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Southwest Economy

China: Awakening Giant

China has had four distinct periods in its 4,000-year history. Until the 16th century, China's economy performed on par with countries elsewhere in the world. As shown in Chart 1, which plots gross domestic product (GDP) per capita, China's economy outperformed that of Western Europe for more than 1,000 years. Toward the end of the Ming Dynasty (1368–1644), however, and throughout the Ching dynasty (1644–1912), China stagnated, its GDP per capita rising virtually zero for more than 300 years.

During the same period, Western Europe enjoyed rapid economic development, riding the scientific revolution that began in the 11th century. After the 18th century, growth in Western Europe skyrocketed, while China slipped into decline as it shunned progress and closed its doors to the outside world. China's isolationism eventually led to invasion from Western and Japanese forces, driving the nation's GDP per capita back down to levels seen 2,000 years earlier. Just a quarter century ago, China began to awaken from its 500-year sleep, and today it is rapidly catching up with the Western world.

The year 1978 marks a turning point in China's modern history. That's when Deng Xiaoping began to remake the economy around market principles.

(Continued on page 2)

U.S. Natural Gas Prices Heat Up

Although the United States is thought to have plentiful natural gas resources, the price of gas has more than doubled in the past year (*Chart 1*). During 2003 the amount of natural gas supplied was insufficient to satisfy demand without sharply higher prices. Futures prices suggest relatively high natural gas prices will be sustained for the next few years.

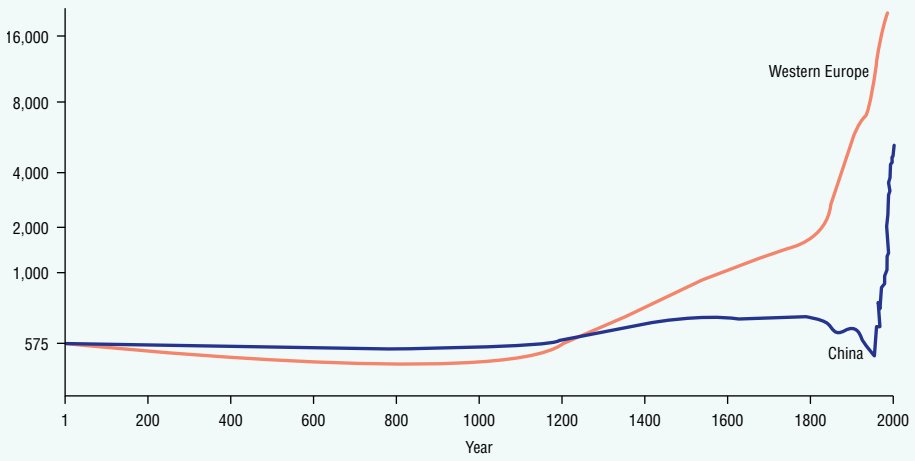
In fact, the outlook for natural gas prices depends on a number of factors. Over the next few years, the prospects for lower prices depend largely on an unseasonably cool summer or an unseasonably warm winter. A lack of shutdowns in offshore production in the Gulf of Mexico during the fall hurricane season could also soften prices. Over the longer run, further development of domestic resources, pipelines and import facilities for liquified natural gas

(Continued on page 9)

INSIDE:

Chart 1

GDP per Capita: China and Western Europe, 1–1998 A.D.



SOURCES: Maddison, Angus (2001), *The World Economy: A Millennial Perspective*, Organization for Economic Cooperation and Development, p. 42; authors' calculations.

In 1978, China had the world's ninth largest economy, with a GDP just one-eighth that of the United States and a third that of Japan. But by 2001, China had grown to the world's second largest economy, with a national output over half that of the United States and 60 percent larger than Japan's.

China's growth rate has slowed somewhat from its torrid double-digit pace of the mid-1980s and early 1990s, but still its GDP is expanding at roughly 8 percent per year (*Chart 2*). At this rate, and assuming, say, a 3 percent average annual growth rate for the United States, China will ascend to the world's largest economy in just 12 years.[1]

Whether or not China continues to grow at such a rapid pace remains to be seen. But with its large population and labor force, China's preeminence is inevitable if its modernization continues. At 1.3 billion, China's population is 4.5 times that of the United States. The labor force comparisons are astounding. The United States has roughly 130 million workers. China has 760 million—six times more than the United States. It is truly a giant.

In many ways, China's emergence into the world economy is like the grand "exogenous" shock economists might conceive in a mathematical model, a change so large that, as economist Joseph Schumpeter wrote, "hardly any 'ways of doing things' which have been optimal before remain so afterward."[2]

This article investigates the effects of China's awakening on the world economy in five major areas—employment, production, trade, capital flows and inflation—and concludes with a look into education and technology—what China must do next to continue down the road of economic development.

Employment and Production

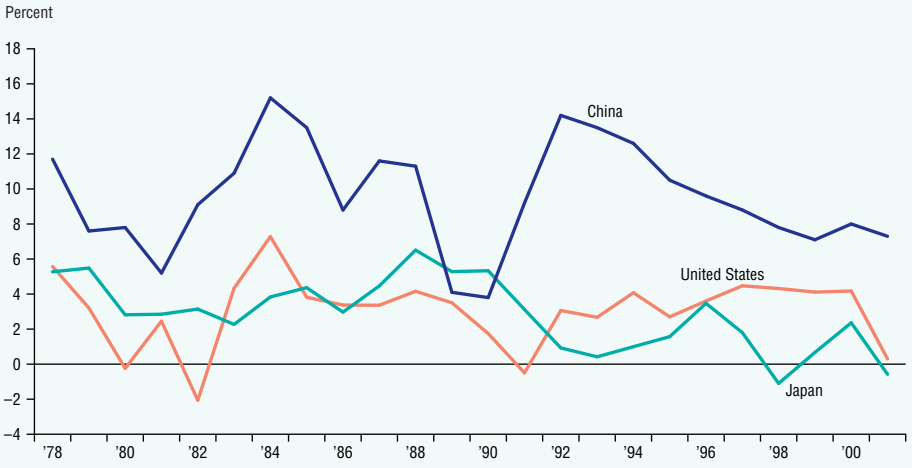
China is a nation in transition from an agricultural economy to an industrial one. Fifty percent of China's labor force still works in agriculture, compared with just 2 percent of U.S. workers. Roughly the same fraction in each nation works in industry—the combination of manufacturing, mining and construction.[3] The industry figure is 22 percent in China and 19 percent in the United States. Just 28 percent of Chinese work in the services sector, whereas 79 percent do so in the United States. China will surely outgrow manufacturing and transition one day to a largely services economy, as did the United States in gaining its wealth, education and human capital. But right now, China is following the footsteps of early 20th century America and mid-20th century Japan, that is, developing its industrial base.

China's transition from agriculture to industry and services is epitomized by the nearly 100 million migrant laborers who work in a city factory or office, often living in a company dormitory and returning to the country once or twice a year to visit their family. Labor is moving to the city because wages there are much higher than in the country. Urban workers in 2001 earned an average of 6,860 yuan, whereas rural workers made just 2,366.

Chinese factory workers earn more than those in agriculture for two (not unrelated) reasons. First, factory goods are readily traded in the world. China's top exports in 2001 were all industrial goods—textiles, fabric, footwear, furniture, electronics and so on. Second, fac-

Chart 2

GDP Growth Rates



SOURCE: *International Financial Statistics*, International Monetary Fund.

Table 1

Four Tiers of Wages

Hourly Pay in Manufacturing, 2001

Country	Dollars per hour
Japan	16.46
United States	16.14
Europe	14.13
Singapore	6.72
Korea	5.69
Taiwan	5.18
Mexico	2.08
Brazil	2.04
China	.61

SOURCES: Bureau of Labor Statistics; *China Statistical Yearbook*, National Bureau of Statistics.

tory workers are generally more productive than those in agriculture because they have more capital with which to work. Chinese factory workers may not have a lot of machinery and equipment compared with U.S. factory workers. But it's a lot more than what's found in Chinese agriculture, where workers still toil mainly with their hands and with little of the technology used on U.S. farms.

Productivity in China's agricultural sector—measured as output per worker—averages just 3.2 percent of that on U.S. farms. One U.S. farm worker produces more output than 31 Chinese farm workers; one U.S. factory worker produces more output than five Chinese factory workers. Employment in China is shifting to manufacturing because productivity and wages there are higher than in agriculture.

But manufacturing jobs are also shifting to China from other parts of the world because of China's cheaper labor. You might say there are four tiers of manufacturing wages in the world: high wages, like those found in Japan, the United States and most of Europe; second-tier wages, such as those of other Asian economies; substantially lower wages in less-developed countries, such as Mexico and Brazil; and wages in China, which are lower still (*Table 1*).

Averaging 61 cents, China's hourly manufacturing wages are just 4 percent of U.S. wages ($16.14) and 29 percent of Mexico's ($2.08).[4] Even adjusting for the higher productivity levels in the United States and Mexico, as well as other factors (shipping cost, product quality and so on), it is easy to see why manufacturing companies might consider shifting operations to China.[5] And the lure will likely continue for quite some time. Economists estimate that over the next decade or so, China's industrial sector will have to create jobs for more than 150 million workers, as it did for nearly 100 million workers during the 1978–2001 period. Such massive labor flows should continue to hold down China's manufacturing wages, affecting the global mix of who produces what and where for years to come.

Trade and Capital Flows

China continues to ramp up into a largely manufacturing-for-export nation. It exported 25 percent of its GDP in 2001, up from less than 5 percent in 1978. China has overtaken Japan as the leading Asian exporter to the United States (*Chart 3*). The huge seasonal pattern of toys and other festive items imported from China each Christmas is distinctive, but the more significant phenomenon is the long-term trend. China is methodically gaining U.S. import market share from all its neighbors.

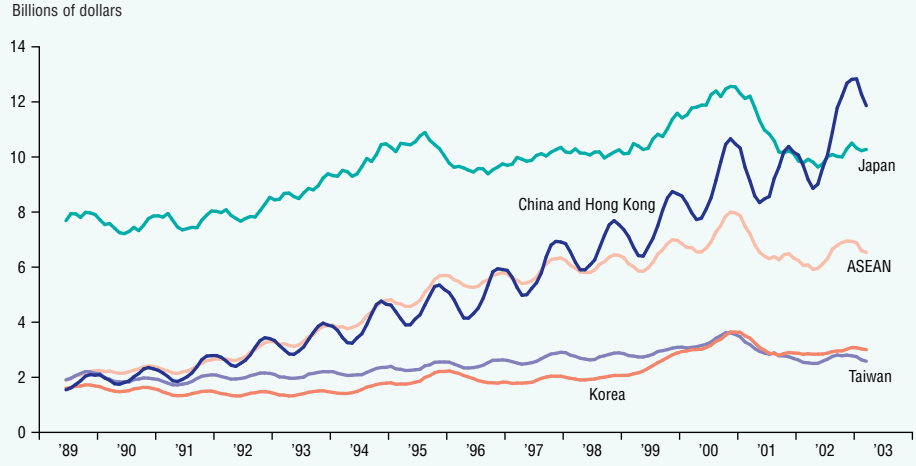
China's awakening is, of course, already affecting industry in other nations. Consider, for example, Japan and Mexico. From 1978 to 1999, both China and Mexico gained market share in clothing, textiles and related industries at the expense of other producers, such as Japan. China's market share in this industry increased from 2.4 percent to 15.4 percent and Mexico's from 0.6 percent to 4.5 percent, while Japan's declined from 20.5 percent to 13.2 percent. More recent data are not available at the specific industry level, but the overall export numbers indicate that even Mexico is now having trouble keeping up with China's export push. Over the period from 1980 to 1999, Mexico's exports rose by $121 billion, while China's rose by $177 billion. But in the past three years, China's exports have shot up by $188 billion—more than the previous two decades—while Mexico's inched up by just $13 billion.

China's growing production is no doubt affecting competitors, but clearly the impact of China's emergence on overall foreign production isn't bad. Just as you're better off when your neighbors are rich than when they're poor, China's growth will come with a mostly positive upside, especially for savvy world suppliers who tune in to China's needs.

As China exports more of what it produces, it will import more of what it consumes, creating a huge market for foreign producers. Indeed, China's imports as a share of GDP grew from 2 percent in 1970 to 23 percent in 2002. The data clearly show that as China produces more, it is consuming more as well. Chinese households—in both the country-

Chart 3

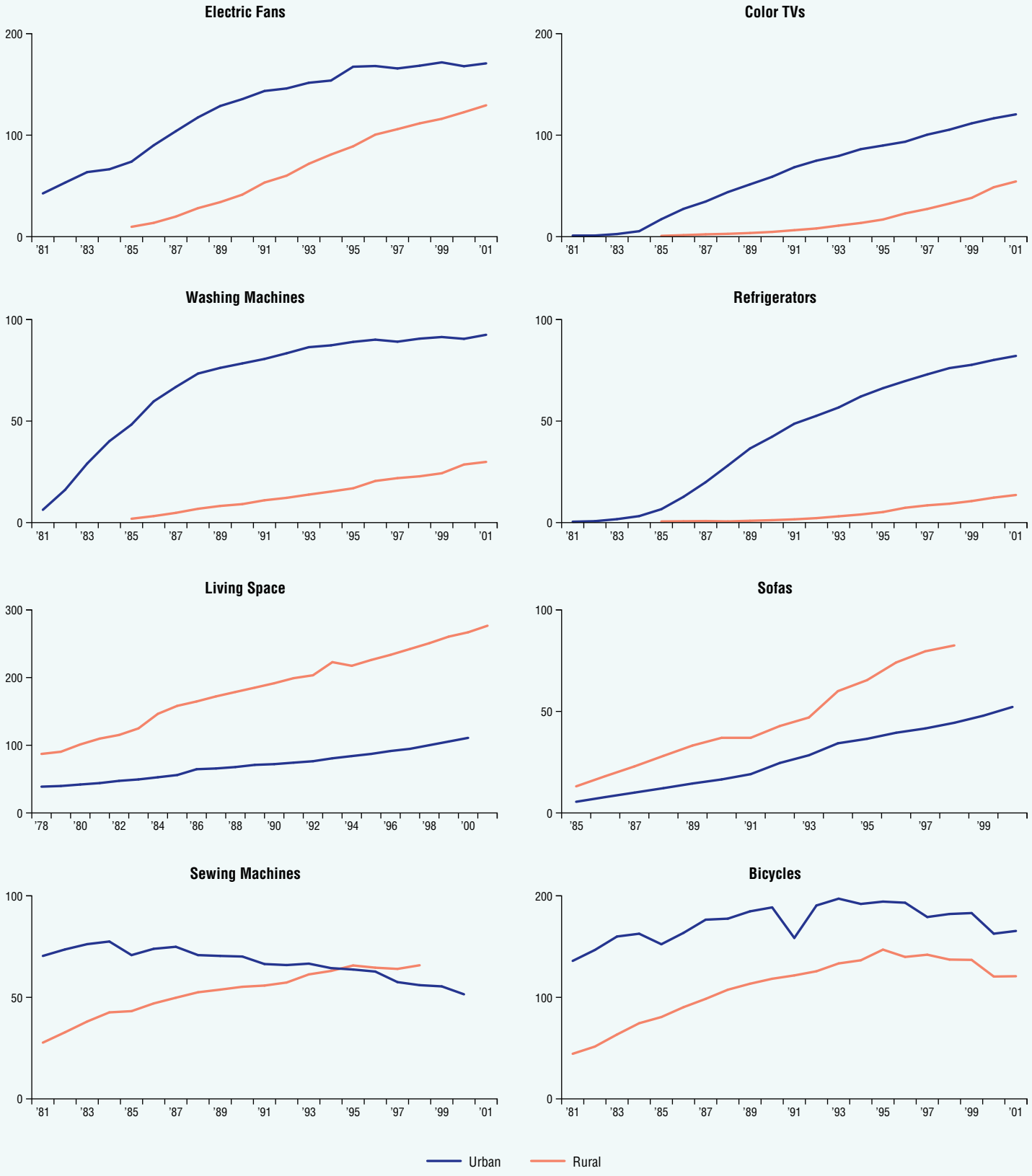
China: Leading Asian Exporter to the United States



SOURCE: *Direction of Trade Statistics*, International Monetary Fund.

Chart 4

Consumer Goods per 100 Households in China



NOTE: Data are in number of items except for living space, which is square feet per capita.

SOURCE: *China Statistical Yearbook*, National Bureau of Statistics.

Table 2

A Burgeoning Consumer Market

Item	Per 1,000 people* China	United States
Bicycles	583	361
Motorcycles	22	15
Autos	6	475
Telephone main lines	137	667
Mobile phones	110	451
Radios	339	2,117
Televisions	304	835
Cable TV subscribers	69	257
Living space (square feet per capita)	66	718
Electric power consumption (kilowatt-hours per capita)	827	12,322

* Unless noted.

SOURCES: China: Bicycle, autos, *China Statistical Yearbook*, National Bureau of Statistics; living space, *The Housing Indicators Program*, vol. 2, United Nations Centre for Human Settlements and the World Bank. United States: Bicycle, www.bikelink.com; living space, *Housing Characteristics, 1993*, U.S. Department of Energy, Energy Information Administration. All other data are from *World Development Indicators*, World Bank.

side and the city—increasingly own electric fans, color TVs, washing machines and refrigerators (*Chart 4*). City dwellers tend to have more of most things. But with less living space than country folks, they tend to own a foldout bed rather than the standard couch.

As China's population gains wealth, it is buying more of most things but less of others, such as sewing machines and bicycles. The bicycle has been the main means of transportation in China for over half a century. It's affordable and versatile. Nearly 100 people in China own a bike for every person who owns an automobile (*Table 2*). China has 583 bikes, 22 motorcycles and just six cars for every 1,000 people. The United States has not six, but 475, cars per 1,000 people. Raising China's auto-ownership rate to, say, just a fifth of U.S. levels would require production of 114 million more vehicles—nearly as many as are already operating in the United States. There's still a lot of room to go in selling many such consumer staples—radios and TVs, electricity and much, much more.

China is a burgeoning consumer market, but it also needs many of the intermediate products and physical capital—machinery, equipment, software and the like—that go into production. Largely on the basis of these types of sales, China's neighbors (excluding Japan)—Korea, Russia, Malaysia, Thailand, Taiwan, Philippines, Singapore, Indonesia and Vietnam—have seen their trade balances with China improve from a combined surplus of $500 million in 1992 to $26.5 billion today. With the exception of Vietnam, every one of these nations now has a trade surplus with China.

World capital flows into China also reflect the nation's growing purchases of investment-type goods. As late as 1980, virtually no capital flowed into China from the rest of the world. Last year, though, the figure approached $50 billion—more than capital flows into the United States (*Chart 5*). The money appears to be coming from all over the globe and includes what might otherwise have been invested in the United States and China's Asian neighbors.

China clearly has been getting a lot of investors' attention worldwide, and interest intensified with the anticipation of China's 2002 entrance into the World Trade Organization. Capital seeks labor, and China's massive shift from farm to factory will likely offer world capitalists the labor with which to earn good rates of return for decades.[6]

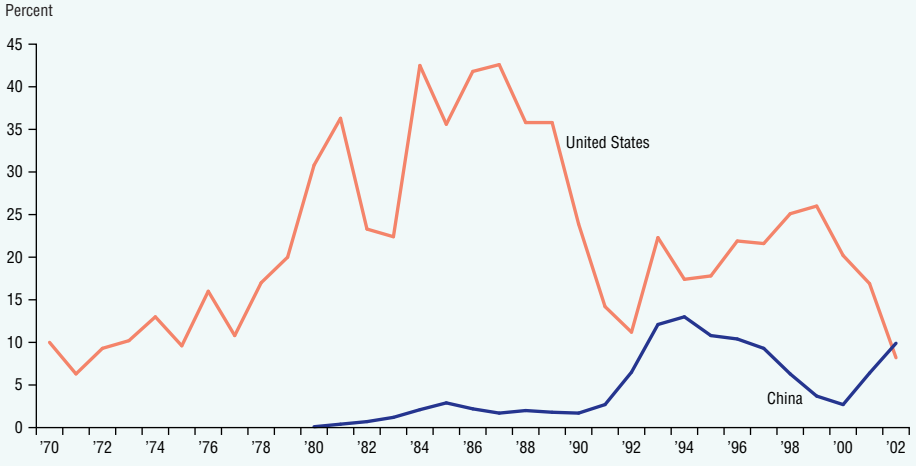
Inflation

China's burgeoning industrial output has almost surely been restraining world and U.S. inflation. In effect, China's emergence into world production and trade has acted like rapid technological progress or a massive supply shock. By importing Chinese goods, nations have been able to replace higher-cost suppliers with lower-cost ones, much the same as they could if production technology were to advance in their home industry.[7]

U.S. imports from China have grown from nil in the late 1970s to 10 percent of GDP today, putting China just below Mexico in terms of U.S. imports from nonindustrialized nations. Roughly half of all U.S. imports today are from nonindustrialized nations—Mexico, China, the Association of Southeast Asian Nations (ASEAN), Korea, Taiwan, Brazil, Venezuela and so on. This is China's peer group in

Chart 5

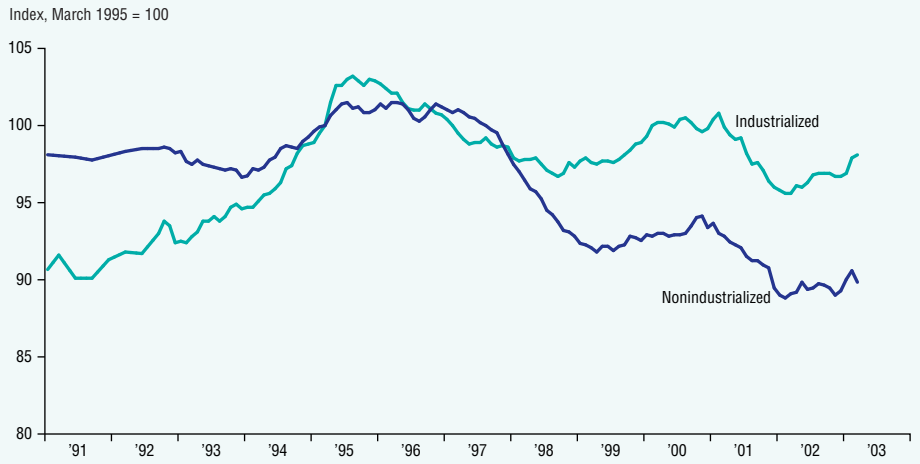
Foreign Direct Investment as a Percentage of World Total



SOURCE: *World Investment Report*, United Nations Conference on Trade and Development.

Chart 6

U.S. Import Price Index for Manufacturing Goods



NOTE: Industrialized countries include Western Europe, Canada, Japan, Australia, New Zealand and South Africa.
SOURCE: Bureau of Labor Statistics.

Our growing imports from China appear to be putting downward pressure on U.S. inflation.

terms of the products it produces and the direct competition it exerts. In 2002, roughly 20 percent of U.S. imports from nonindustrialized nations were from China. But just as a large, growing retailer like Wal-Mart can exert price pressure on its market well beyond its market share, China's influence over its competitors' pricing power likely extends far beyond its current market share.[8] This is important because the price index for manufactured goods from nonindustrialized nations has been falling for the past six years (*Chart 6*).

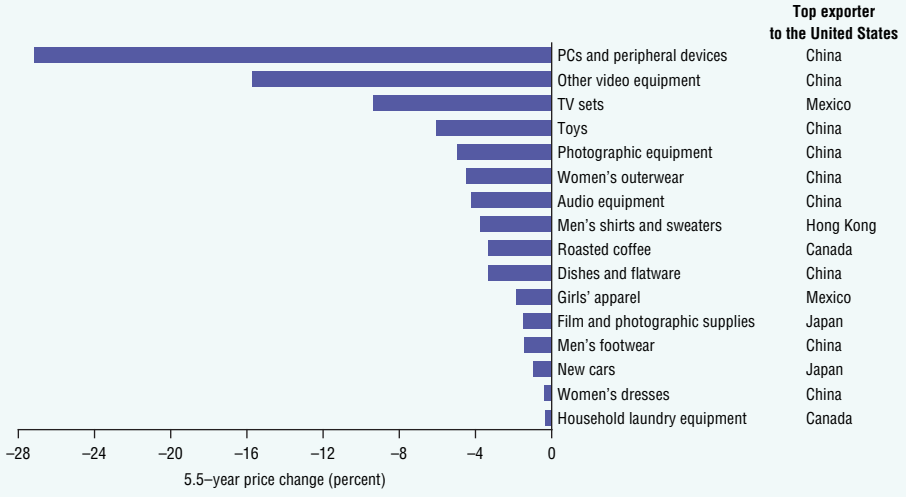
Our growing imports from China appear to be putting downward pressure on U.S. inflation. China is the leading exporter to the United States of PCs, video, audio and photographic equipment, toys, dishes and flatware, numerous clothing items and more, all of whose prices have fallen over the past five and a half years (*Chart 7*).[9]

What's Ahead for China: Building Education and Technology

China is now a low-wage nation, abundant in unskilled labor. If China is

Chart 7

China: Bringing the U.S. Cheaper Products



SOURCES: Bureau of Labor Statistics; U.S. International Trade Commission.

to improve its living standard substantially, it will have to produce and export more knowledge-intensive products. Indeed, China is already doing so. High-tech products make up 23 percent of China's exports today, compared with less than 1 percent in 1985. In its early years of industrialization, Japan mass-produced relatively unsophisticated electronics—such as transistor radios—and progressively upgraded production to more sophisticated, higher-dollar exports, typified by the Lexus automobile. This development model has been observed by most other modern wealthy nations, including the United States, and it's one that can work for China, too. But it requires building education and technology far above current levels.

China today has six times the university population it did in 1978—56 students per 10,000 population, compared with just nine back then. But that's still just about a tenth of U.S. levels (541 students per 10,000 population), not enough to sustain growth. So Chinese students are leaving in droves to get advanced degrees elsewhere. 1999 is the latest year for which data are available on the number of Chinese students going abroad to study, but even back then the data showed a huge jump. Interestingly also—and exactly what one would expect—more Chinese students today are returning to China once they complete their education. This is probably just the beginning of a trend, where more and more students return home as China's economy develops and becomes more privatized.

Nearly 40 percent of China's workers today are employed in private or foreign-funded enterprises. That's up from zero in 1978, and it means they can now run a business for profit. Economic theory suggests that as market principles take greater and greater hold in China, its population will earn a better rate of return on education; thus, more people will get an education, and more will remain in China. As this happens, China will be able to transition to the next phase—a high-tech and services economy.

But China will also have to develop its information-age infrastructure. The United States has 625 personal computers per 1,000 people; China has 19. The United States spends $2,924 per capita on information and communications technology annually; China spends $53. The United States has nine times the scientists and engineers engaged in research and development. China has 184 secure Internet servers; the United States, 78,126. The United States has 20 times as many Internet users per capita (*Table 3*).

Right now, China's labor force is allocated between agriculture, industry and services roughly as America's was in 1882. This does not mean, though, that it will take China 120 years to reach current U.S. living standards. Just as it's easier to walk through a jungle on a path others have already cut, followers can grow faster than leaders through technology transfer.

Currently, China's per capita GDP (purchasing-power-parity-adjusted) is roughly $4,800—about one-eighth that of U.S. levels (*Chart 8*). That's an income roughly equal to 1901 America's. But regardless of whether China's living standards ever fully catch up with the United States', the massive change that's occurring in China will have profound

Table 3

Education, Science and Technology

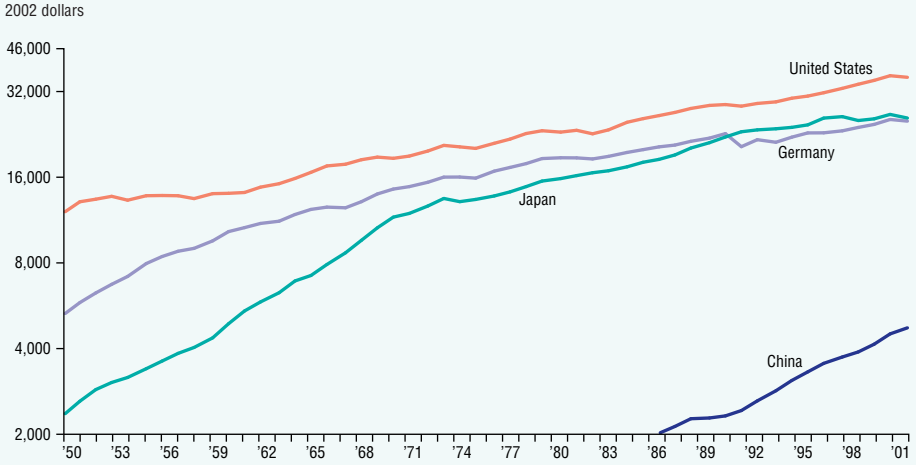
	China	United States
Literacy rate	85.8%	97.0%
High school graduates aged 25+	18.0%	84.1%
College graduates aged 25+	5.2%	25.6%
University students (per 10,000 population)	56	541
Personal computers (per 1,000 population)	19	625
Information and communication technology expenditure per capita ($U.S.)	$53	$2,924
Scientists and engineers in R&D (per million people)	473	4,099
Scientific and technical journal articles	11,675	163,526
Secure Internet servers	184	78,126
Internet users (per 1,000 people)	26	501

SOURCES: China: High school graduate, college graduate: National Bureau of Statistics; university students: *China Statistical Yearbook*, National Bureau of Statistics. U.S.: Literacy rate: *The World Factbook*, U.S. Central Intelligence Agency; high school graduate, college graduate, university students: U.S. Bureau of the Census. All other data are from *World Development Indicators*, World Bank.

Chart 8

Catch Us If You Can

*Per Capita GDP, 1950–2001**



* Purchasing-power-parity-adjusted.

SOURCES: Maddison, Angus (2001), *The World Economy: A Millennial Perspective*, Organization for Economic Cooperation and Development, Table C; *World Development Indicators*, World Bank.

effects on the world economy for decades. Certainly the post-World War II development of Japan and Germany greatly affected other nations, even though Japan and Germany never fully converged to our living standards and even though the two countries' combined labor force is only 110 million—one-seventh the size of China's. One would expect the magnitude of China's influence on the world to be much greater.

Conclusion

China is at an intersection of yesterday and tomorrow. Just a quarter century ago, China was a largely agricultural nation—isolated, less educated and stagnant. But today, China is rapidly transforming itself into an industrial nation and thereby raising its population's living standards. To progress much further beyond this stage and toward the heights of modern nations, China must develop its knowledge and service base—which it is doing. China's full transformation can happen; it probably will happen; indeed, it already is happening in China's modern cities—Shanghai, Beijing, Qingdao, Guangzhou, Nanjing, Shenzhen and so on.

The lifestyle China's youth will grow to enjoy will be far above what previous generations have ever known.

The lifestyle China's youth will grow to enjoy will be far above what previous generations have ever known. And as China grows, the world will be a richer place as well.

— W. Michael Cox
Jahyeong Koo

Cox is senior vice president and chief economist and Koo is an economist in the Research Department of the Federal Reserve Bank of Dallas.

Notes

The authors wish to thank Dong Fu, Fanying Kong and Julia Kedrova for their excellent comments and assistance with data. We also received helpful comments from Evan Koenig and Mark Wynne.

1 There is an ongoing debate regarding the reliability of China's GDP data. However, even skeptics of China's high GDP growth rates do not deny that China has had markedly higher growth following the reforms of 1978.

2 Joseph Schumpeter (1939), *Business Cycles: A Theoretical, Historical, and Statistical Analysis of the Capitalist Process*, vol. I, p. 101. Schumpeter also recognized the power of emerging markets to create a new economic order when he wrote, "The opening up of new markets, foreign or domestic…revolutionizes the economic structure *from within*, incessantly destroying the old one, incessantly creating a new one. This process of Creative Destruction is the essential fact about capitalism. It is what capitalism consists in and what every capitalist concern has got to live in" (*Capitalism, Socialism, and Democracy*, orig. pub. 1942, 1950 ed., p. 83).

3 Manufacturing is by far the largest industrial component. In the United States, roughly 68 percent of industry workers are in manufacturing, 2 percent in mining and 30 percent in construction. In China, the manufacturing figure is 66 percent; in Mexico, 80 percent.

4 Figures are in current U.S. dollars.

5 Using labor force and purchasing-power-parity-adjusted output statistics from combined industry (manufacturing, mining and construction) as reported by the World Bank, productivity in Chinese industry is 19.2 percent that of U.S. industry and 78 percent of Mexican industry.

6 In 2001, the market capitalization of China's 1,154 companies listed on its domestic stock exchanges was just $542 billion, whereas the 6,355 domestically listed U.S. companies were valued at $13,984 trillion, according to the World Bank.

7 Many economic models would yield the result that world prices would fall as a large country like China comes on the economic scene. One simple such model is comparative advantage, as illustrated in "The Fruits of Free Trade," Federal Reserve Bank of Dallas *2002 Annual Report*, exhibit 2, p. 7. In this model, world production of shoes and soybeans (the two goods used for illustration) rises by 150 percent and 43 percent, respectively, as China and the United States move from autarky to free trade. The overall dollar price index (the monetary cost of the base-year consumption bundle) falls by 30 percent in the United States, and the yuan price index falls by 60 percent in China.

In general, extending specialization and trade creates both relative and absolute price effects, but absolute prices tend to fall, which lowers the overall price index. The lower prices in each country are accomplished not just through added production, but through trade—each country importing the good that its trading partner produces most efficiently. It is in this context that we treat the import of Chinese goods as lowering U.S. prices—that is, reflecting not merely a relative price effect (the price of imports versus domestically produced goods) but an increase in world output and consumption as production shifts to lower-cost producers.

8 Wal-Mart's share of 2002 sales among the 100 leading retailers was 20 percent ($246.5 billion of $1,236.2 billion). Few, though, would doubt Wal-Mart's ability to exert downward pressure on its competitors' prices by making those suppliers more efficient as well.

9 The five and one-half year time horizon is chosen because of data availability. Price statistics on all the products in Chart 7 are available beginning in January 1998.

U.S. Natural Gas Prices Heat Up

(Continued from front page)

(LNG) are likely to prove necessary to prevent prices from remaining high.

A sustained increase in the price of natural gas can slow the pace of overall U.S. economic activity. More than 70 percent of natural gas is consumed directly or indirectly by commercial and industrial establishments. Many industries, particularly those such as petrochemicals that rely heavily on natural gas, are adversely affected by higher natural gas prices.

Inventories and Natural Gas Prices

Sharply rising prices are always the consequence of demand expanding more than supply or supply contracting more than demand. In the case of natural gas, the analysis is complicated by strong seasonal patterns in consumption and a very mild seasonality in production. U.S. natural gas consumption is nearly double in January what it is in May and June. Unusually cold winter weather or unusually warm summer weather can further accentuate seasonal patterns.

In a market with sharp swings in consumption, inventories play an important role. In an average year, natural gas consumption exceeds production and imports in November, December, January, February and March. During those months, current production, imports *and* inventories are typically used to meet consumption. During the average year, inventories are built during the months of May, June, July, August, September and October, when natural gas production and imports typically exceed consumption.

Consequently, swings in inventories are one key to understanding movements in natural gas prices. When inventories fall below normal averages for a given month, natural gas is seen as relatively more scarce, and its price rises. When inventories rise above normal averages for a given month, natural gas is seen as relatively more plentiful, and its price falls.

Oil Prices and Natural Gas Price Volatility

For some industries and electric utilities, natural gas and residual fuel oil (a petroleum product) are good substitutes. These energy users are able to switch back and forth between these fuels quickly, depending upon which is cheaper. Rising oil prices push these energy users toward natural gas, and falling oil prices attract them back to residual fuel oil. This substitution is commonly known as *intra*plant fuel substitution.

Although the number of facilities that are able to switch from natural gas to residual fuel oil has declined substantially, changes in the relative prices of natural gas and crude oil can lead to switching between plants that use natural gas and those that use oil products in what is known as *inter*plant fuel switching. Changes in the relative prices of natural gas and crude oil also lead to interfirm fuel switching (where the firms producing a given product change) and interindustry fuel switching (where the composition of output changes). Consequently, economic research finds that oil and natural gas prices have tended to track each other over long periods, and shocks in one of these fuel markets are quickly transmitted to the other.[1]

Recent Volatility in Natural Gas Prices

In winter 2000–01, two factors contributed to sharply rising natural gas prices. In the West, a drought reduced hydroelectric power. Other parts of the United States had colder than normal winter weather. Both contributed to a surge in natural gas demand. In the West, the additional natural gas was used to generate electricity. Elsewhere, it was used to heat homes and businesses. The surge in natural gas demand led to a sharp reduction in inventories (*Chart 2*). As inventories fell, natural gas prices skyrocketed—with the spot price reaching nearly $10 per million Btu in December 2000.

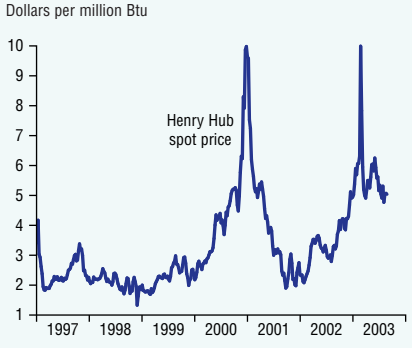
In subsequent months, production was increased, and mild weather and weakening economic activity contributed to falling natural gas demand. Inventories were swiftly rebuilt. By December 2001, inventories were at a five-year high. The spot price of natural gas was just over $2 per million Btu. Throughout 2002, inventories varied seasonally but remained at the high end of their five-year range.

During 2002, oil prices began to rise. Oil production was disrupted in Venezuela. Tension in the Middle East began to escalate. Rising oil prices prompted a movement away from oil consumption toward natural gas, which boosted natural gas consumption and pushed natural gas prices upward—even though inventories remained very high.

During winter 2002–03, continued gains in oil prices, colder-than-normal weather and a recovering economy contributed to stronger-than-anticipated gains in natural gas demand. At about the same time, reports suggest, natural gas production slipped below expectations. Natural gas fields that were made economi-

Chart 1

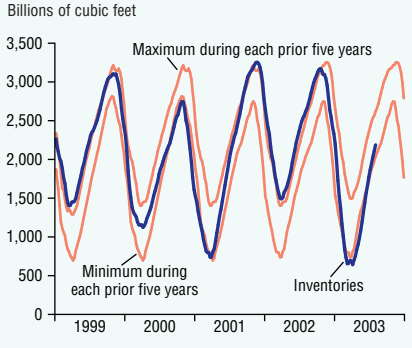
U.S. Natural Gas Prices Rise Sharply in 2003



SOURCE: *Wall Street Journal.*

Chart 2

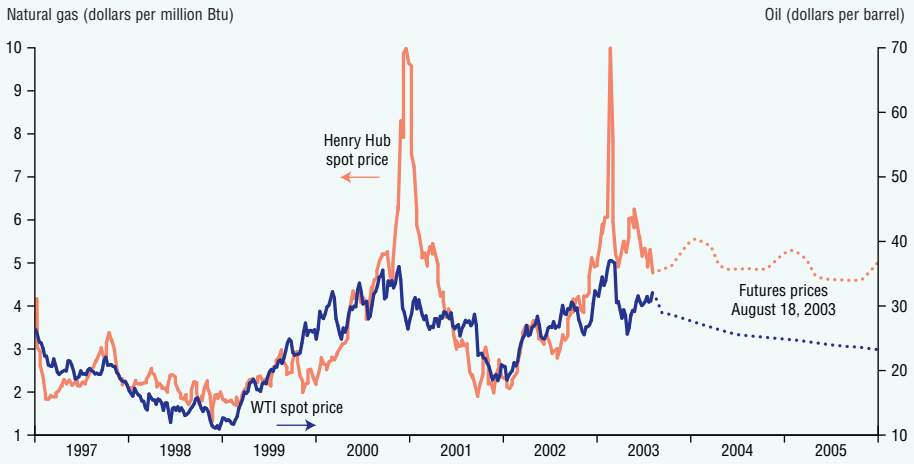
Natural Gas Inventories Remain Low



SOURCE: Energy Information Administration.

Chart 3

U.S. Natural Gas Prices Decouple from Oil Prices



SOURCE: *Wall Street Journal.*

Over the next few years, the prospects for substantially lower natural gas prices than are forecast by the futures market depend largely on the weather. An unseasonably cool summer or unseasonably warm winter could reduce demand. A lack of production shutdowns offshore in the Gulf of Mexico during the fall hurricane season could boost supply. Although domestic drilling for natural gas responded to higher prices (*Chart 4*), increases in domestic production are not expected to enable significant inventory rebuilding over the short term. Imports from Canada are constrained by the current extent of resource development in that country and a lack of pipeline capacity. Imports of LNG have risen sharply, but substantial growth is currently limited by a lack of LNG terminal facilities in the United States.

cally feasible with newer technology proved to have sharper decline rates than had been expected. Although we had approached winter with high natural gas inventories, they were used quickly and fell to five-year lows by March 2003. Once again, natural gas prices skyrocketed.

Near-Term Outlook for Natural Gas Prices

As natural gas prices surged in late 2002 and 2003, they pulled away from their historical relationship with oil prices (*Chart 3*). An old rule of thumb is that the spot price of natural gas at Henry Hub (a delivery point in Louisiana) is roughly $1 per million Btu for each $10 per barrel for the spot-price West Texas Intermediate crude oil (WTI). A more appropriate pricing rule makes use of the substitutability between natural gas and residual fuel oil. Under such a rule, the price of a million Btu of natural gas at Henry Hub should be about 15 percent of the per-barrel price of WTI, minus the extra cost of transporting natural gas to end users. By the latter rule, a price of $32 per barrel of WTI would imply a price of about $4.50 per million Btu for natural gas at Henry Hub—a little less than the last price shown on the chart.

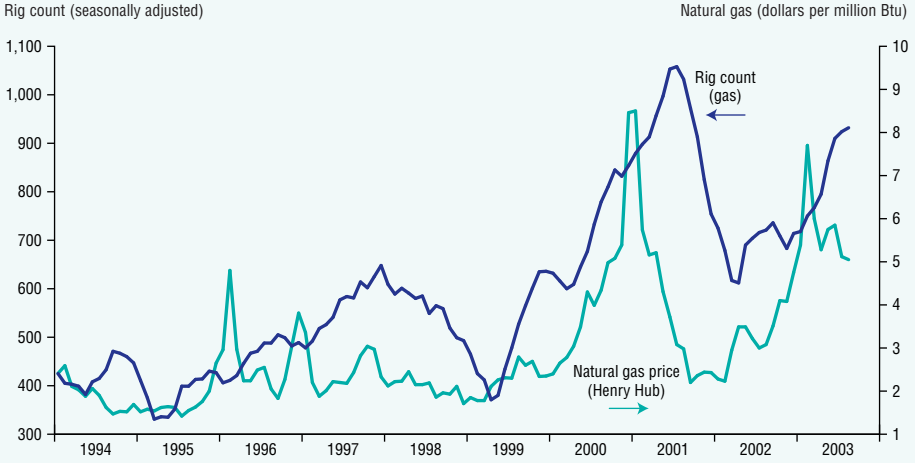
Although natural gas prices broke away only temporarily from oil prices from late 2000 to mid-2001, the current market outlook is that natural gas prices will continue to command a premium over their historical relationship with crude oil. Futures markets for these two fuels show expectations of a continued decoupling of natural gas and oil prices through year-end 2005. While the price of WTI is expected to decline to the low $20s by 2005, natural gas prices are expected to hover around $5 per million Btu for the next few years. Inventories are being rebuilt, but they are staying only slightly ahead of normal seasonal growth and are still below the five-year average for August.[2]

Longer-Term Outlook for Natural Gas Prices

Over the longer term, analysts generally expect natural gas demand to expand more rapidly than that for other fuel sources (*Chart 5*).[3] In comparison with other fuels, natural gas is seen as environmentally desirable because it burns more cleanly. Without adequate development of domestic natural gas resources and additional imports, rising demand will continue to keep natural gas prices elevated relative to their historical relationship with oil. Conse-

Chart 4

Drilling Responds to Higher Natural Gas Prices



SOURCES: *Wall Street Journal*; Baker Hughes, Inc.

quently, the decoupling of natural gas and petroleum prices could persist, even though many analysts believe there are adequate natural gas resources in place to bring prices back to about $3.50 per million Btu, which is roughly consistent with $25 oil.[4]

Some analysts have estimated that significant quantities of LNG can be imported into the United States at a domestic price of $2.50 to $4 per million Btu. Some additional natural gas may be available on public lands in the lower 48 states at market prices of $2.50 to $3.50 per million Btu. Some analysts estimate that significant quantities of natural gas from Alaska can be brought to the lower 48 at market prices of $3.50 to $4 per million Btu. Additional natural gas is believed to be available in remote areas of northern Canada.

A significant increase of LNG will require the construction of additional terminal facilities beyond the current four (in Georgia, Louisiana, Massachusetts and Maryland) that currently serve the entire United States. Further development of natural gas resources in the lower 48 will require better access to public lands and the development of new pipeline capacity to move the gas from remote locations to markets. Bringing natural gas to the lower 48 from Alaska will require construction of a new pipeline. Looking further ahead, a significant increase in natural gas imports from Canada will require the exploration and development of remote fields not yet in use and the construction of new pipelines.

Although increased usage of natural gas is seen as one way toward a cleaner environment, further development of natural gas resources is necessary to support increased usage. Opponents of new development are concerned about environmental consequences and see energy conservation as a potential solution to the looming problems in natural gas markets. A substantial body of research suggests that such conservation is likely to have economic costs at least as high as elevated energy prices and probably higher.[5]

Economic Effects of Higher Natural Gas Prices

Sustained high natural gas prices—forecast by the futures market and the likely consequence of failing to develop additional resources—are likely to prove a drag on U.S. economic activity. Higher energy prices are indicative of increased scarcity of natural gas, which is a basic input to production.[6] As such, rising natural gas prices result in a classic supply-side shock that reduces potential output. Consequently, output and productivity growth slow. The decline in productivity growth lessens real wage growth and increases the unemployment rate at which inflation accelerates.[7] If market participants expect the near-term effects on output to be greater than the long-term effects, they will attempt to smooth their consumption by saving less or borrowing more, which boosts the interest rate. With slowing output growth and an increase in the real interest rate, the demand for real cash balances falls, and for a given rate of growth in the monetary aggregate, the rate of inflation increases. Therefore, rising natural gas prices reduce the growth of gross domestic product (GDP) and boost real interest rates and the measured rate of inflation.[8]

To my knowledge, no research that has been through peer review has quantified the effects of rising natural gas prices on U.S. economic activity. A considerable body of research has addressed the economic effects of higher oil prices.[9] That research can be adapted to provide a rough approximation of the economic effects of rising natural gas prices.

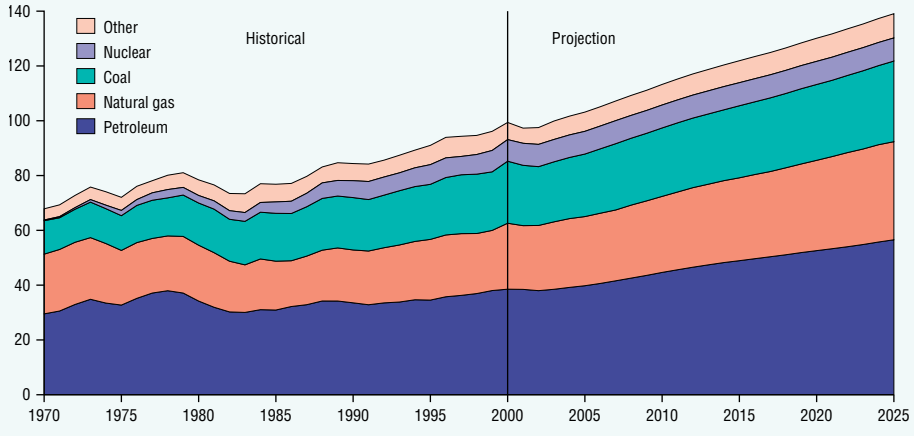
During previous oil price shocks, natural gas and oil prices have generally moved together. Prices for other primary energy sources were relatively unchanged. Consequently, the measured effects of oil price shocks may represent the combined effects of both oil and natural gas price movements. Natural gas accounts for about 40 percent of total oil and natural gas consumption, so 40 percent of the measured effect of an oil price shock may be a rough approximation of the effect of a natural gas price shock by itself. On that basis, a rough estimate is that a permanent doubling of natural gas prices would yield a one-time reduction in U.S. GDP by 0.6 to 2.1 percent below what it would otherwise be.[10] The increase in the GDP deflator would be about the same. The effects would be fully realized over two to three years.

Several factors suggest the rough estimate may be a little high. A reduced energy-to-GDP ratio may have made the economy less sensitive to energy price shocks. Because U.S. natural gas prices are determined primarily in a North American market rather than world markets, high U.S. prices are unlikely to slow economic activity outside North America, which would lessen the effects on the U.S. economy. In addition, rising oil prices result in substantial income transfers from the United States to oil-exporting nations, but rising natural gas prices do not result in similar transfers because most of the

Chart 5

U.S. Energy Consumption Projected to Rise

Quadrillion Btu



SOURCE: Energy Information Administration.

natural gas consumed in the United States is produced domestically. The smaller transfers associated with rising natural gas prices have a theoretically interesting, but quantitatively small, effect in lessening the overall economic effects of higher energy prices.

In contrast, the heavy use of natural gas in the industrial and commercial sectors may make the economy more sensitive to natural gas price movements than oil price movements. On balance, a more refined estimate is that a permanent doubling of natural gas prices would result in a one-time reduction of U.S. GDP by 0.5 to 1.8 percent below what it would otherwise be. The increase in the GDP deflator would be about the same. The effects would be fully realized in about two to three years.

The economic effects of higher natural gas prices are likely to be uneven across industries and regions of the country.[11] States with extensive natural gas fields will benefit from rising natural gas prices, while states with industries that use natural gas extensively will be hurt. Among the domestic industries most adversely affected by rising natural gas prices are fertilizer producers, the petrochemical industry, electric utilities, aluminum producers and the users of these goods and services.[12]

Conclusion

Natural gas prices rose sharply during 2003, pulling away from their historical relationship with crude oil prices. Domestic natural gas production and imports failed to keep pace with consumption, and inventories fell sharply. Higher natural gas prices seem likely to be sustained through the next few years unless we have mild weather. With expectations that natural gas consumption will increase faster than that of other fuels over the next 20 years, development of additional natural gas resources, pipelines and LNG terminals is likely to prove necessary to return natural gas prices to their historical relationship with crude oil prices.

If sustained indefinitely, elevated natural gas prices will act as a drag on U.S. economic activity over the next few years. A permanent doubling of natural gas prices could reduce U.S. GDP by 0.5 to 1.8 percent below what it would otherwise be. The increase in the price level would be roughly the same. These economic effects would be uneven across industries and regions of the country and take two to three years to be fully realized.

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Notes

1 See Yücel and Guo (1994) and Brown and Yücel (2003).

2 Natural gas inventories have remained below the five-year seasonal average for each month since March 2003.

3 For example, see the U.S. Energy Information Administration's *Annual Energy Outlook 2003*.

4 Although the imposition of price controls for natural gas could keep natural gas prices in line with those of oil, such controls would exacerbate the shortage rather than alleviate it. See Brown (1985) and Brown and Yücel (1993).

5 See Brown (1998), Schipper (1998) and Sutherland (1994, 1998 and 2000).

6 See Brown and Yücel (2002).

7 Reduced productivity would reduce profits and expected future profits, which would reduce stock prices and wealth.

8 See Brown and Yücel (2002).

9 For surveys on the research about the aggregate economic response to oil price shocks, see Brown and Yücel (2002) and Brown, Yücel and Thompson (forthcoming).

10 A 1987 Energy Modeling Forum study (Hickman, Huntington and Sweeney 1987) that incorporated the work of many researchers estimated the elasticity of the response to the U.S. economy to an oil price shock as −0.02 to −0.076. Brown and Yücel (1995) find it likely that the response to an oil price shock has declined since the 1980s.

11 See Brown and Yücel (1995).

12 Natural gas is the principal feedstock for ammonia-based fertilizers. Foreign producers with access to lower-priced natural gas gain a competitive advantage when U.S. natural gas prices rise. Natural gas is also the principal feedstock for the U.S. petrochemical industry, while foreign competitors primarily use petroleum as their feedstock. When U.S. natural gas prices rise relative to the oil price, domestic petrochemical producers are placed at a competitive disadvantage. Natural gas is one of many fuels that are used to generate electricity, but it is the fuel of choice for most peaking facilities—that is, facilities that meet transitory spikes in electricity demand. Consequently, high natural gas prices can raise costs for an electric utility and its customers. Aluminum production uses considerable energy both directly and through the consumption of electricity. The industry generates some of its own electricity with natural gas. Combined, these factors make the aluminum industry relatively sensitive to natural gas and electricity prices.

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Social Security Restructuring: Tough Decisions Ahead

Social Security is the largest, and perhaps the most popular, government program in U.S. history. Created to help elderly Americans weather the Great Depression, Social Security now pays benefits to more than 50 million Americans each year. It provides more than half the income for 64 percent of America's elderly and is the exclusive source of income for one-fifth.

In recent years, talk of Social Security restructuring has grown because the system offers many current and future workers below-market returns. This means they will retire with less income than they would have had if Social Security had never been established. Some have suggested that workers be allowed to deposit some or all of their Social Security contributions into individual retirement accounts. While a case can be made for individual accounts, such accounts alone cannot solve the problem of Social Security's below-market returns because they do not address the underlying source of the low returns.

Although the textbook economic analysis explaining these below-market returns is well established, it is often ignored in policy discussions. We review this analysis and discuss why large sacrifices by current generations, in the form of tax increases and spending cuts, are the only way to provide higher returns for future generations.

Why Does Social Security Pay Below-Market Returns?

Many people believe Social Security provides below-market returns because it is not just a pension program—it also, for example, redistributes resources from high-wage to low-wage workers. This redistribution certainly causes a high-wage worker's benefit check to be lower than it would have been in a true pension plan. But it also causes low-wage workers to receive higher checks. These monetary transfers from one worker to another do not change the rate of return achieved by the generation as a whole and have nothing to do with Social Security's low returns.

In fact, the Social Security system would pay below-market returns even in the hypothetical case in which there are no risks in the economy and all members of each generation are identical. We initially focus on that simple case, treating each generation as a group and looking at its aggregate contributions and benefits.

The below-market returns paid to current and future workers are directly caused by the fact that Social Security is (largely) a pay-as-you-go system. In such a system, workers' contributions are not invested to pay their own future benefits but are instead used to provide benefits to current retirees. In other words, each generation's retirement is financed by the contributions of its children rather than its own past saving. Such a system accumulates no assets; it is merely a sequence of transfer payments from young to old.

To see the effects of pure pay-as-you-go financing, suppose a social security system is introduced for the first time, permanently imposing a payroll tax on the working generation's labor income and transferring those funds to pay benefits to retirees. In the first period, the generation that is then retired enjoys a financial windfall, or start-up bonus, because it receives benefits without having contributed to the system. Pay-as-you-go Social Security is an exceedingly good deal for this first generation.

But later generations do not enjoy this windfall because they must pay for their elders' retirement before receiving benefits. The rate of return each generation receives from the system can be computed from the generation's payment to its parents and the payment it receives from its children. (Of course, these are not actually investment returns because nothing has been invested.) Whether Social Security is a good deal for each generation depends on how its return from the system compares with the return it could have earned through capital accumulation.

The central result in the textbook analysis is straightforward. If the tax rate on labor income remains constant, each generation earns a rate of return equal to the growth rate of total labor income.[1] For example, if labor income rises by 50 percent between one generation and the next, each generation receives 50 percent more in benefits from its children than it paid to its parents. Or if labor income doubles between one generation and the next, each generation receives double its contributions when it retires.

Of course, a generation receives better returns if the tax rate is higher when it retires than when it worked. If the system is phased in over several generations, for example, each affected generation can earn an expansion bonus akin to the start-up bonus enjoyed by the first retirees. But because the tax rate can't go up forever (certainly not above 100 percent), a pay-as-you-go system cannot permanently deliver returns higher than the growth rate of total labor income.

What has that growth rate been in the United States? From 1929 to 2002, total labor income (adjusted for inflation) grew at an average rate of 3.4 percent per year. A 3.4 percent real return may seem like a good deal, but it's not. If workers weren't paying into Social Security, they could accumulate capital and earn a return that averages around 6 percent per year (adjusted for inflation).[2]

In any given year, the difference between 3.4 percent and 6 percent is not very large. But it is quite large when compounded over a lifetime. The lower return cuts the retirement benefit roughly in half. So a generation that faces a constant tax rate throughout its lifetime suffers a net loss from the pay-as-you-go system equal to about half its tax payments.

Low Birthrate Further Pushes Down Returns

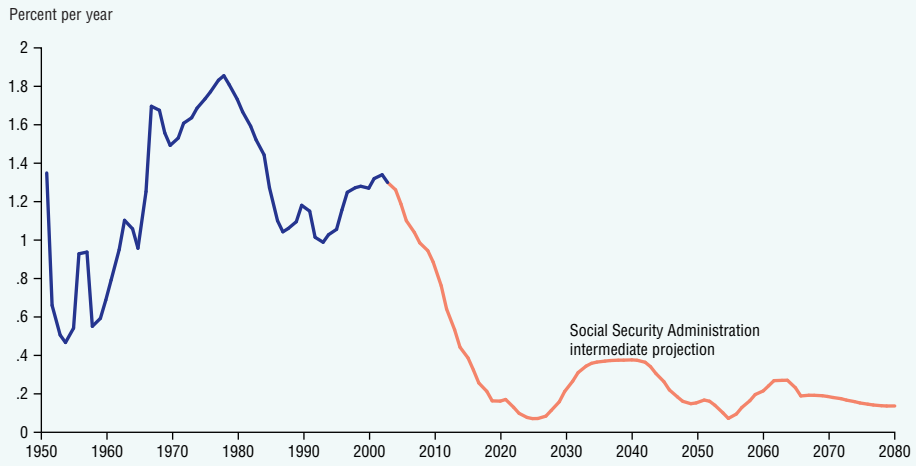
Looking ahead, though, the future growth rate of total labor income—and the long-run return that pay-as-you-go Social Security can deliver—is likely to be lower than the 3.4 percent average observed from 1929 to 2002. That growth rate had two components: 2.1 percent average growth in labor income per working-age person and 1.3 percent average growth in the working-age population. Labor income per working-age

person is likely to keep growing at its historical pace or faster. But the growth of the working-age population will be largely halted by a lower birthrate.

The United States has witnessed a dramatic fall in the total fertility rate—the number of children an average woman will bear over her lifetime, based on a given year's birthrates for women at each age. The total fertility rate peaked at 3.68 in 1957, plunged to 1.74 in 1976 and is now around 2.05. The Social Security Administration projects that the fertility rate will slip back to 1.95 and stay there. A reduction in the birthrate slows the growth of the working-age population, with a lag of a few decades. Even with a boost from immigration, the Social Security Administration projects an average growth rate of only 0.2 percent from 2015 to 2080 (*Chart 1*).

Chart 1

Growth Rate of Population 20 to 64 Years Old Projected to Slow



SOURCE: Social Security Administration.

While a low birthrate may not itself be undesirable (many would welcome its environmental implications), it imposes a significant strain on pay-as-you-go Social Security. Slowing the growth of the working population causes U.S. labor income to grow at a slower rate than it otherwise would, further pushing down the system's returns.[3]

The Closed-Group Liability

Having bestowed above-market returns on earlier participants, a pay-as-you-go system lacks the resources to give market returns to later participants. The losses suffered by later generations are the price of the bonuses paid to the earlier generations; it turns out that their combined losses have a present discounted value equal to the bonus.[4] Of course, their combined *undiscounted* losses are much larger, even infinite if the pay-as-you-go system lasts forever.

The system allows earlier generations to consume more but forces later generations to consume less. This increase in earlier consumption and decline in later consumption shows up as a smaller capital stock (and in an economy open to international capital flows, as smaller net holdings of foreign assets). The pay-as-you-go system crowds out capital accumulation because each generation "saves" for retirement through the system rather than through investment.

The system's distinctive feature is that at each moment, the past contributions of the current retirees have been paid to the retirees' parents rather than invested in capital. If the contributions *had* been invested, the accumulated capital would give retirees a market return on those contributions, which would leave current and future workers' contributions available for investment, giving them market returns as well. There would be exactly enough resources on hand to give everyone market returns, with nothing left to spare.

But in the pay-as-you-go system, the retirees' past contributions are irretrievably gone; only current and future workers' contributions are on hand. Their contributions alone are insufficient to provide market returns for both them and the retirees. Because past contributions were not invested to finance the benefits promised to retirees and those approaching retirement, future generations must finance them by accepting below-market returns.

Every pay-as-you-go system has a "closed-group liability" that is equal to the benefit promises for which no assets have been accumulated.[5] This liability measures the present value of the burden future generations must bear through below-market returns.

This liability turns out to be mathematically equivalent to traditional government debt. The impact of a pay-as-you-go system on each generation is the same as if the government had issued debt to pay the earlier generations' benefits and taxed later generations to service the debt.[6] Like government debt, Social Security transfers resources from later generations to earlier ones and crowds out capital formation. In each case, later generations' losses, though painful to them, do not reflect economic inefficiency. Instead, they reflect the fact that resources have been redistributed from them to earlier generations.

Of course, a pay-as-you-go system could pay benefits that provide a market return relative to payroll tax contributions if general government revenue was tapped to make up the difference. But all government revenue comes from the American people. General revenue is just a name for other taxes paid by Americans, such as the income tax. Using general revenue would not give the affected generations a market return on their total contributions (payroll taxes plus general revenue). Instead, each generation would simply bear part of the burden of below-market returns in the form of higher income taxes or fewer government services rather than higher payroll taxes.

The U.S. Experience

Numerous studies confirm that the Social Security system's actual treatment of different generations matches the predictions of the textbook economic analysis. Chart 2 displays Social Security expert Dean Leimer's estimates of the

actual and projected returns Social Security provides to different cohorts of workers if the current tax rate and benefit formula are maintained.

As the chart shows, early cohorts received phenomenally high returns. The initial retirees received a large start-up bonus; although individuals could not receive Social Security benefits unless they paid into the system for at least a brief time, early recipients received far more in benefits than they paid in Social Security taxes. (For example, the first recipient, Ida May Fuller, paid $25 in taxes but received $22,889 in benefits over her lifetime.) Because Congress steadily raised the system's tax rate during its first four decades, some of the subsequent cohorts received expansion bonuses.

On the other hand, Leimer estimates that cohorts born after 1950 can expect aggregate returns below 2 percent, one-third of what they could receive by investing in capital. The picture becomes even worse once an additional factor is considered. Because current-law benefits are not adjusted for the ongoing rise in life expectancy, they cannot be sustained over the long term by the current-law tax rate. (See box titled "The Impact of Longer Lifetimes.") Chart 2 also shows Leimer's estimates of expected returns for current and future workers if the system's financial imbalance is remedied with a series of tax increases. While these estimated returns (around 1 percent) may be a little low (due to Leimer's pessimistic assumptions about productivity growth), his analysis makes clear the price current and future workers must pay for the bonuses given to earlier generations.

The closed-group liability of the U.S. system is enormous—about $10 trillion, or a year and a half of the country's labor income. Pay-as-you-go Social Security, in conjunction with pay-as-you-go Medicare, is projected to impose crushingly high burdens on future generations, particularly as these programs expand in response to rising life expectancy and medical costs.[7]

Moving Away from a Pay-As-You-Go System

To forestall this grim outcome, many analysts have proposed a system in which each generation finances its own retirement. Such a system would allow workers to earn market returns on their contributions, boosting their retirement income.

Of course, ending the system does not painlessly erase the closed-group liability. Dealing with that liability—the promised benefits for which no assets have been accumulated—poses an important obstacle. Abruptly ending the pay-as-you-go system would inflict financial catastrophe on recent retirees, who would receive no benefits after paying taxes for their entire working lives. Workers approaching retirement would also lose their expected benefits, which far exceed their remaining expected taxes. This shutdown penalty from ending the current system is the mirror image of the start-up bonus from introducing the system. Commonly called the transition cost, it is equal to the $10 trillion closed-group liability.

Even the most ardent proponents of Social Security restructuring do not propose eliminating benefits for current retirees and those approaching retirement. At most, they suggest modest benefit cuts. But if those groups do not bear this $10 trillion burden, someone else must do so.

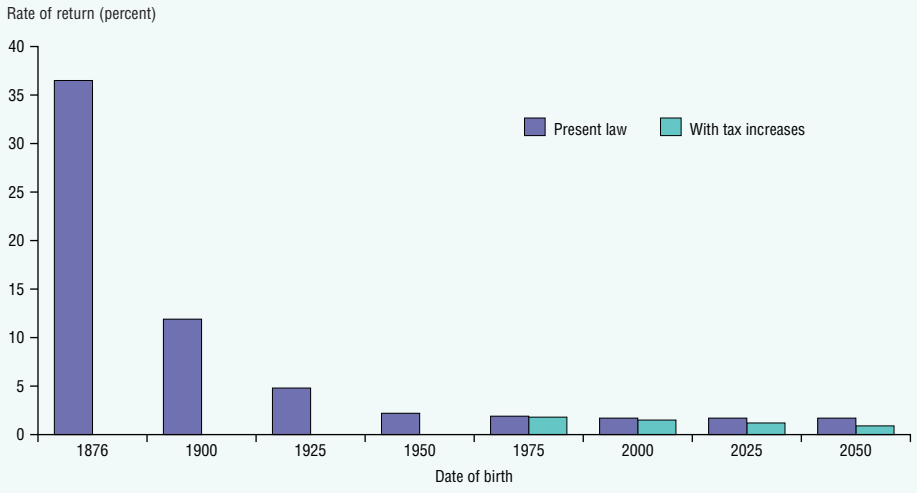
One possible approach, roughly similar to some leading proposals, would require current workers to provide full benefits for their elders but receive a reduced benefit check from their children, who would receive no benefit checks at all from their own children. After this transition period, each subsequent generation would fund its own retirement and receive the higher rate of return afforded by capital accumulation. Each of these generations would enjoy a more prosperous retirement because current workers and their children bore the transition cost and paid off the closed-group liability. Their combined gains would have a present discounted value equal to the $10 trillion transition cost. (Of course, their undiscounted gains would be much larger.)

Most reform plans would use general government revenues to finance at least part of the transition. But again, all government revenue comes from the American people. Using general revenues wouldn't change the reality or the size of the transitional burden. The first few generations would still bear this burden, but in the form of higher income taxes or fewer government services rather than higher payroll taxes.

Some economists have suggested that the transition cost be spread across all future generations by issuing debt and servicing it forever. But that wouldn't solve the problem; requiring each gener-

Chart 2

Social Security Paid High Returns to Past Workers, Offers Low Returns to Current and Future Workers



SOURCE: Dean R. Leimer (1995), "A Guide to Social Security Money's Worth Issues," *Social Security Bulletin* 58 (Summer), 3–20, at p.12.

ation to service this debt would be just as burdensome as requiring them to explicitly pay for their elders' retirement. Since the closed-group liability is equivalent to government debt, replacing it with government debt wouldn't accomplish anything.[8]

The inescapable reality is that the pay-as-you-go system has promised benefits to current retirees without accumulating any assets to pay them. If the current system is maintained, every future generation must bear below-market returns to service this liability. If the system is shut down, some generations must bear a large transition cost to pay off this liability. Every subsequent generation, freed from the obligation to pay for its predecessor's retirement, could then earn market returns by accumulating capital.[9]

Maintaining Social Protections

The transition cost is the biggest fiscal obstacle to be overcome in moving away from a pay-as-you-go system. If it were paid, the system's closed-group liability would be eliminated and each generation could then invest its own retirement savings in the capital markets. Government's current role in transferring money between generations would end, and the new system could, in theory, operate without any government involvement.

But government's role in the Social Security system extends beyond intergenerational transfers. In particular, government provides three forms of social protection via the current system. Social Security ensures that workers "save" even if they aren't yet thinking about retirement. Social Security also provides workers with benefits that can't be lost through unwise or unlucky investment decisions. Finally, Social Security redistributes money within each generation, giving low-wage workers a more plentiful retirement than their own contributions would have given them. These protections have costs, such as a potential reduction in work effort. But if they are going to be maintained in a restructured system, some government involvement will be required.

Contrary to popular belief, Social Security restructuring need not reduce the benefits of low-wage workers. Each generation in a restructured system would be responsible for its own retirement, so the system would no longer redistribute income from young to old. But individuals *within* each generation would not necessarily be completely responsible for their own retirement. Income could still be redistributed from high-wage to low-wage workers within each generation, providing what many view as an important social protection for the elderly poor.

Two major options would allow each generation's savings to be invested in capital while the government regulated the use and distribution of the investment to provide social protections. The first option is a centralized program in which the government would require workers to save and would pool each generation's contributions and invest them in the capital markets. Government would then distribute the proceeds to the generation when it retired. The government would decide how the contributions are invested and how the proceeds would be distributed within each generation. This government-investment option could maintain all the current system's social protections.

The second option seeks a middle ground between centralization and a completely private pension plan. Under this option, the government would mandate that workers save, but each worker's contributions would be placed in a privately owned individual account, except for a portion the government would redirect to low-wage workers. Each worker would have broad discretion to choose how his or her contributions would be invested, and each worker's retirement benefit would be paid from his or her own account. Although this mandatory-accounts option is often called "privatization," the term is somewhat misleading. The option would actually offer a hybrid of public regulation and private choice.

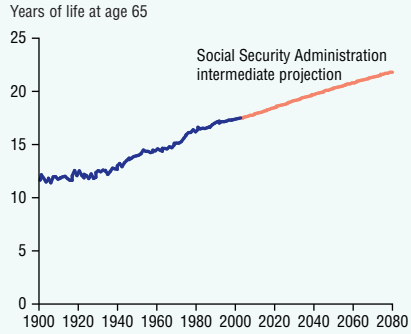
Government investment would have the lowest administrative costs. But the

The Impact of Longer Lifetimes

The upward trend in life expectancy at age 65 is steadily increasing the number of years Americans spend in retirement (*chart*). Unlike the lower birthrate, this trend doesn't change the pay-as-you-go system's long-run rate of return, because it doesn't change the growth rate of the working-age population. But with an unchanged rate of return, an increase in the number of months spent in retirement forces participants to choose between higher contributions and lower monthly retirement benefits. Of course, that choice is unavoidable under any system; workers investing in the capital markets would face a similar trade-off. Still, the need to make this choice poses two potentially troubling issues for the Social Security system.

Upward Trend in Life Expectancy Projected to Continue

(Average of Male and Female Life Expectancy at Age 65)



SOURCE: Social Security Administration.

The first concern is due to the design of current law. The law promises members of each generation monthly benefits proportional to wage rates at the time they retire (no matter how long they live), but doesn't raise the tax rate to cover the extra cost of paying benefits over a longer retirement period. In effect, current law promises that the system will pay ever-higher rates of return as life expectancy rises. This unsustainable promise is expected to lead to a solvency crisis around 2042. Social Security benefits would then have to be immediately and permanently cut below current-law levels, initially by 26 percent, unless (as expected) Congress takes other action. By failing to specify a viable response to rising life expectancy and postponing the final decision until a future solvency crisis, current law introduces uncertainty in the decades before the crisis and the potential for political turmoil when it occurs.

The second concern arises if, as is likely, Congress responds to the rise in life expectancy by raising the tax rate to forestall part or all of the post-2042 cuts in monthly benefits. At first glance, such a response might seem similar to a worker's decision to accumulate more capital in preparation for a longer retirement. But because the pay-as-you-go system offers below-market returns, putting more money into it increases the economic burden it imposes on future generations.

government could divert its asset holdings to the current elderly, moving back to a pay-as-you-go system—which essentially describes the early years of the Social Security program. This risk would be largely avoided with individual accounts, where workers' contributions would be their private property and couldn't be used for other purposes. Government investment would also pose the risk of increased political interference in the capital markets. Of course, given the many possible variations on mandatory accounts and government investment, it is important to look at the specific provisions of any proposal.

The Real Issue

Neither mandatory individual accounts nor government investment alters the fundamental economic trade-off discussed above. Abolishing a pay-as-you-go system imposes a transition cost on some generations and offers higher (market) returns to all later generations, regardless of whether each later generation saves on its own, in mandatory accounts or through the government. Neither mandatory accounts nor government investment actually causes the higher returns. Once freed from the obligation to pay benefits to the preceding generation, workers could earn such returns on their own. Instead, mandatory accounts and government saving are ways to maintain social protections while workers earn those returns.

This point is relevant for proposals that would keep the pay-as-you-go system but establish a new system of mandatory accounts or government investment alongside it. Such a new system would impose no transition cost, since it would provide market returns to everyone paying into it. But it would also offer no gains to future generations, who could have earned the same returns by investing on their own. These generations would still face the same burden they do now—below-market returns on their contributions to the pay-as-you-go system.

There may be sound reasons to support "privatization," but neither it nor any other reform can eliminate below-market returns unless and until the closed-group liability has been paid off and each generation pays for its own retirement. No plan to eliminate below-market returns can sidestep the need for $10 trillion of tax increases or spending cuts.

Conclusion

Social Security is a pay-as-you-go system in which each generation pays for the retirement of its elders and receives Social Security benefits from its children. The inescapable result of this design is the payment of above-market returns to the earliest participants and below-market returns to later participants. The low U.S. birthrate will further push down returns for future workers. If the system continues in its current form, the retirement income received by all future generations will be smaller than what the capital markets could provide.

Moving away from the pay-as-you-go system would raise the retirement income of future generations but would require current generations to accept returns even lower than the 2 percent offered by the current system. Their $10 trillion sacrifice would create a more generous and financially secure retirement system for their descendants. Whether to make this sacrifice is the difficult decision citizens and policymakers face.

—Jason L. Saving
Alan D. Viard

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Notes

[1] This result was first stated by Samuelson (1958) and Aaron (1966). For thorough reviews of the textbook analysis, see Geanakoplos, Mitchell and Zeldes (1998); Kotlikoff (2002); and Lindbeck and Persson (2003). For a simplified review with numerical examples, see Viard (2002).

[2] The reference is to the pretax marginal product of capital, which is the overall payoff from investment. For estimates of its average value, see the sources cited by Viard (2002, p. 4). In the actual economy, both the marginal product of capital and the growth rate of total labor income are subject to risk. The financial markets package the overall return to capital into different securities with different risk characteristics, such as stocks and bonds.

A completely different analysis than that presented in this article (with far more favorable implications for pay-as-you-go Social Security) would apply if the growth rate were greater than the marginal product, but that is not the case for any major industrialized country.

[3] In equilibrium, however, a slower growth of the workforce may also reduce the marginal product of capital. This effect is smaller in an economy open to international capital flows.

[4] This statement refers to the present value, discounted at the marginal product of capital. See Gokhale and Smetters (2003, pp. 14–15); Kotlikoff (2002, pp. 1882, 1886); Viard (2002, pp. 4–5); and Geanakoplos, Mitchell and Zeldes (1998, p. 146).

[5] This liability equals the present discounted value of current retirees' and current workers' future benefits minus the current workers' future contributions. It is sometimes referred to as the "Social Security wealth" of current retirees and current workers. It is also often called the "unfunded liability," but that usage can cause confusion because others define that term to refer to the present value (under current law) of future benefits minus future contributions for all participants, including future workers. The latter calculation measures whether current law is sustainable, a separate issue from the burden the system places on future generations.

[6] The mathematical equivalence of pay-as-you-go Social Security and government debt has been emphasized in the generational accounting literature. See Gokhale and Smetters (2003, p. 12) and Kotlikoff (2002, p. 1887).

[7] See Gokhale and Smetters (2003).

[8] Many authors have noted this fact. For a thorough analysis, see Geanakoplos, Mitchell and Zeldes (1998). Also see Lindbeck and Persson (2003, p. 90) and the numerous sources cited by Viard (2002, p. 8, note 10).

[9] They would earn returns somewhat lower than the currently observed marginal product of capital because the expansion of the capital stock would reduce the marginal product. This reduction would be smaller in an economy open to international capital flows.

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(Mis)reporting Mexico's Gross Domestic Product

The health of Mexico's economy is important to business people and analysts in the United States. This is especially true in Texas, which shares a 1,254-mile border with Mexico and whose economy is closely related to that of its southern neighbor. For example, approximately 43 percent of Texas' exports flow to Mexico. Perhaps the most closely watched indicator of the Mexican economy is quarterly Gross Domestic Product (GDP), published by Mexico's Instituto Nacional de Estadística, Geografía e Informática (INEGI). This article cautions followers of Mexico GDP that the media have misinterpreted the recent GDP statistics, resulting in reports that exaggerate the weakness in Mexico's economy.

INEGI released second-quarter 2003 GDP statistics on Aug. 15. News media characterized the results as continued weakness in the Mexican economy. According to Reuters, "Mexico's economy slowed in the second quarter to post anemic year-on-year growth of 0.2 percent in the second quarter...." The headline of a *Wall Street Journal* story read, "Mexico's GDP Barely Grew in the Second Quarter." Market News International reported, "Mexico's gross domestic product grew a paltry 0.2% year-over-year in the second quarter, following a 2.3% rise in the prior quarter...." Dow Jones said, "Output of goods and services in Mexico grew modestly in the second quarter...."

The United States and most other countries routinely report GDP statistics that have been statistically adjusted to remove the effects of seasonality, the presence of which makes quarter-to-quarter comparisons difficult. For example, there is *always* a decline in GDP from the fourth quarter of one year to the first quarter of the next because of a ramp-up in production for the Christmas season and a decline in economic activity following Christmas. One would need to know the normal magnitude of this decline to know whether a particular fourth-quarter to first-quarter change meant strength or weakness in the economy. Seasonal adjustment removes this confounding effect from the data and makes comparisons from quarter to quarter straightforward. Until recently, reliable seasonally adjusted Mexico GDP data were not generally available. Therefore, analysts and the media have tended to focus on year-over-year comparisons—which should at least be free of the clouding influence of seasonality—although they don't provide information on the most recent trends.

One factor that makes such year-over-year comparisons of Mexico's GDP highly unreliable is the tendency for the Easter holiday to move around in the calendar. Easter can fall as early as March 22 or as late as April 25. In many Latin American countries, economic activity declines during the week or so prior to Easter. La Semana Santa, or Holy Week, runs from Palm Sunday to Easter Sunday and is a period of reduced economic activity during which many Mexicans take vacation. When Easter occurs in March or early April, the lull in economic activity shows up in first-quarter figures. When Easter occurs later in April, the lull manifests itself in second-quarter data. Clearly, a year-over-year comparison in which Easter does not occur in the same quarter in both years will produce an unreliable estimate of true economic growth.

In 2002, Easter fell on March 31, depressing economic activity in the first quarter. In 2003, Easter occurred on April 20, exclusively affecting second-quarter data. The year-over-year GDP growth of 2.3 percent, measured as of the first quarter of 2003 in the unadjusted data, is biased upward, while the 0.2 percent year-over-year growth, measured as of the second quarter of 2003, is biased downward. These are the figures being widely cited in media reports.

Following a joint effort with the Finance Ministry and the Bank of Mexico, INEGI began publishing seasonally adjusted GDP data with its release of first quarter 2003 data on May 15. The new statistical series is calculated using the X12-Arima procedure, which has appropriate tools for correcting the moving Easter problem. In the adjusted data, the year-over-year GDP growth rates, measured as of the first and second quarters of 2003, are 1 and 1.4 percent, respectively (*Chart 1*). Compare these figures with the previously cited 2.3 percent and

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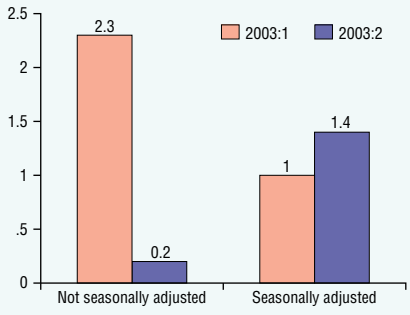
Chart 1

Adjusted Mexico GDP Shows Less Volatile, Accelerating Year-Over-Year Growth

Percent change from same quarter, previous year

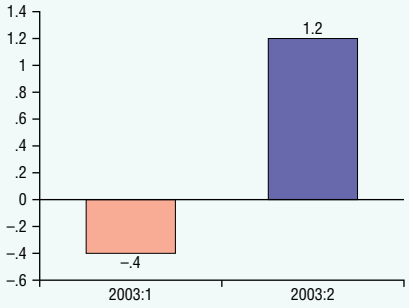


SOURCE: Instituto Nacional de Estadística, Geografía e Informática.

Chart 2

Recent Mexico GDP Growth Far From Paltry

Percent change from previous quarter



SOURCE: Instituto Nacional de Estadística, Geografía e Informática.

Regional Update

During 2003, regional economic indicators have implied that the Texas economy is on the road to recovery. Although economic measures have been mixed, most have been positive. Nevertheless, Texas employment continues to be a disappointment.

With recent revisions, the slight gain in employment seen so far this year was reduced to a mere 4,100 jobs, a 0.04 percent increase. The trade, transportation and utilities sector continues to be the major culprit in job losses, with manufacturing close behind. Employment growth in these sectors declined 13.6 and 11.4 percent, respectively.

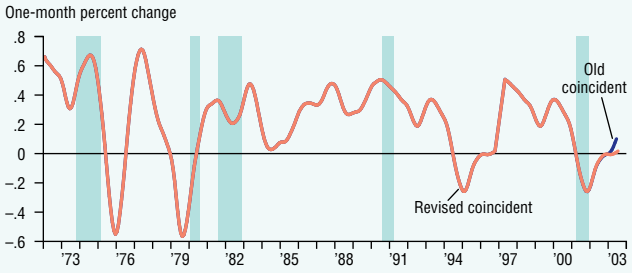
Because employment is a component of the Texas Coincident Index, the index was also revised. Previously, the coincident index indicated the Texas economy began expanding in January 2003. The revised index implies that the expansion did not start until May. Consistent with Beige Book reports, the Texas economy was flat from January through May.

Another discouraging signal is the unemployment rates for Texas' major metro areas. After a steady decline, unemployment rates in July edged up for some metros. The Dallas rate was unchanged at 6.8 percent, but it remains the highest of the major metros. Austin's unemployment rate was also unchanged and, at 5.3 percent, is currently the lowest of the group.

One encouraging signal for the region's economy is the Texas Leading Index, which has shown a positive net change over the past three months. The only two Texas Leading Index components that were negative during the April–July period were well permits and average weekly hours. Both measures declined as they settled back from their surge in previous months. The direction of the Texas Leading Index may indicate a continuing expansion in the region's economy.

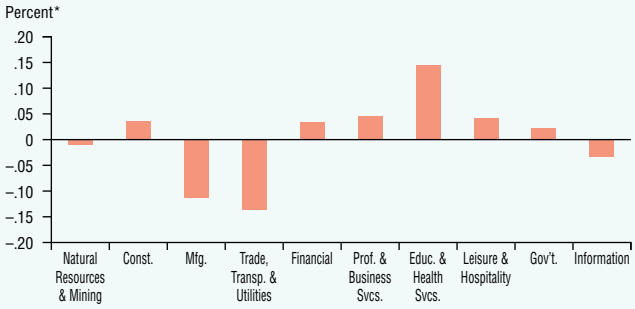
—Priscilla Caputo

Growth of Texas Coincident Indicators



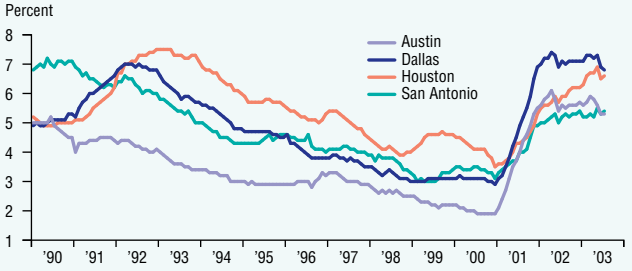
NOTE: Shaded areas indicate U.S. recession.

Sector Contributions to Total Texas Employment Growth, 2003

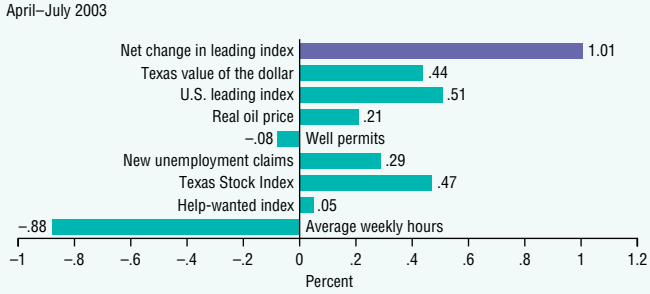


*Year-to-date, seasonally adjusted, annualized rate. Data are through July.

Texas Major Metro Area Unemployment Rates



Leading Index Increases Over Three-Month Period



Regional Economic Indicators

	Texas Leading Index	TIPI† total	TEXAS EMPLOYMENT* Mining	Construction	Manufacturing	Government	Private service-producing	TOTAL NONFARM EMPLOYMENT* Texas	Louisiana	New Mexico
7/03	113.8	127.1	140.4	576.7	912.3	1,641.4	6,151.4	9,424.3	1,896.7	780.4
6/03	113.8	127.6	141.2	577.2	915.9	1,654.6	6,146.1	9,437.2	1,898.5	779.1
5/03	114.1	127.8	141.7	576.4	923.1	1,651.3	6,153.9	9,448.3	1,897.6	779.0
4/03	112.6	127.5	141.5	577.8	925.4	1,649.4	6,142.3	9,437.5	1,896.5	778.9
3/03	111.8	127.1	139.8	574.8	927.9	1,646.6	6,141.5	9,432.4	1,895.7	775.8
2/03	112.2	126.8	139.5	573.2	928.7	1,642.3	6,141.4	9,426.4	1,897.9	776.7
1/03	113.4	125.7	140.0	574.2	930.5	1,639.3	6,146.0	9,431.0	1,903.2	773.2
12/02	112.4	125.1	140.4	571.1	929.9	1,637.8	6,137.3	9,420.2	1,898.4	772.0
11/02	112.6	124.9	141.4	569.8	934.7	1,643.3	6,143.7	9,436.3	1,896.9	770.6
10/02	111.8	125.0	142.1	566.8	936.8	1,638.5	6,144.3	9,431.7	1,895.8	766.4
9/02	112.0	125.6	142.1	566.7	940.3	1,628.4	6,138.6	9,419.3	1,899.2	766.4
8/02	113.8	125.4	142.1	568.3	944.1	1,625.0	6,136.4	9,418.8	1,901.1	767.1

* In thousands. † Texas Industrial Production Index.

For more information on employment data, see "Reassessing Texas Employment Growth" (*Southwest Economy*, July/August 1993). For TIPI, see "The Texas Industrial Production Index" (Dallas Fed *Economic Review*, November 1989). For the Texas Leading Index and its components, see "The Texas Index of Leading Indicators: A Revision and Further Evaluation" (Dallas Fed *Economic Review*, July 1990). Online economic data and articles are available on the Dallas Fed's Internet web site, www.dallasfed.org.

(Mis)reporting Mexico's Gross Domestic Product

(Continued from page 18)

0.2 percent from the unadjusted data. We see a less volatile and accelerating growth pattern using the unbiased data.

The new seasonally adjusted GDP series is better not only because it allows unbiased calculation of year-over-year growth, but also because it allows meaningful quarter-to-quarter comparisons. INEGI's Aug. 15, 2003, press release reports that seasonally adjusted GDP increased by 1.21 percent from the first quarter of 2003 to the second quarter, following a decline of 0.4 percent from the fourth quarter of 2002 (*Chart 2*). Most of the media sources we surveyed did not mention quarter-to-quarter growth at all. Those that did seemed not to know what to make of it, reporting it without comment and without noting the inconsistency of the second-quarter figure with their characterization of poor performance in the second quarter, based on the 0.2 percent year-over-year figure. The 0.2 percent figure is wrong because it includes the Easter bias. Furthermore, it is misleading to treat the year-over-year growth measure as if it reflects recent activity. The media reports cited earlier repeatedly use the phrase, "in the second quarter." It is important to note that these reports refer to growth *over an entire year*, not growth *in the second quarter*.

What are the data really saying? First, GDP growth during the preceding year, measured as of second quarter 2003, was 1.4 percent, not 0.2 percent as has been widely reported. Second, GDP growth between the first and second quarters of 2003 was 1.21 percent (which is a robust 4.9 percent, annualized), up from the 0.4 percent decline in the previous quarter. It is beyond the scope of this article to speculate about whether Mexico's economy is emerging from recession. Other economic indicators suggest that is not the case. Suffice to say that media reports have underreported Mexico's GDP growth during the last year and that growth has, in fact, accelerated recently.

The introduction of the new seasonally adjusted GDP data has contributed greatly to our ability to assess the performance of Mexico's economy. In time, analysts and the media will learn to put this information to best use—both to calculate meaningful year-over-year comparisons and to pay increased attention to quarter-to-quarter changes.

—Franklin D. Berger

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