates and assumptions that affect the reported amounts of assets and liabilities, disclosure of contingent assets and liabilities at the date of the financial statements, and the reported amounts of income and expenses during the reporting period. Actual results could differ from those estimates. Unique accounts and significant accounting policies are explained below.

a. *Gold Certificates*

The Secretary of the Treasury is authorized to issue gold certificates to the Reserve Banks to monetize gold held by the U.S. Treasury. Payment for the gold certificates by the Reserve Banks is made by crediting equivalent amounts in dollars into the account established for the U.S. Treasury. These gold certificates held by the Reserve Banks are required to be backed by the gold of the U.S. Treasury. The U.S. Treasury may reacquire the gold certificates at any time and the Reserve Banks must deliver them to the U.S. Treasury. At such time, the U.S. Treasury's account is charged, and the Reserve Banks' gold certificate accounts are lowered. The value of gold for purposes of backing the gold certificates is set by law at $42 2/9 a fine troy ounce. The Board of Governors allocates the gold certificates among Reserve Banks once a year based on average Federal Reserve notes outstanding in each District.

b. *Special Drawing Rights Certificates*

Special drawing rights ("SDRs") are issued by the International Monetary Fund ("Fund") to its members in proportion to each member's quota in the Fund at the time of issuance. SDRs serve as a supplement to international monetary reserves and may be transferred from one national monetary authority to another. Under the law providing for United States participation in the SDR system, the Secretary of the U.S. Treasury is authorized to issue SDR certificates, somewhat like gold certificates, to the Reserve Banks. At such time, equivalent amounts in dollars are credited to the account established for the U.S. Treasury, and the Reserve Banks' SDR certificate accounts are increased. The Reserve Banks are required to purchase SDR certificates, at the direction of the U.S. Treasury, for the purpose of financing SDR acquisitions or for financing exchange stabilization operations. At the time SDR transactions occur, the Board of Governors allocates SDR certificate transactions among Reserve Banks based upon Federal Reserve notes outstanding in each District at the end of the preceding year. There were no SDR transactions in 2003 or 2002.

c. *Loans to Depository Institutions*

The Depository Institutions Deregulation and Monetary Control Act of 1980 provides that all depository institutions that maintain reservable transaction accounts or nonpersonal time deposits, as defined in Regulation D issued by the Board of Governors, have borrowing privileges at the discretion of the Reserve Banks. Borrowers execute certain lending agreements and deposit sufficient collateral before credit is extended. Loans are evaluated for collectibility. If loans were ever deemed to be uncollectible, an appropriate reserve would be established. Interest is accrued using the applicable discount rate established at least every fourteen days by the Boards of Directors of the Reserve Banks, subject to review by the Board of Governors.

d. *U.S. Government and Federal Agency Securities and Investments Denominated in Foreign Currencies*

The FOMC has designated the FRBNY to execute open market transactions on its behalf and to hold the resulting securities in the portfolio known as the System Open Market Account ("SOMA"). In addition to authorizing and directing operations in the domestic securities market, the FOMC authorizes and directs the FRBNY to execute operations in foreign markets for major currencies in order to counter disorderly conditions in exchange markets or to meet other needs specified by the FOMC in carrying out the System's central bank responsibilities. Such authorizations are reviewed and approved annually by the FOMC. The effect of this change was not material; therefore, it was included in the 2003 interest income.

In December 2002, the FRBNY replaced matched sale-purchase ("MSP") transactions with securities sold under agreements to repurchase. MSP transactions, accounted for as separate sale and purchase transactions, are transactions in which the FRBNY sells a security and buys it back at the rate specified at the commencement of the transaction. Securities sold under agreements to repurchase are treated as secured borrowing transactions with the associated interest expense recognized over the life of the transaction.

The FRBNY has sole authorization by the FOMC to lend U.S. government securities held in the SOMA to U.S. government securities dealers and to banks participating in U.S. government securities clearing arrangements on behalf of the System, in order to facilitate the effective functioning of the domestic securities market. These securities-lending transactions are fully collateralized by other U.S. government securities. FOMC policy requires the FRBNY to take possession of collateral in excess of the market values of the securities loaned. The market values of the collateral and the securities loaned are monitored by the FRBNY on a daily basis, with additional collateral obtained as necessary. The securities loaned continue to be accounted for in the SOMA.

F/X contracts are contractual agreements between two parties to exchange specified currencies, at a specified price, on a specified date. Spot foreign contracts normally settle two days after the trade date, whereas the settlement date on forward contracts is negotiated between the contracting parties, but will extend beyond two days from the trade date. The FRBNY generally enters into spot contracts, with any forward contracts generally limited to the second leg of a swap/warehousing transaction.

The FRBNY, on behalf of the Reserve Banks, maintains renewable, short-term F/X swap arrangements with two authorized foreign central banks. The parties agree to exchange their currencies up to a pre-arranged maximum amount and for an agreed-upon period of time (up to twelve months), at an agreed-upon interest rate. These arrangements give the FOMC temporary access to foreign currencies it may need for intervention operations to support the dollar and give the partner foreign central bank temporary access to dollars it may need to support its own currency. Drawings under the F/X swap arrangements can be initiated by either the FRBNY or the partner foreign central bank and must be agreed to by the drawee. The F/X swaps are structured so that the party initiating the transaction (the drawer) bears the exchange rate risk upon maturity. The FRBNY will generally invest the foreign currency received under an F/X swap in interest-bearing instruments.

Warehousing is an arrangement under which the FOMC agrees to exchange, at the request of the Treasury, U.S. dollars for foreign currencies held by the Treasury or ESF over a limited period of time. The purpose of the warehousing facility is to supplement the U.S. dollar resources of the Treasury and ESF for financing purchases of foreign currencies and related international operations.

In connection with its foreign currency activities, the FRBNY, on behalf of the Reserve Banks, may enter into contracts that contain varying degrees of off-balance-sheet market risk, because they represent contractual commitments involving future settlement and counter-party credit risk. The FRBNY controls credit risk by obtaining credit approvals, establishing transaction limits, and performing daily monitoring procedures.

While the application of current market prices to the securities currently held in the SOMA portfolio and investments denominated in foreign currencies may result in values substantially

above or below their carrying values, these unrealized changes in value would have no direct effect on the quantity of reserves available to the banking system or on the prospects for future Reserve Bank earnings or capital. Both the domestic and foreign components of the SOMA portfolio from time to time involve transactions that may result in gains or losses when holdings are sold prior to maturity. Decisions regarding the securities and foreign currencies transactions, including their purchase and sale, are motivated by monetary policy objectives rather than profit. Accordingly, market values, earnings, and any gains or losses resulting from the sale of such currencies and securities are incidental to the open market operations and do not motivate its activities or policy decisions.

U.S. government and federal agency securities and investments denominated in foreign currencies comprising the SOMA are recorded at cost, on a settlement-date basis, and adjusted for amortization of premiums or accretion of discounts on a straight-line basis. Interest income is accrued on a straight-line basis and is reported as "Interest on U.S. government and federal agency securities" or "Interest on investments denominated in foreign currencies," as appropriate. Income earned on securities lending transactions is reported as a component of "Other income." Gains and losses resulting from sales of securities are determined by specific issues based on average cost. Gains and losses on the sales of U.S. government and federal agency securities are reported as U.S. government securities gains, net. Foreign-currency-denominated assets are revalued daily at current foreign currency market exchange rates in order to report these assets in U.S. dollars. Realized and unrealized gains and losses on investments denominated in foreign currencies are reported as Foreign currency gains, net. Foreign currencies held through F/X swaps, when initiated by the counter-party, and warehousing arrangements are revalued daily with the unrealized gain or loss reported by the FRBNY as a component of "Other assets" or "Other liabilities," as appropriate.

Balances of U.S. government and federal agency securities bought outright, securities sold under agreements to repurchase, securities loaned, investments denominated in foreign currency, interest income and expense, securities lending fee income, amortization of premiums and discounts on securities bought outright, gains and losses on sales of securities, and realized and unrealized gains and losses on investments denominated in foreign currencies, excluding those held under an F/X swap arrangement, are allocated to each Reserve Bank. Securities purchased under agreements to resell and unrealized gains and losses on the revaluation of foreign currency holdings under F/X swaps and warehousing arrangements are allocated to the FRBNY and not to other Reserve Banks.

In 2003, additional interest income of $61 million, representing one day's interest on the SOMA portfolio, was accrued to reflect a change in interest accrual methods, of which $1.4 million was allocated to the Bank. Interest accruals and the amortization of premiums and discounts are now recognized beginning the day that a security is purchased and ending the day before the security matures or is sold. Previously, accruals and amortization began the day after the security was purchased and ended on the day that the security matured or was sold. The effect of this change was not material; therefore, it was included in the 2003 interest income.

e. *Bank Premises, Equipment, and Software*

Bank premises and equipment are stated at cost less accumulated depreciation. Depreciation is calculated on a straight-line basis over estimated useful lives of assets ranging from two to fifty years. Major alterations, renovations, and improvements are capitalized at cost as additions to

the asset accounts. Maintenance, repairs, and minor replacements are charged to operations in the year incurred. Costs incurred for software, either developed internally or acquired for internal use, during the application development stage are capitalized based on the cost of direct services and materials associated with designing, coding, installing, or testing software. Capitalized software costs are amortized on a straight-line basis over the estimated useful lives of the software applications, which range from two to five years.

f. *Interdistrict Settlement Account*

At the close of business each day, all Reserve Banks and branches assemble the payments due to or from other Reserve Banks and branches as a result of transactions involving accounts residing in other Districts that occurred during the day's operations. Such transactions may include funds settlement, check clearing and ACH operations, and allocations of shared expenses. The cumulative net amount due to or from other Reserve Banks is reported as the "Interdistrict settlement account."

g. *Federal Reserve Notes*

Federal Reserve notes are the circulating currency of the United States. These notes are issued through the various Federal Reserve agents (the Chairman of the Board of Directors of each Reserve Bank) to the Reserve Banks upon deposit with such agents of certain classes of collateral security, typically U.S. government securities. These notes are identified as issued to a specific Reserve Bank. The Federal Reserve Act provides that the collateral security tendered by the Reserve Bank to the Federal Reserve agent must be equal to the sum of the notes applied for by such Reserve Bank. In 2003, the Federal Reserve Act was amended to expand the assets eligible to be pledged as collateral security to include all Federal Reserve Bank assets. Prior to the amendment, only gold certificates, special drawing rights certificates, U.S. government and federal agency securities, securities purchased under agreements to resell, loans to depository institutions, and investments denominated in foreign currencies could be pledged as collateral. The collateral value is equal to the book value of the collateral tendered, with the exception of securities, whose collateral value is equal to the par value of the securities tendered. The par value of securities pledged for securities sold under agreements to repurchase is similarly deducted. The Board of Governors may, at any time, call upon a Reserve Bank for additional security to adequately collateralize the Federal Reserve notes. The Reserve Banks have entered into an agreement that provides for certain assets of the Reserve Banks to be jointly pledged as collateral for the Federal Reserve notes of all Reserve Banks in order to satisfy their obligation of providing sufficient collateral for outstanding Federal Reserve notes. In the event that this collateral is insufficient, the Federal Reserve Act provides that Federal Reserve notes become a first and paramount lien on all the assets of the Reserve Banks. Finally, as obligations of the United States, Federal Reserve notes are backed by the full faith and credit of the United States government.

The "Federal Reserve notes outstanding, net" account represents the Bank's Federal Reserve notes outstanding reduced by its currency holdings of $1,335 million and $1,785 million at December 31, 2003 and 2002, respectively.

h. *Capital Paid-in*

The Federal Reserve Act requires that each member bank subscribe to the capital stock of the Reserve Bank in an amount equal to 6 percent of the capital and surplus of the member bank. As a member bank's capital and surplus changes, its holdings of the Reserve Bank's stock must be adjusted. Member banks are those state-chartered banks that apply and are approved for membership in the System and all national banks. Currently, only one-half of the subscription is paid-in and the

remainder is subject to call. These shares are nonvoting with a par value of $100. They may not be transferred or hypothecated. By law, each member bank is entitled to receive an annual dividend of 6 percent on the paid-in capital stock. This cumulative dividend is paid semiannually. A member bank is liable for Reserve Bank liabilities up to twice the par value of stock subscribed by it.

i. *Surplus*

The Board of Governors requires Reserve Banks to maintain a surplus equal to the amount of capital paid-in as of December 31. This amount is intended to provide additional capital and reduce the possibility that the Reserve Banks would be required to call on member banks for additional capital. Pursuant to Section 16 of the Federal Reserve Act, Reserve Banks are required by the Board of Governors to transfer to the U.S. Treasury as interest on Federal Reserve notes excess earnings, after providing for the costs of operations, payment of dividends, and reservation of an amount necessary to equate surplus with capital paid-in.

In the event of losses or a substantial increase in capital, payments to the U.S. Treasury are suspended until such losses are recovered through subsequent earnings. Weekly payments to the U.S. Treasury may vary significantly.

j. *Income and Costs Related to Treasury Services*

The Bank is required by the Federal Reserve Act to serve as fiscal agent and depository of the United States. By statute, the Department of the Treasury is permitted, but not required, to pay for these services.

k. *Taxes*

The Reserve Banks are exempt from federal, state, and local taxes, except for taxes on real property. The Bank's real property taxes paid were $4 million for each of the years ended December 31, 2003 and 2002, and are reported as a component of "Occupancy expense."

l. *Recent Accounting Developments*

In May 2003, the Financial Accounting Standards Board issued SFAS No. 150, "Accounting for Certain Financial Instruments with Characteristics of both Liabilities and Equity." SFAS No. 150, which will become applicable for the Bank in 2004, establishes standards for how an issuer classifies and measures certain financial instruments with characteristics of both liabilities and equity and imposes certain additional disclosure requirements. When adopted, there may be situations in which the Bank has not yet processed a member bank's application to redeem its Reserve Bank stock. In those situations, this standard requires that the portion of the capital paid-in that is mandatorily redeemable be reclassified as debt.

m. *2003 Restructuring Charges*

In 2003, the System restructured several operations, primarily in the check and cash services. The restructuring included streamlining the management and support structures, reducing staff, decreasing the number of processing locations, and increasing processing capacity in the remaining locations.

Footnote 10 describes the restructuring and provides information about the Bank's costs and liabilities associated with employee separations and contract terminations. Costs and liabilities associated with enhanced pension benefits for all Reserve Banks are recorded on the books of the FRBNY as discussed in footnote 8 and those associated with the Bank's enhanced postretirement benefits are disclosed in footnote 9.

4. U.S. GOVERNMENT AND FEDERAL AGENCY SECURITIES

Securities bought outright are held in the SOMA at the FRBNY. An undivided interest in SOMA activity and the related premiums, discounts, and income, with the exception of securities purchased under agreements to resell, is allocated to each Reserve Bank on a percentage basis derived from an annual settlement of interdistrict clearings. The settlement, performed in April of each year, equalizes Reserve Bank gold certificate holdings to Federal Reserve notes outstanding. The Bank's allocated share of SOMA balances was approximately 2.232 percent and 1.563 percent at December 31, 2003 and 2002, respectively.

The Bank's allocated share of securities held in the SOMA at December 31, that were bought outright, was as follows (in millions):

	2003	2002
Par value:		
U.S. government:		
Bills	$ 5,465	$ 3,544
Notes	7,218	4,657
Bonds	2,198	1,638
Total par value	14,881	9,839
Unamortized premiums	219	168
Unaccreted discounts	(20)	(16)
Total allocated to Bank	$ 15,080	$ 9,991

The total of SOMA securities bought outright was $675,569 million and $639,125 million at December 31, 2003 and 2002, respectively.

As noted in footnote 3, the FRBNY replaced MSP transactions with securities sold under agreements to repurchase in December 2002. At December 31, 2003 and 2002, securities sold under agreements to repurchase with a contract amount of $25,652 million and $21,091 million, respectively, were outstanding, of which $573 million and $330 million were allocated to the Bank. At December 31, 2003 and 2002, securities sold under agreements to repurchase with a par value of $25,658 million and $21,098 million, respectively, were outstanding, of which $573 million and $330 million were allocated to the Bank.

The maturity distribution of U.S. government securities bought outright and securities sold under agreements to repurchase, that were allocated to the Bank at December 31, 2003, was as follows (in millions):

Maturities of Securities Held	U.S. Government Securities (Par value)	Securities Sold Under Agreements to Repurchase (Contract amount)
Within 15 days	$ 1,066	$ 573
16 to 90 days	3,111	—
91days to 1 year	3,662	—
Over 1 year to 5 years	4,175	—
Over 5 years to 10 years	1,145	—
Over 10 years	1,722	—
Total	$ 14,881	$ 573

At December 31, 2003 and 2002, U.S. government securities with par values of $4,426 million and $1,841 million, respectively, were loaned from the SOMA, of which $99 million and $29 million were allocated to the Bank.

5. INVESTMENTS DENOMINATED IN FOREIGN CURRENCIES

The FRBNY, on behalf of the Reserve Banks, holds foreign currency deposits with foreign central banks and the Bank for International Settlements, and invests in foreign government debt instruments. Foreign government debt instruments held include both securities bought outright and securities purchased under agreements to resell. These investments are guaranteed as to principal and interest by the foreign governments.

Each Reserve Bank is allocated a share of foreign-currency-denominated assets, the related interest income, and realized and unrealized foreign currency gains and losses, with the exception of unrealized gains and losses on F/X swaps and warehousing transactions. This allocation is based on the ratio of each Reserve Bank's capital and surplus to aggregate capital and surplus at the preceding December 31. The Bank's allocated share of investments denominated in foreign currencies was approximately 4.053 percent and 2.028 percent at December 31, 2003 and 2002, respectively.

The Bank's allocated share of investments denominated in foreign currencies, valued at current foreign currency market exchange rates at December 31, was as follows (in millions):

	2003	2002
European Union Euro:		
Foreign currency deposits	$ 278	$ 113
Government debt instruments including agreements to resell	166	67
Japanese Yen:		
Foreign currency deposits	60	36
Government debt instruments including agreements to resell	297	125
Accrued interest	4	2
Total	$ 805	$ 343

Total investments denominated in foreign currencies were $19,868 million and $16,913 million at December 31, 2003 and 2002, respectively.

The maturity distribution of investments denominated in foreign currencies which were allocated to the Bank at December 31, 2003, was as follows (in millions):

Maturities of Investments Denominated in Foreign Currencies	
Within 1 year	$ 739
Over 1 year to 5 years	52
Over 5 years to 10 years	14
Over 10 years	0
Total	$ 805

At December 31, 2003 and 2002, there were no outstanding F/X swaps or material open foreign exchanges contracts.

At December 31, 2003 and 2002, the warehousing facility was $5,000 million, with no balance outstanding.

6. BANK PREMISES, EQUIPMENT, AND SOFTWARE

A summary of bank premises and equipment at December 31 is as follows (in millions):

	2003	2002
Bank premises and equipment:		
Land	$ 18	$ 17
Buildings	114	113
Building machinery and equipment	14	14
Furniture and equipment	41	45
Subtotal	$ 187	$ 189
Accumulated depreciation	(44)	(43)
Bank premises and equipment, net	$ 143	$ 146
Depreciation expense, for the years ended	$ 7	$ 8

Future minimum lease payments under noncancelable agreements in existence at December 31, 2003, were not material.

The Bank has capitalized software assets, net of amortization, of $3 million and $2 million at December 31, 2003 and 2002, respectively. Amortization expense was $589 thousand and $488 thousand for the years ended December 31, 2003 and 2002, respectively.

7. COMMITMENTS AND CONTINGENCIES

At December 31, 2003, the Bank was obligated under noncancelable leases for premises and equipment with terms ranging from one to approximately ten years. These leases provide for increased rental payments based upon increases in real estate taxes, operating costs, or selected price indices.

Rental expense under operating leases for certain operating facilities, warehouses, and data processing and office equipment (including taxes, insurance and maintenance when included in rent), net of sublease rentals, was $1 million for the years ended December 31, 2003 and 2002, respectively. Certain of the Bank's leases have options to renew.

Future minimum rental payments under noncancelable operating leases and capital leases, net of sublease rentals, with terms of one year or more, at December 31, 2003, were not material.

There were no other material commitments and long-term obligations in excess of one year at December 31, 2003.

Under the Insurance Agreement of the Federal Reserve Banks dated as of March 2, 1999, each of the Reserve Banks has agreed to bear, on a per incident basis, a pro rata share of losses in excess of one percent of the capital paid-in of the claiming Reserve Bank, up to 50 percent of the total capital paid-in of all Reserve Banks. Losses are borne in the ratio that a Reserve Bank's capital paid-in bears to the total capital paid-in of all Reserve Banks at the beginning of the calendar year

in which the loss is shared. No claims were outstanding under such agreement at December 31, 2003 or 2002.

The Bank is involved in certain legal actions and claims arising in the ordinary course of business. Although it is difficult to predict the ultimate outcome of these actions, in management's opinion, based on discussions with counsel, the aforementioned litigation and claims will be resolved without material adverse effect on the financial position or results of operations of the Bank.

8. RETIREMENT AND THRIFT PLANS

Retirement Plans

The Bank currently offers two defined benefit retirement plans to its employees, based on length of service and level of compensation. Substantially all of the Bank's employees participate in the Retirement Plan for Employees of the Federal Reserve System ("System Plan") and the Benefit Equalization Retirement Plan ("BEP"). In addition, certain Bank officers participate in the Supplemental Employee Retirement Plan ("SERP").

The System Plan is a multi-employer plan with contributions fully funded by participating employers. Participating employers are the Federal Reserve Banks, the Board of Governors of the Federal Reserve System, and the Office of Employee Benefits of the Federal Reserve Employee Benefits System. No separate accounting is maintained of assets contributed by the participating employers. The FRBNY acts as a sponsor of the Plan for the System and the costs associated with the Plan are not redistributed to the Bank. The Bank's projected benefit obligation and net pension costs for the BEP and the SERP at December 31, 2003 and 2002, and for the years then ended, are not material.

Thrift Plan

Employees of the Bank may also participate in the defined contribution Thrift Plan for Employees of the Federal Reserve System ("Thrift Plan"). The Bank's Thrift Plan contributions totaled $3 million for the years ended December 31, 2003 and 2002, and are reported as a component of "Salaries and other benefits."

9. POSTRETIREMENT BENEFITS OTHER THAN PENSIONS AND POSTEMPLOYMENT BENEFITS

Postretirement Benefits other than Pensions

In addition to the Bank's retirement plans, employees who have met certain age and length of service requirements are eligible for both medical benefits and life insurance coverage during retirement.

The Bank funds benefits payable under the medical and life insurance plans as due and, accordingly, has no plan assets. Net postretirement benefit costs are actuarially determined using a January 1 measurement date.

Following is a reconciliation of beginning and ending balances of the benefit obligation (in millions):

	2003	2002
Accumulated postretirement benefit obligation at January 1	$ 43.1	$ 37.2
Service cost-benefits earned during the period	1.1	1.2
Interest cost of accumulated benefit obligation	2.5	2.8
Actuarial loss	3.7	4.4
Contributions by plan participants	0.2	0.2
Benefits paid	(1.5)	(1.6)
Plan amendments	—	(1.1)
Accumulated postretirement benefit obligation at December 31	$ 49.1	$ 43.1

Following is a reconciliation of the beginning and ending balance of the plan assets, the unfunded postretirement benefit obligation, and the accrued postretirement benefit costs (in millions):

	2003	2002
Fair value of plan assets at January 1	$ —	$ —
Contributions by the employer	1.3	1.4
Contributions by plan participants	0.2	0.2
Benefits paid	(1.5)	(1.6)
Fair value of plan assets at December 31	$ —	$ —
Unfunded postretirement benefit obligation	$ 49.1	$ 43.1
Unrecognized prior service cost	4.1	4.5
Unrecognized net actuarial loss	(11.5)	(7.8)
Accrued postretirement benefit costs	$ 41.7	$ 39.8

Accrued postretirement benefit costs are reported as a component of "Accrued benefit costs."

At December 31, 2003 and 2002, the weighted average discount rate assumptions used in developing the benefit obligation were 6.25 percent and 6.75 percent, respectively.

For measurement purposes, a 10 percent annual rate of increase in the cost of covered health care benefits was assumed for 2004. Ultimately, the health care cost trend rate is expected to decrease gradually to 5 percent by 2011 and remain at that level thereafter.

Assumed health care cost trend rates have a significant effect on the amounts reported for health care plans. A one percentage point change in assumed health care cost trend rates would have the following effects for the year ended December 31, 2003 (in millions):

	One Percentage Point Increase	One Percentage Point Decrease
Effect on aggregate of service and interest cost components of net periodic postretirement benefit costs	$ 0.8	$ (0.6)
Effect on accumulated postretirement benefit obligation	8.5	(6.6)

The following is a summary of the components of net periodic postretirement benefit costs for the years ended December 31 (in millions):

	2003	2002
Service cost-benefits earned during the period	$ 1.1	$ 1.2
Interest cost of accumulated benefit obligation	2.5	2.8
Amortization of prior service cost	(0.3)	(0.2)
Recognized net actuarial loss	—	0.1
Net periodic postretirement benefit costs	$ 3.3	$ 3.9

Net periodic postretirement benefit costs are reported as a component of "Salaries and other benefits."

The recognition of special termination loss is the result of enhanced retirement benefits provided to employees during the restructuring described in footnote 10. Because the special termination benefits are less than $50 thousand, the amount is not displayed in the tables above. Curtailment gains will be recovered in 2004 when the affected employees terminate employment.

Following the guidance of the Financial Accounting Standards Board, the Bank elected to defer recognition of the financial effects of the Medicare Prescription Drug Improvement and Modernization Act of 2003 until further guidance is issued. Neither the accumulated postretirement benefit obligation at December 31, 2003, nor the net periodic postretirement benefit cost for the year then ended reflect the effect of the Act on the plan.

Postemployment Benefits

The Bank offers benefits to former or inactive employees. Postemployment benefit costs are actuarially determined and include the cost of medical and dental insurance, survivor income, and disability benefits. Costs were projected using the same discount rate and health care trend rates as were used for projecting postretirement costs. The accrued postemployment benefit costs recognized by the Bank were $7 million for each of the years ended December 31, 2003 and 2002. This cost is included as a component of "Accrued benefit costs." Net periodic postemployment benefit costs included in 2003 and 2002 operating expenses were $1 million and $2 million, respectively.

10. RESTRUCTURING CHARGES

In 2003, the System announced plans for consolidation and restructuring to streamline operations and reduce costs, including consolidation of operations and staff reductions in various functions of several Banks. The Bank's costs associated with the restructuring are not material.

For more information on the Minneapolis Fed and the Federal Reserve System, go to minneapolisfed.org.

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For the Public

Consumer Affairs Help Line: 204-6500

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