

JULY/AUGUST 1997

ECONOMIC PERSPECTIVES

A review from the
Federal Reserve Bank
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**Reversal of fortune:
Understanding the
Midwest recovery**

**Accounting for the
federal government's
cost of funds**

FEDERAL RESERVE BANK
OF CHICAGO

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ECONOMIC PERSPECTIVES

July/August 1997, Volume XXI, Issue 4

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ISSN 0164-0682

Reversal of fortune: Understanding the Midwest recovery

William A. Testa, Thomas H. Klier,
and Richard H. Mattoon



The Midwest economy has received considerable attention in recent years as it has shed its image as the Rust Belt and reemerged as a strong regional competitor both on the national and international stage. This reversal of fortune has surprised some analysts, and explanations of the region's resurgent strength have often been more anecdotal than empirical. In this article, we take a more systematic approach to analyzing the elements that have contributed to the region's recovery since the mid-1980s.¹ Specifically, we describe the contribution of external and internal factors to the economic revival of the Midwest and identify the challenges and opportunities the region now faces.

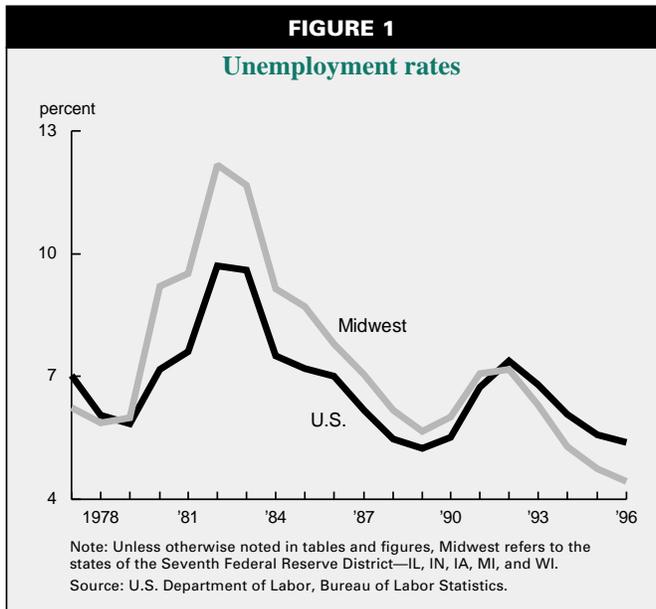
Charting the turnaround

A region's economy can be represented by many diverse measures. Unemployment rates are perhaps the most widely recognized indicators of both economic progress and participation of the region's population in the economy. Looking at the aggregate unemployment rate for the Midwest versus the nation from the 1980s to date, two remarkable features can be seen.² First, from an average annual rate that exceeded the nation's by 3 percentage points in 1983, the Midwest's unemployment rate had fallen to a full percentage point below the nation's by 1996 (see figure 1). The same year marked the fifth consecutive year that the rate remained below the nation's. A second feature of the labor market reflected by the unemployment rate is the behavior of the

Midwest economy during the most recent (1990–91) recession. In prior recessions, the highly cyclical nature of the Midwest economy, combined with the region's eroding share of national production, resulted in a more rapid rise in Midwest unemployment relative to the nation. In contrast, during 1990–91, the underlying secular strength of the region's economy allowed its labor market to continue to gain on its national counterpart and, ultimately, to experience a more fully employed work force.

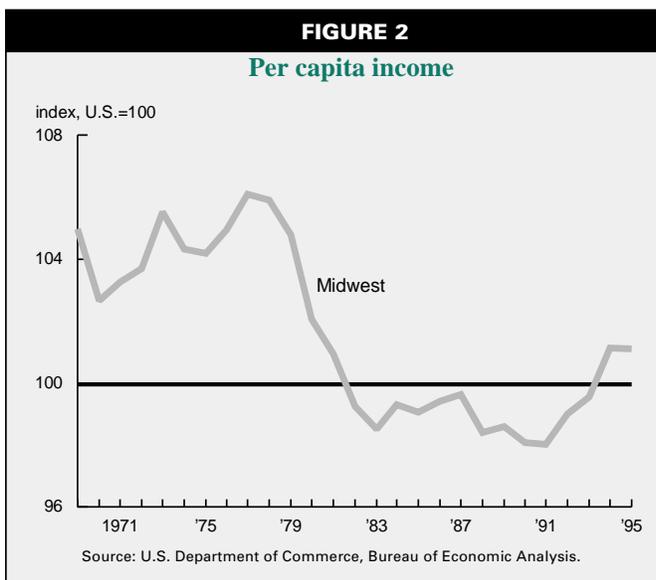
Despite the Midwest's tight labor markets, its growth of employment and population are not, in general, exceeding the nation's. The Midwest turnaround has been characterized by a convergence in the pace of employment growth with that of the nation. Job growth in the early 1990s was especially strong relative to the nation, but has now probably eased to a pace that is on par with the nation. Because the region's work force is approximately at full capacity, any further supranational employment growth cannot reasonably be expected unless population growth increases sharply. Although recent employment gains in the Midwest have been accompanied by population

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growth, reflecting a turnaround from a net outflow in the 1980s to a net inflow in the 1990s, the Midwest continues to lag other regions (especially most of the Sun Belt) in terms of population growth.

This combination of strong employment growth and lagging population accounts for the marked improvement in the Midwest's labor force participation relative to the rest of the nation. From a deficit position during the 1980s, the region's ratio of employed, aged 16 and above, to population (at 0.65) has surpassed the U.S. average (0.63).



Heightened work force participation appears to be reviving the incomes of Midwest residents. Per capita income relative to the nation had dipped sharply from a superior position in the late 1970s to an inferior position by the early 1980s. However, the region's relative position began to improve in 1991 and slightly exceeded the national average in 1994 and 1995, the latest year available (see figure 2). Median household income, measured in constant purchasing power, largely parallels this pattern. After dipping to parity with the nation from 1980 to 1983, Midwest income continued on par with the nation through 1994, and is now showing preliminary

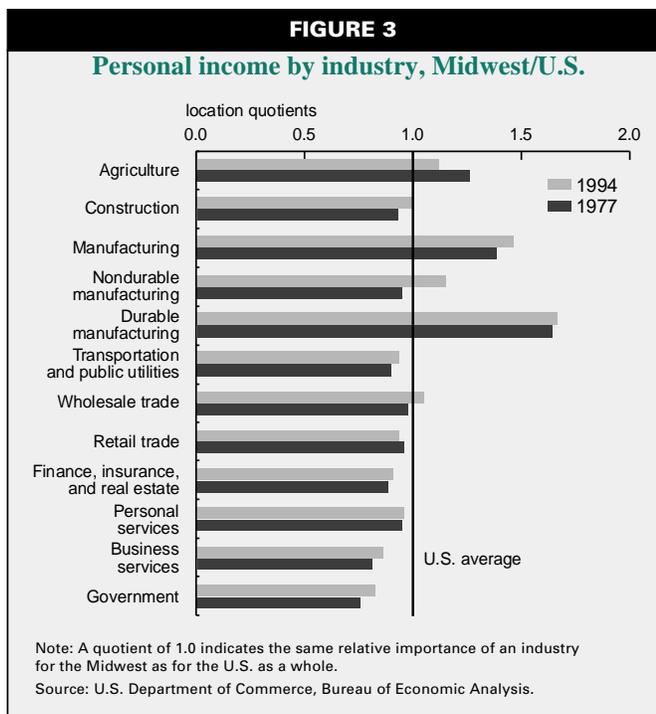
signs of strength relative to the nation.

Midwest income continues to flow from the region's traditional industries. The Midwest remains markedly more concentrated than the nation in its mainstay industries—durable goods manufacturing and agriculture (see figure 3). Examining industry composition at a finer level of detail does little to alter this conclusion.

It is not surprising, then, to find that the revival in Midwest job and production growth has been led by manufacturing and agriculture. The Midwest lost 2.5 percentage points in its

share of the nation's manufacturing employment from 1977 to 1983 (going from roughly 19.5 percent to 17 percent). It has since regained 2 percentage points and the rate of gain has accelerated in the 1990s. Manufacturing industries such as autos and steel have reconcentrated in the Midwest. For example, the region had 31 auto plants in 1996, compared with 27 in 1979. Although nine Midwest auto plants closed between 1979 and 1996, 13 new plants opened.

Rural areas have benefited from both the rising manufacturing tide and the recovery of production agriculture. Over the past 15 years, rural growth in



manufacturing jobs has outpaced metropolitan growth. Meanwhile, the recovery of the farm sector from the debt overhang and sagging markets of the late 1970s and early 1980s has lifted farmland prices. Grain prices are high by historical standards and demand from developing countries has buoyed world markets for grains, meat products, and some processed foods.

Emergence of these goods-producing industries in rural areas—especially manufacturing—has translated into an improvement in population growth and a turnaround from net out-migration to net in-migration.³ In Midwest rural counties, population declined by 2.2 percent from 1980 to 1990, with 70 percent of counties experiencing declines in absolute terms. From 1990 to 1994, rural Midwest counties recorded population gains of 2.4 percent, with 74 percent reporting gains during this period.⁴

Despite the dramatic swings in rural fortunes, the Midwest's and nation's population continues to shift to metropolitan (metro) areas, much as it has done throughout this century. By 1994, metro areas' share of population was approaching 80 percent in the nation and 76 percent in the Midwest. However, the pace of the shift appears to be slowing considerably in the 1990s, harkening back to the rural-urban turnaround of the 1970s.⁵ In metro areas, the natural population increase continues to dominate

in-migration. Midwestern metro areas experienced a modest out-migration from 1990 to 1994, even as employment continued to grow. Some workers may be choosing to reside in adjacent counties, while commuting to jobs in metro areas.

Metro areas continue to be magnets for jobs, but the nature of jobs is changing: Many midwestern metro areas are successfully transforming from manufacturing centers to service centers (see table 1).⁶ Important industries of the service and information economy of the 1990s include producer services, such as management consulting, advertising, accounting, and business and legal, as well as trade, travel, and financial services. Midwest metro areas have been very successful in attracting

these industries and, in some cases, developing a service industry niche, such as sports-oriented travel centers (Indianapolis), convention tourism (Appleton-Oshkosh), health services and insurance (Peoria), air freight/air maintenance centers (Indianapolis), financial services/insurance (Des Moines), automotive R&D (Detroit), and convention-business meeting centers (Chicago).

Industrial restructuring has differed by size of metro area, with large metro areas tending to transform to a greater degree away from manufacturing toward business and financial services.⁷ Manufacturing losses in large metro areas, especially core counties, have been sharp. Smaller metro areas have tended to lose out on some business-oriented services such as financial service industries, while picking up the slack, in general, as preferred manufacturing locations. As a result, the Midwest's economic recovery, as reflected in relatively low unemployment rates, has been pervasive across metro areas.

Timing and depth

From 1947 to 1987, the Midwest's (defined in this case as Illinois, Indiana, Michigan, Ohio, and Wisconsin) share of national manufacturing declined from 30 percent to 22.1 percent.⁸ To a large extent, this reflected a natural process of population deconcentration within the continental

TABLE 1

Personal income derived from labor and proprietor earnings (indexes of concentration)

	Midwest/U.S.			
	1969	1977	1985	1994
Manufacturing				
Large MSAs	1.31	1.35	1.29	1.30
Core counties	1.28	1.34	1.22	1.20
Medium MSAs	1.52	1.63	1.70	1.70
Small MSAs	1.41	1.48	1.55	1.68
Nonmetro	1.10	1.19	1.34	1.62
FIRE				
Large MSAs	1.00	1.09	1.14	1.15
Core counties	1.12	1.22	1.37	1.32
Medium MSAs	0.70	0.71	0.70	0.78
Small MSAs	0.71	0.73	0.71	0.72
Nonmetro	0.60	0.62	0.51	0.47
Business services				
Large MSAs	1.06	1.07	1.16	1.13
Core counties	1.13	1.02	1.01	0.97
Medium MSAs	0.52	0.58	0.63	0.75
Small MSAs	0.43	0.51	0.54	0.61
Nonmetro	0.49	0.53	0.44	0.40

Note: An index value of 1 signals the same importance of an industry for the Midwest as for the U.S. That is, an index value of 2.0 could be obtained from a 40 percent share of manufacturing in Midwest metro areas divided by a 20 percent share of manufacturing in U.S. metro areas.

Source: U.S. Department Of Commerce, Bureau of Economic Analysis, Regional Economic Information System.

U.S. For example, the Southeast developed manufacturing industries as its work force was released from agriculture, and improvements in technology, infrastructure, and transportation opened up previously isolated areas in many parts of the country.

Recessionary periods were particularly difficult for the Midwest because of its concentration in capital goods and consumer durables, which were most vulnerable to a falloff in demand.⁹ Furthermore, the region's technology and physical stock of capital tended to be of earlier vintage (and often lower efficiency) than in other regions of the U.S. and abroad. Consequently, when demand slackened, it was more cost-effective to continue remaining production at newer (lower cost) plants elsewhere. During the 1979–83 period, as the nation passed through two recessions in quick succession, the Midwest lost over one-fifth of its manufacturing work force at the same time that the rural agricultural economy experienced its worst times since the Great Depression.

After a languid recovery in 1983, the Midwest economy showed some vigor in 1984, supported by strengthening auto demand. However, in 1985 and 1986, the dollar value of overall export sales from the region remained flat despite depreciation of the value of the dollar against currencies of trading partners.¹⁰ Domestic markets for capital goods, other than computer-related purchases from coastal regions, also continued to disappoint.

Beginning in 1987, the Midwest's capital goods sectors began to recover late in the expansion and exports began to grow. In the agricultural sector, farm equipment purchases and exports began to show some life and balance sheets began to strengthen.

Many observers believed that the shakeout of the early 1980s was so severe that it destroyed a large portion of the most inefficient and antiquated physical capital stock. Accordingly, the renewed strength of the Midwest in the second half of the decade was

interpreted as an inevitable bounce-back in production and productivity, albeit from a much lower baseline level.¹¹ Even as other regions such as the Southwest and New England began to experience economic setbacks, few believed that these setbacks would continue for very long. Although the high-tech industry, the darling of the decade, was toppling in New England, along with defense-related industries there and elsewhere, many believed that a bounce-back in high technology was only a matter of time, and that the Midwest was at a disadvantage because the fastest growing sectors were almost nonexistent in the region.¹² It also took some time before the extent of overbuilding in real estate in other regions could be fathomed. The coastal regions and parts of the Southwest struggled through the overbuilding and savings and loan debacles to a significantly greater extent than the conservative and still "shell-shocked" Midwest. Through the distorted lens of these events, fundamental changes underlying a sustained turnaround of the Midwest were difficult to distinguish.

Today, it is evident that the signs of strength in the Midwest economy of the mid- to late 1980s were more than the anticipated snap-back from the restructuring of the early 1980s. Much of the adjustment had taken place by 1985 and the transitory shocks in other regions have significantly dissipated. Yet, the pace of economic growth in the Midwest remains strong and capacity utilization remains high. The Midwest economy has been changing from within during the past ten to 15 years, and these changes have been supported by favorable external conditions and trends.

External conditions

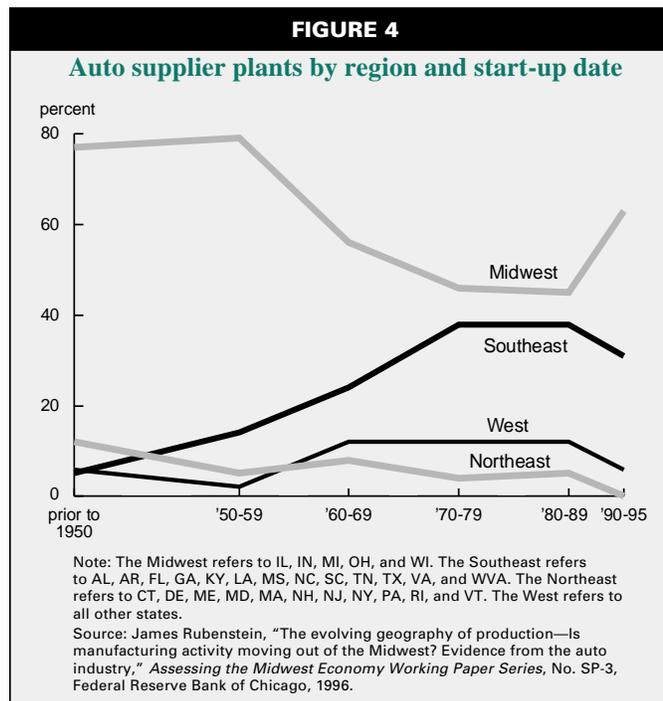
External factors in the Midwest's economic turnaround include technological and organizational changes in the automotive industry, which have favored its reconcentration in the midsection of the nation; the geographic pattern of federal defense spending; declining real energy prices, important both as an input to the region's industries and as a determinant of demand for its products; and, from the mid-1980s until recently, a declining dollar, which improved the international competitiveness of the region's companies.

Changing geography of the auto industry

U.S. auto assembly plants have tended to reconcentrate in the Midwest over the 1980s and 1990s. Auto supplier plants had tended to disperse over the three decades to 1990, but this trend appears to be reversing during the 1990s (see figure 4) as more technologically advanced and innovative automotive parts and services providers continue to locate in the Midwest. The reconfiguration of auto assembly, the continued preference of supplier R&D operations to locate close to Detroit, plus evidence of spatial clustering of tier 1 supplier plants around their assembly plant customers suggest a strengthening of agglomeration effects in the auto industry.

As discussed in Rubenstein (1996), the reconcentration of auto assembly has resulted from broad changes in the industry's product mix that, consistent with neoclassical

location theory, have changed the economics of plant location in favor of the midsection of the country. The costs of distributing the final product to the customer have always been important in deciding the location of auto assembly plants. Henry Ford opened far-flung branch assembly plants to produce identical Model T cars closer to the population centers outside the Midwest; it was cheaper to ship parts to branch assembly plants than to ship finished automobiles across the country from a centrally located assembly plant. Soon, General Motors and Chrysler emulated that strategy. However, by the 1960s the proliferation of car and truck models meant that location strategy was no longer optimal. The number of different car and truck models sold in the U.S. increased eightfold, from 30 in 1955 to 241 in 1995, while sales only doubled from about eight million units to about 16 million in 1995. With reduced output per individual model, the entire output would best be produced at one plant. Consequently, the geographic argument for an interior location became compelling; that way the company could minimize the cost of distributing the output to a national market. As a result, during the past 16 years auto producers have opened assembly plants in the interior, especially



along the I-65/I-75 corridor, and closed coastal plants. While freight costs can account for the reconcentration of auto production in the Midwest, variables such as the local labor climate, access to highways, and general costs of doing business influence the selection of particular communities or sites.

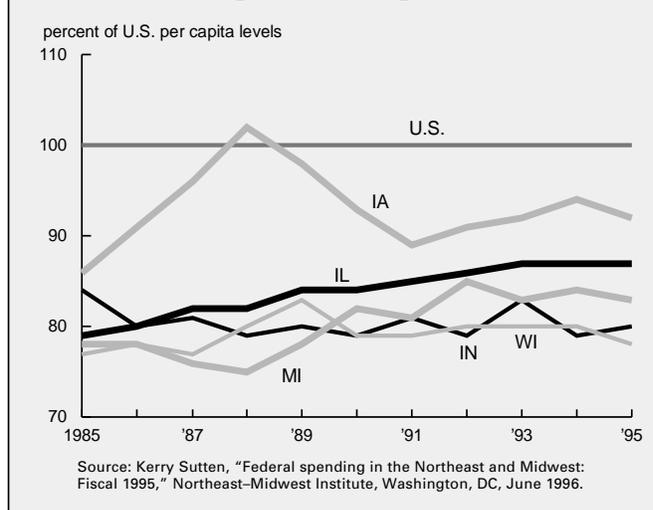
Federal spending patterns

Historically, the Midwest has not fared well relative to other regions in terms of receiving money from Washington. Measured as a percentage of U.S. per capita levels, federal expenditures were below the national average in each of the five states of the Seventh Federal Reserve District from 1985 to 1995, with the exception of Iowa in 1988 (see figure 5). First, because of the small concentration of defense-related industries, federal procurement spending in the region is particularly weak. For example, in fiscal 1995, Illinois ranked 47th and Indiana and Wisconsin tied for 46th on per capita military procurement expenditures. In addition, the relatively small number of military bases in the region keeps military spending on wages and salaries significantly below the U.S. average. Spending by the federal government for grants, federal salaries and wages, and direct payments in the Midwest is generally below average on a per capita basis.

Over the past ten years, however, regions that depended heavily on federal dollars have been particularly affected by program cuts. Defense spending reductions and the difficulty of converting defense industries to nondefense functions have damaged economies in California and New England. Figures on U.S. military procurement spending from 1985 to 1996 and projected to 2002 demonstrate the spending boom in states with concentrations of defense-related industries in the 1980s (\$80 billion in 1991) and the rapid decline in expenditure levels in the 1990s (an estimated \$40 billion in 1998). A study of the Chicago economy suggests that even those industries in the Midwest that have traditionally done business with the federal defense establishment may convert to civilian products relatively easily.¹³

The Midwest is also less reliant on federal transfers (primarily Medicaid, social welfare,

FIGURE 5
Per capita federal expenditures



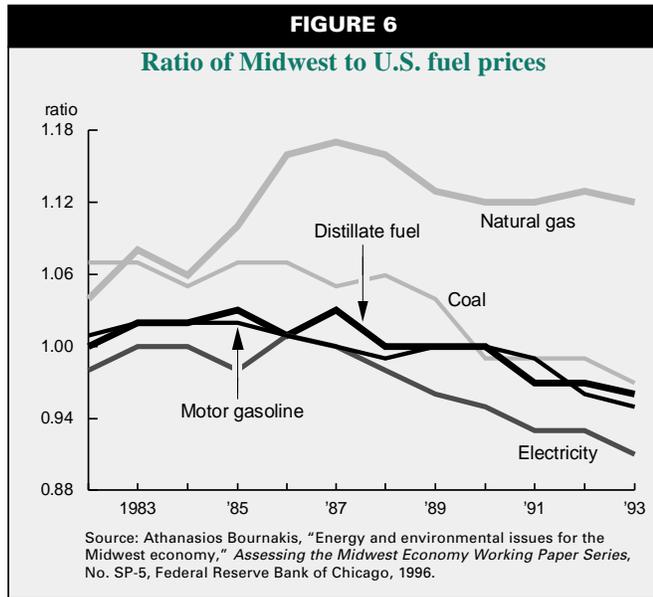
and highway infrastructure funds) than many other regions. According to data compiled by the Northeast-Midwest Institute, in fiscal 1994 federal transfers on average represented 27.7 percent of total state budgets in the U.S.¹⁴ Federal transfers comprised 25.8 percent of the Illinois budget, 28.4 percent of the Indiana budget, 25.7 percent of the Iowa budget, 25.4 percent of the Michigan budget, and 24.4 percent of the Wisconsin budget.

Energy

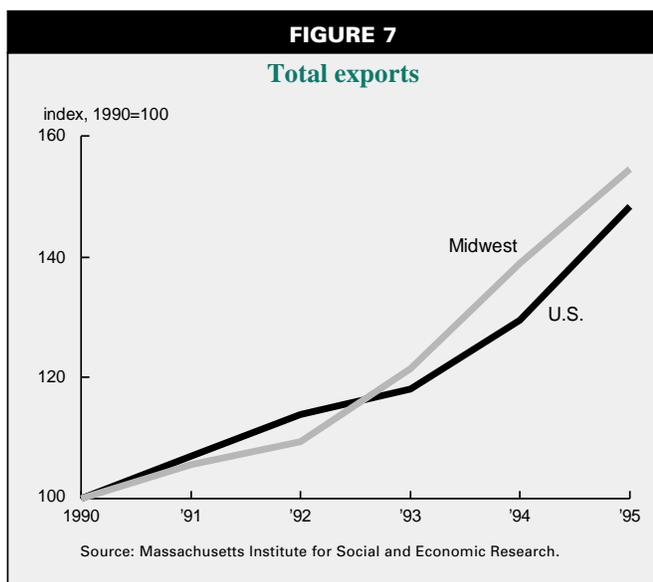
Delivered prices of all major fuels have declined in the Midwest since the early to mid-1980s (Bournakis, 1996). Despite recent price run-ups, national real gasoline prices are currently lower than in 1967 and 25 percent lower than their peak in the latter half of the 1970s. At that time, high petroleum-based fuel prices exerted a significant drag on Midwest industry and hampered sales of domestic automakers. Recently, midwestern energy prices have been edging down relative to national energy prices (see figure 6). Why these prices have eased is not clear but may be due to external developments, such as deregulation of the U.S. natural gas market since the mid-1980s, or regional issues, such as state-local tax and regulatory policies.

Exports

Exports now account for 13 percent of U.S. gross domestic product, compared with 8 percent in 1987 and 5 percent in 1971. From



1992 to 1995, exports from the Midwest grew even more dramatically than exports from the U.S. as a whole (see figure 7). Exports from the region's telecommunications, farm machinery, construction machinery and equipment, machine tools, and specialized capital goods sectors, as well as the agriculture sector, have grown rapidly during the past ten years to meet growing demand from developing markets worldwide.¹⁵ The lion's share of future trade expansion is expected to derive, not from trade with developed nations, but from emerging



markets in Asia and South America.¹⁶

Currency swings since the dollar's peak in early 1985 are often cited in the popular press as having boosted midwestern exports and shielded domestic markets from displacement by foreign imports. The Midwest's share of Big Three auto production has increased since 1991. Thanks to the reconcentration of domestic automakers and the presence of Japanese automakers, the region's share of domestic car production has climbed from 45 percent in 1981 to more than 56 percent.¹⁷ However, the drop-off in the dollar's value was completed by 1987. Over the past nine years, aggregate

trade-weighted dollar indexes suggest that the currency-influenced terms of trade have remained mostly flat, even as exports have continued to climb. Moreover, recent research by Hervey and Strauss (1996) suggests that the dollar has appreciated rather than depreciated against currencies of nations to which the Midwest exports.¹⁸

Changing how we do business (internal adjustments)

The Midwest's constancy in line of business and evidence of productivity gains driven by internal private and public sector actions suggest that internal factors have also been important sources of regional revival. In particular, midwestern industry has adopted new technologies and modes of business operation, and the region's relative cost position has improved. The public sector has facilitated regional competitiveness by prudent taxation and spending policies, by focusing spending on value-producing services and public infrastructure, and, more recently, by adopting innovative delivery of public services. So too, the region's "institutional capital"—public and private organizations, including universities, research

centers, and business and civic organizations—proved responsive in the face of economic crisis.

Technology and organization

There is substantial evidence that the Midwest has changed the way it does business—its organization, mode of operation, and technology. As discussed in Klier (1996), implementation of best manufacturing practices, notably lean manufacturing technologies, has helped revitalize Midwest manufacturing. Lean manufacturing, which gained widespread attention in the early 1980s, combines aspects of both craft and mass production, ranging from teamwork on the shop floor, to emphasis on low inventory and flexible production equipment, to close relationships with suppliers. The most familiar

setting is the U.S. auto industry. Successful auto assembly operations have been transplanted to the U.S. environment by companies such as Toyota, Honda, and Mitsubishi. In some cases, existing assembly plants, such as GM's NUMMI venture with Toyota in California, have been transformed through organization and technology alone.

The extent to which this experience is characteristic of manufacturing in general was addressed in two large-scale studies.¹⁹ Both Statistics Canada (Baldwin, Diverty, and Sabourin, 1988) and the U.S. Census Bureau (1988 and 1994) administered surveys of manufacturing technologies to measure the extent and type of advanced manufacturing technologies used in their respective country's manu-

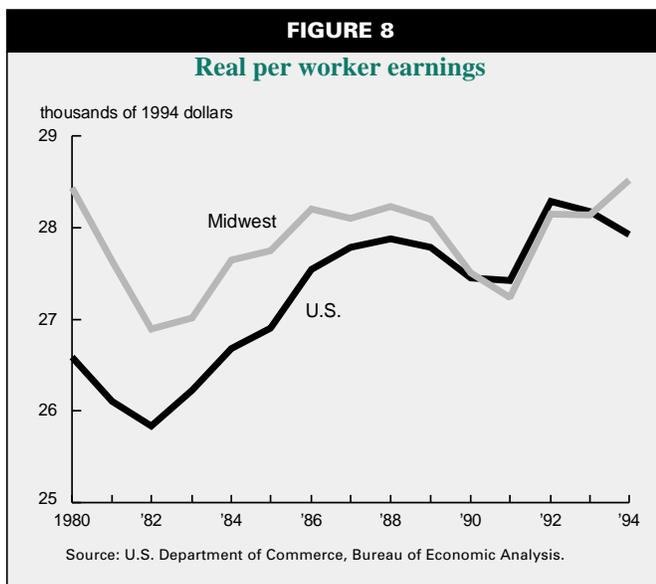
facturing plants. Both surveys found that the application of advanced manufacturing technologies was widespread across plants and industries, typically with multiple technologies applied per establishment (see table 2). These results indicate that advanced manufacturing techniques are reshaping manufacturing on a broad scale. In the Midwest, more concentrated in manufacturing than any other region, these technological advances have tended to boost the economy.

At the same time, the region's industries are outside those (mostly defense) sectors that require both a change in product mix and a transformation in technology. Regions specializing in declining industries, such as defense-oriented manufacturing, must change not only how business is conducted but the entire product mix. To date, for several regions that compete with the Midwest, the barriers of changing both "how" and "what" have been too high to bring about the resurgent experience of the Midwest.

Costs of business operation

The neoclassical view in economics suggests that firm location is significantly driven by the search for low costs of operation.

TABLE 2			
Application of some advanced technologies			
	FMC/ FMS	CAD/ CAE	Interco. network
	<i>(---percent of plants using---)</i>		
Plant employment			
20–99	7.6	49.5	12.0
100–499	21.4	76.4	28.4
500+	40.4	87.2	47.1
Age of plant			
Less than 5 years	13.4	63.5	15.0
5–15	13.3	62.0	18.0
16–30	13.4	64.4	20.5
Greater than 30	15.2	63.1	22.0
Major industrial groups			
Fabricated metal products	9.5	46.5	16.7
Industrial machinery and equipment	11.8	64.1	15.4
Electronic and other electric equipment	17.0	64.2	21.9
Transportation equipment	15.5	53.9	23.4
Instruments and related products	14.2	65.5	15.3
Notes: The table reports information on three of the 17 advanced manufacturing technologies surveyed. They are defined as follows: Flexible manufacturing cells and systems (FMC/FMS): two or more machines with automated material handling capabilities controlled by computers or programmable controllers, capable of single/multiple path acceptance of raw material and single/multiple path delivery of finished product. Computer-aided design and engineering (CAD/CAE): use of computers for drawing and designing parts or products and for analysis and testing of designed parts or products. Intercompany computer network (Interco. network): use of network technology to link subcontractors, suppliers, and/or customers with the plant. Source: U.S. Department Of Commerce, Bureau of the Census, <i>Current Industrial Reports: Manufacturing Technology: Prevalence and Plans for Use</i> , 1994, tables 4D and 4E.			



relative to those of their national counterparts. Real per worker earnings approached national levels from 1980–82 and continued to converge throughout the 1980s (see figure 8).²¹ While these figures are merely suggestive of labor costs, changes in the level of hourly wages of workers in the manufacturing sector point in the same direction (see table 3).²² Adjusting for differences in industry mix, Midwest manufacturing wages eased from 17 percent above national levels in the early 1980s to a 13 percent premium in the 1990s.

As mentioned earlier, energy prices in the region have also eased relative to national prices,

Labor costs commonly comprise the largest share of operating costs to business enterprises. This implies that capital investment flows toward regions with low wage costs and that job openings grow in tandem with capital investment. In many instances, labor does not migrate, as might be expected, toward high-wage areas, because job openings are absent due to rigid wages and, perhaps, institutional features such as unionization.²⁰ As a result, economies with low wage costs can experience economic growth of capital and labor.

Evidence from the past ten to 15 years is consistent with this theory in partly explaining the Midwest turnaround. The Midwest has long been reputed as a high-wage locale, especially for manufacturing. But over the past ten to 15 years, workers in the Midwest have apparently eased their wage demands

including prices of coal and natural gas, which the region consumes in greater proportion than the nation.²³ The region has also taken measures toward greater energy conservation and efficiency; at the same time, industry composition has shifted away from energy-intensive sectors. Today, the Midwest consumes much less energy relative to gross state product than 20 years ago (see figure 9). Thus, Brown and Yücel (1995) suggest the region would experience dramatically milder responses to potential oil price shocks (less than half of 1980 levels).

The public sector

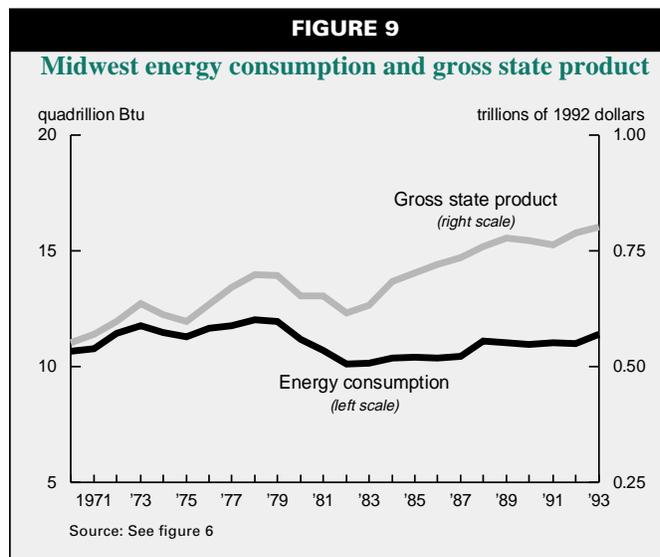
Some analysts suggest that the Midwest has assisted its own revival through judicious fiscal policies. The region followed a conservative fiscal path characterized by minimal increases in levels of taxation (even during the 1990–91 recession) and conservative spending policies. At the same time, public spending was generally above national levels in areas that are seen as contributing to economic growth, such as education and highway expenditures, while spending was below national levels in areas less associated with economic growth, such as government administration, corrections/prisons, and welfare expenditures (see figure 10).

It is hard to say to what extent this behavior contributed to the

TABLE 3
**Index of relative wages in manufacturing:
Midwest versus U.S.**

	1979	1983	1989	1993	1995
Illinois	1.09	1.10	1.07	1.03	1.02
Indiana	1.16	1.14	1.12	1.12	1.13
Iowa	1.16	1.14	1.03	1.04	1.03
Michigan	1.30	1.32	1.29	1.31	1.32
Wisconsin	1.09	1.11	1.03	1.04	1.03
Midwest	1.17	1.17	1.13	1.13	1.13

Source: U.S. Department of Labor, Bureau of Labor Statistics.



Midwest's economic revival, since the relationship between public spending/taxation and economic growth has not been definitively demonstrated. Beneficial effects between state-local government fiscal health and private sector economic growth run in both directions, thereby making it difficult to discern cause from effect.

The Midwest's current prosperity is evident in its state and local sector, as midwestern state and local governments have, in general, rebuilt their budget balances and improved their fiscal position. While the national average state fund balance (as a percentage of state expenditures) was slightly more than 5 percent in 1996, Indiana recorded a fund balance of 20 percent; Iowa, 15 percent; and Michigan, 13 percent. The recessionary period of the early 1980s reduced the region's fiscal capacity and induced states to strain their capacity to fund public spending. However, Midwest states are seen to have begun easing the strain on their fiscal capacity by the mid-1980s.²⁴ The fiscal experience of District states followed the same break with the past that has characterized the economic performance of the region. Unlike previous recessions which had usually forced dramatic tax increases in the region, the national recession of 1990-91 had a relatively shallow impact.²⁵

Institutional capital

Nonprofit institutions and organizations that engage in economic growth and development policies and programs are often believed

to be influential to regional growth. In her 1995 book *World Class*, for example, Rosabeth Moss Kantor suggests the places that succeed in the new global economy often do so because they have created and supported organizations, their so-called institutional capital.²⁶ These organizations are often found in the not-for-profit sector and include public-private partnerships and councils, nonprofit organizations of business leaders, public-private development councils, foundations, trade associations, chambers of commerce, research centers at local universities, and research institutes.

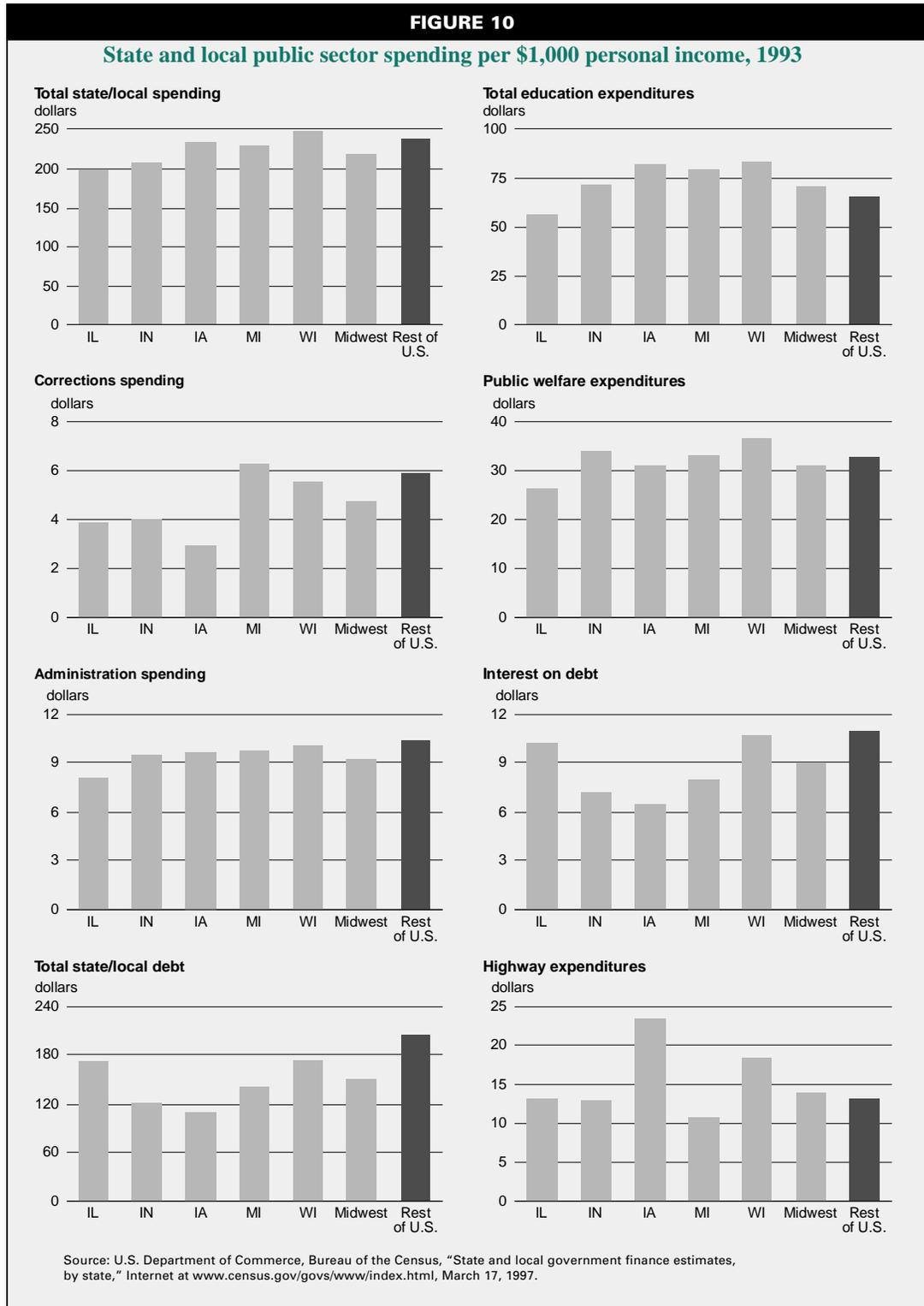
The Midwest has fostered a rich endowment of organizations that form its institutional capital stock, contributing to a variety of regional economic development efforts. In the case of state and local economic development planning, for example, community-based organizations and local business associations provide important information to public-sector decisionmakers on which efforts and programs work best and often promote solutions that fall outside of narrow political boundaries.²⁷ For example, several multistate efforts have addressed environmental challenges in the Midwest. One such effort is aimed at understanding the atmospheric science and fashioning compliance solutions to the ozone-related ambient air quality standards of the Clean Air Act Amendments.²⁸ Another arises from the Great Lakes Water Quality Initiative, a basin-wide approach to reducing toxic contamination of the Great Lakes system.²⁹ Proactive development initiatives at a multistate level have been no less common, including tourism and export promotion and efforts to broaden skill standards and certification.³⁰

What does the future hold for the Midwest?

This article has identified developments that have restored the region's luster. With ten to 15 years hindsight it is evident that, while business cycle timing and external factors have been very important, profound changes have taken place in the way midwestern businesses and governments compete and conduct their

affairs. Although it is impossible to discern the relative contribution of these forces with a great deal of precision, it is clear that the Midwest is partly responsible for its own recovery.

The challenges and opportunities facing the region can be discussed in terms of two important characteristics of this economic recovery: the resurgent strength of the region's



mainstay industries and the increase in labor force participation. First, production agriculture and manufacturing exhibited startling resilience during this period by improving productivity, regaining market share, and aggressively targeting export markets. In this regard, there is reason for optimism. Following the shocks of the 1980s, the region's firms will most likely stay on their guard with regard to changing technology and the benchmarks of global competition. So too, much of the future growth in export markets is expected to derive from developing countries, whose needs for the region's products—capital goods and agricultural products—are expected to continue to grow.

Second, the region's labor force faces an important challenge. Will work force numbers and skills be adequate to sustain the growth that the region has experienced in the 1990s? In achieving recent growth, the region has drawn from both new work force entrants and adults who were unemployed or underemployed. However, this pool of skilled workers is now showing signs of strain. Currently tight labor markets suggest the need for midwestern workers who no longer are seen as disproportionately expensive relative to other regions. Labor supply may become further strained in the years ahead, because the work force in the Midwest is reported to be older than in the nation, so loss of workers through retirement is likely to be relatively high in the region.³¹

Insofar as the region's two industry mainstays—agriculture and manufacturing—continue to shed labor, a lower level of growth in the work force may be needed. If so, natural population growth, upgrading of skills, and work force innovations to bring more people into the labor force may suffice. For example, job networking of workers from the inner city to the suburbs and moving welfare recipients into the workplace may ease labor market pressures. Furthermore, some workers may decide to

defer retirement, especially if the rewards of working become more attractive.³²

In-migration of population could provide another “release valve” to labor market pressures. In most parts of the Midwest, the cost of living does not present a barrier to in-migration. The median home price in the Midwest is the lowest of any of the four regions defined by the National Association of Realtors; the association's index of housing affordability is also more favorable here than in other regions. However, significant in-migration to the region has not occurred to date, although out-migration has been stemmed. Moreover, regions from which the Midwest might expect to draw workers, such as the West Coast and the Northeast, are experiencing labor market tightening.

An alternative approach to easing labor shortages is the upgrading of skills of the existing and emerging work force. This is a preferred approach, because higher skills tend to be rewarded in the form of higher wages and income for Midwest residents. For this to come about, workers must act to acquire needed skills or credentials and policymakers must act to create publicly assisted training, educational, and job-assistance programs or increase the effectiveness of existing programs. Young adults continue to enter the work force, but there is concern that some training/educational programs have fallen into disrepair or were abandoned during the early 1980s, when one in five manufacturing jobs evaporated in the region and growth in other sectors stagnated. As a result, a renewed push is needed to reestablish school-to-career and other programs in selected skill areas. In the absence of such initiatives, the region's residents could miss opportunities for better and higher paying jobs and the region's businesses and property owners could miss significant income-generating opportunities.

NOTES

¹For a more detailed summary of this work, see Testa, Klier, and Mattoon (1997). Unless specified otherwise, Midwest refers to the states of the Seventh Federal Reserve District—Illinois, Indiana, Iowa, Michigan, and Wisconsin.

²See Allardice and Bergman (1996).

³See Johnson (1996).

⁴Surprisingly, net migration into the rural Midwest exceeded population gains derived from natural increase, that is, births minus deaths. Throughout this century, population gains in rural counties have generally been realized through natural increase concurrent with net out-migration of young adults. By the 1990s, the resulting aging of the population, coupled with in-migration, resulted in a

notable reversal; in-migration gains were leading those achieved by natural increase in rural counties of the nation and the Midwest.

⁵See Johnson, *op. cit.*

⁶See Groshen and Robertson (1993).

⁷For further industry-specific analysis, see Testa (1992). Other authors note the further spatial division of labor by size of metro area according to industries or facilities characterized by routinized or “back office” operations and those engaged in “command and control,” operations such as corporate headquarters or highly specialized business and legal services. For further discussion, see Atkinson (1996) and Federal Reserve Bank of Chicago (1996a).

⁸Kim (1996).

⁹Howland (1984).

¹⁰Languish total dollar volume of exports is somewhat expected in this instance because rising physical quantities of exports may be slight or insufficient to make up for lower dollar prices per physical unit, that is, the “J-curve” effect. Of course, other forces, especially changing economic growth of export destinations, also determine export sales.

¹¹A more farsighted view of the region is attributed to Annable (1985) and Swonk (1991).

¹²For example, Browne (1983).

¹³Research completed by Philip Israilevich on defense-related businesses in the metro Chicago economy found that less than 1 percent of the total output of goods and services in the Chicago economy was related to military procurement expenditures in 1987 (during the height of the military spending boom). Furthermore, electrical machinery, business services, food, and control instruments were the industry groups that accounted for 73 percent of the procurement funds that the metro economy received. These industry groups can serve civilian as well as defense markets without the difficult transition associated with prime contractors, such as ship builders, plane manufacturers, or weapons and munitions firms. See Israilevich and Weiss (1992).

¹⁴Sutten (1996).

¹⁵See Aguilar and Singer (1995) and David Walters’ comments in Federal Reserve Bank of Chicago (1996d).

¹⁶Walters, *ibid.*

¹⁷The share of production has slipped during 1996. Some analysts partly attribute this slippage to the climbing value of the dollar versus the yen. See Meredith (1997).

¹⁸Hervey and Strauss (1996) constructed foreign currency measures against the dollar that are specific to the Midwest’s export composition. They found that the Midwest’s export success has run counter to deleterious trends in the exchange currencies of the region’s major export destinations. It is likely that the region’s export success derives

from a favorable expansion and pattern of expansion in foreign markets and from improving productivity.

¹⁹Baldwin, Diverty, and Sabourin (1994); U.S. Department of Commerce, Bureau of the Census (1994).

²⁰A popular exposition of the neoclassical theme with regard to the recent Midwest experience can be found in Swonk (1996). For a discussion of the possible effects of one such institutional feature, that is, right-to-work laws, see Holmes (1995); also Kendix (1990).

²¹Such figures are merely suggestive and not definitive, assuming, for example, the shift between part-time and full-time workers across regions does not distort the findings, and that the findings are not similarly distorted by regional differences in labor force growth.

²²The evidence is also consistent with falling wages having resulted from a shrinking economy (and shrinking labor demand). The early period strongly suggests the falling wages were caused by loss of manufacturing and attendant high-paying jobs and by excess supplies of willing workers. It is unclear, as yet, whether lower wages have helped revive investment and employment in the region.

²³See Bournakis (1996).

²⁴Fiscal capacity measures of a state are constructed by comparing a state’s per capita tax base to the nation’s, aggregated across all commonly used tax bases, for example, sales, income, and property value. See U.S. Advisory Commission on Intergovernmental Relations (1989).

²⁵See Mattoon and Testa (1992).

²⁶See Kantor (1995). The hypothesis that long-developed regions will necessarily have an advantage in sustaining growth during a period of adversity or shock remains contentious. For an opposing hypothesis, see Kendix, *op. cit.* For a balanced and wide-ranging discussion of the role of such institutions in economic development, see Bonser (1995). For an in-depth discussion of state and local government development initiatives and concepts in the 1980s, see Eisinger (1988).

²⁷For example, see Ameritrust Corporation (1994), Wisconsin Strategic Development Commission (1985), Iowa Business Council and Federal Reserve Bank of Chicago (1987), and the Commercial Club of Chicago (1984).

²⁸To understand and facilitate compliance with urban ozone regulations, the Lake Michigan Air Directors Consortium has been studying regionwide atmospheric chemistry; see Gerritsen (1993).

²⁹The Council of Great Lakes Governors has been active in shaping the new environmental guidance for protecting the basin’s water quality. See DRI/McGraw Hill (1993).

³⁰For a review of such efforts, see McNulty (1991).

³¹McAlinden, Smith, and Cole (1995).

³²Judy and D’Amico (1997).

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Accounting for the federal government's cost of funds

George J. Hall and Thomas J. Sargent



The press routinely reports extraordinarily large government deficits, mainly consisting of interest costs, for countries experiencing high rates of inflation.¹ For example, the *New York Times* reported that in 1993 Brazil's government deficit was 30 percent of the country's gross domestic product (GDP).² Most of this deficit was accounted for by interest costs. In the late 1980s, less dramatic but still large government interest costs (around 12 percent of GDP) were reported for Italy. These large ratios are computed by dividing a government's nominal interest payments by nominal GDP. Financial specialists know such figures to be substantial overstatements because they fail to account for the real capital losses that government creditors experience during high inflation.³

Every year, an equally flawed ratio is reported in the federal budget of the United States. Figure 1 reports these official interest expenses as a percent of federal outlays over the period 1960 to 1995.⁴ The figure displays the well-known 1980s growth in interest payments as a fraction of outlays, a hallmark of Reaganomics. Figure 2 displays our corrected estimates of federal interest expenses as a fraction of federal outlays. Compared with the official numbers, the true figures are much more variable, and lower on average.

It is timely to note that section 7 of the recently proposed balanced budget amendment explicitly includes the official interest payments on the federal debt as expenditures.⁵ We are not necessarily suggesting that the framers of the amendment are unaware that this measurement is flawed from a purely economic standpoint. The current measure tends to overstate

interest payments more the higher the inflation rate is. By including the official measure of interest costs, the amendment's framers may intend to add incentives to lower both inflation and expenditures.

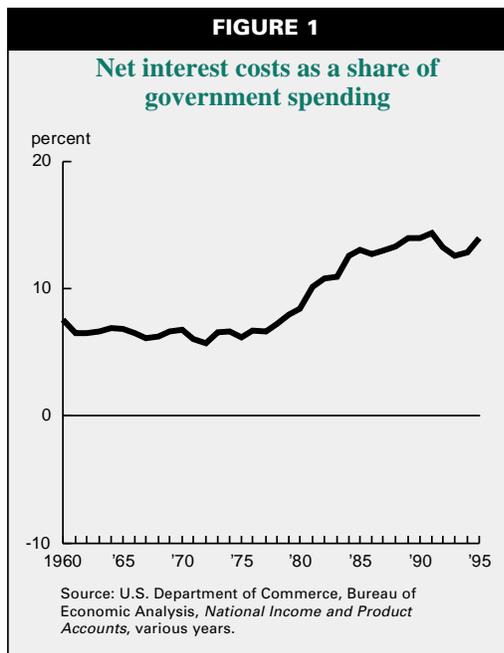
This article describes and defends our corrections to the official series. After showing how to do the accounting correctly, we calculate how the interest costs of the government would have been affected had it used a different debt-management strategy. We simulate the consequences of particular versions of *shorts only* and *longs only* debt-management policies, two classic policies that have been advocated.

A flawed measure of the government's cost of funds

When investors compute the real return on an equity or debt investment, they take into account dividend and coupon payments, the change in price of the stock or bond, and the effect of inflation on the general price level. So should the government in accounting for its interest costs to the public.

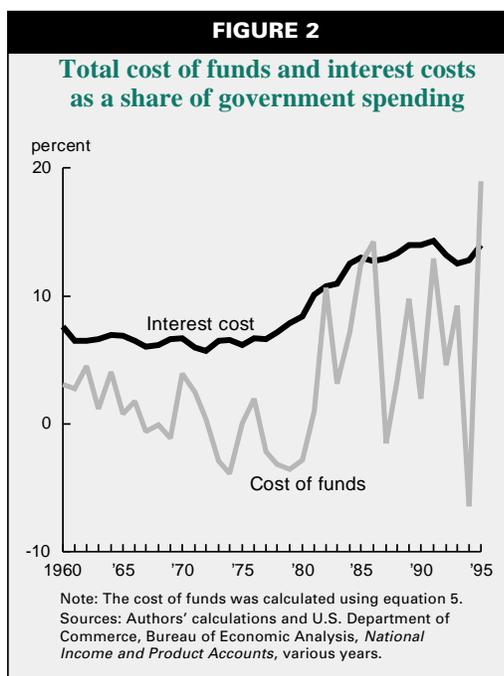
In each time period, the government repays its debtholders in two ways: *explicitly* in the form of coupon payments and principal repayments, and *implicitly* in the form of real capital gains on outstanding debt stemming from the diminished term to maturity of the debt, interest rate changes, and inflation. To measure the government's cost of funds, one must account for

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the capital gains and losses on all outstanding Treasury securities.

The federal government reports an incorrect measure of its cost of funds. It records an imperfect measure of its explicit interest costs and ignores its implicit interest costs. The government computes its cost of funds by forming the sum of current coupons on long-term



coupon bonds and the appreciation on short-term discount bonds.⁶ This measure of the government's cost of funds, shown in figure 1, is a remarkably smooth series, and it is always positive.

The following example illustrates how the government's methodology mismeasures its cost of funds. Consider two bonds that would raise the same value for the government at time $t = 0$, assuming no uncertainty and a constant real interest rate, r . One is a *pure discount* (zero-coupon) bond with ten periods to maturity, paying off P_0 at time 10; the second is a coupon bond with coupon c , paying off P_1 at time 10. From the net one-period interest rate we can compute the *discount factor*, $1/(1+r)$. The value of the pure discount bond $p_0(t)$ satisfies $p_0(t) = (1+r)^{-1}p_0(t+1)$, for $t = 0, 1, \dots, 9$, where $p_0(10) = P_0$. Evidently, for the pure discount bond, interest accrues through the gradual appreciation in the value of the bond from $p_0(0) = (1+r)^{-10}P_0$, at time 0 to $p_0(10) = P_0$ at time 10. The rate of appreciation equals the gross interest rate:

$$1 + r = \frac{p_0(t+1)}{p_0(t)}.$$

The value $p_1(t)$ of the coupon bond satisfies $p_1(t) = c + (1+r)^{-1}p_1(t+1)$, $t = 1, \dots, 9$ and $p_1(0) = (1+r)^{-1}p_1(1)$, where $p_1(10) = P_1$. The interest rate satisfies

$$1) \quad 1 + r = \frac{c}{p_1(t)} + \frac{p_1(t+1)}{p_1(t)}$$

for $t = 1, \dots, 9$.

For coupon bonds of finite maturity with a *principal* payment at the end (really a last big coupon), interest payments (that is, the left-hand side of equation 1) include more than the coupon. Hence, it is not appropriate to measure the interest costs associated with coupon bonds by simply adding up the coupons due this period. Indeed, coupon payments do not represent pure interest in an economic sense; they are partly a repayment of principal. Furthermore, part of the return to investors, and of the cost to the issuer, is in the form of capital gains or losses on bonds as time passes. Any bond with a large final

payment is partly a pure discount bond with a significant portion of its return coming in the form of capital gains or losses over time.

Our example indicates some but not all of the corrections that we want to make in the government's accounting for its interest costs. The other adjustments have to do with the treatment of inflation, the time variation in interest rates, and the existence at any moment of a variety of bonds with various coupon schedules and maturities. Next we expand our example to incorporate all of these features and show how to do the accounting properly.

Doing the accounting right

We can build a system for properly counting the government's real interest costs by carefully rearranging the government's period by period budget constraint. We manipulate the budget constraint algebraically to isolate explicit and implicit interest expenses. Explicit interest expenses are the real capital gains on one-period discount bonds; implicit interest expenses are the capital gains to the public from holding longer term bonds.

First we need to convert nominal yields to maturity on government debt into prices of claims on future dollars in terms of current goods. The modern theory of the term structure of interest rates prices a coupon bond in three steps: 1) viewing the coupon bond as a bundle of pure discount bonds; 2) unbundling it into the constituent pure discount bonds and valuing these components; and 3) adding up the values of the components to attain the value of the bundle. The theory thus strips the coupons from the bond, and prices the bond as though it is a weighted sum of pure discount bonds of maturities 1, 2, . . . , j . (The market and the government have followed theory: pre-stripped zero-coupon bonds, or STRIPS, themselves are available in the market.)

Let s_{jt} be the number of dollars at time $t + j$ that the government has promised to deliver, as of time t . To compute s_{jt} from historical data, we have to add up all of the dollar principal-plus-coupon payments that the government has promised to deliver at date $t + j$ as of date t .

Let a_{jt} be the number of time t goods that it takes to buy a dollar in time $t + j$. We work with a real (inflation-adjusted) price, a_{jt} , denominated in units of time goods (so-called dollars of constant purchasing power) and not time t dollars, because we want to keep track of the

government accounts in *real* (in goods) terms. We can calculate the prices a_{jt} from

$$2) \quad a_{jt} = \frac{v_t}{(1 + \rho_{jt})^j},$$

where v_t is the value of currency (the reciprocal of the price level, measured in goods per dollar), and ρ_{jt} is the yield to maturity on a j -period pure discount bond.⁷ Equation 2 tells how to convert the yield to maturity ρ_{jt} on a j -period nominal pure discount bond into the real price of a promise, sold at time t , to one dollar at time $t + j$.

Let def_t be the government's real net-of-interest budget deficit, measured in units of time t goods. We can write the government's time t budget constraint as:

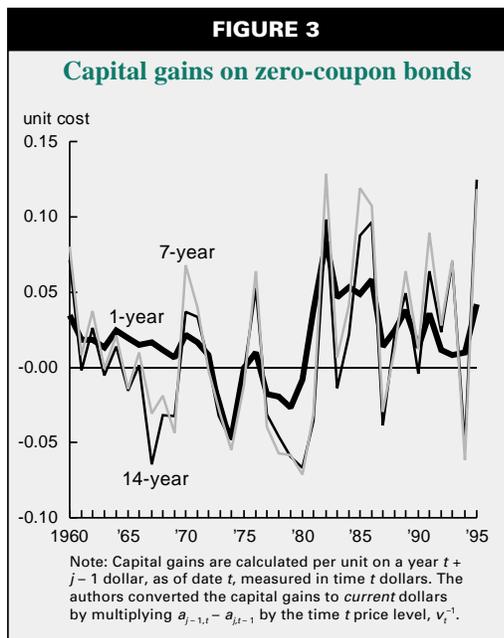
$$3) \quad \sum_{j=1}^n a_{jt} s_{jt} = \sum_{j=1}^n a_{j-1,t} s_{j,t-1} + \text{def}_t,$$

where it is understood that $a_{0,m} \equiv v_t$ and n denotes the longest years to maturity for bonds.⁸ The left-hand side of equation 3 is the real value of the interest bearing debt at the end of period t , determined by multiplying the number of time $t + j$ dollars that the government has sold in the form of j period pure discount bonds, s_{jt} , by their price in terms of time t goods, a_{jt} , and then summing this product (or value) over all such outstanding bonds, $j = 1, \dots, n$. The right side of equation 3 is the sum of the current net-of-interest real deficit, def_t , and the value of the outstanding debt that the government owes at the beginning of the period, which in turn is simply the value this period of the outstanding promises to deliver future dollars, $s_{j,t-1}$, that the government issued last period.

Equation 3 can be rearranged to take the form

$$4) \quad \sum_{j=1}^n a_{jt} s_{jt} = \sum_{j=1}^n (a_{j-1,t} - a_{j,t-1}) s_{j,t-1} + \sum_{j=1}^n a_{j,t-1} s_{j,t-1} + \text{def}_t.$$

These two forms of the budget constraint are algebraically equivalent. We have remarked how equation 3 expresses the real value of total debt with which the government leaves a period t , $\sum_{j=1}^n a_{jt} s_{jt}$ as the sum of the real value of obligations with which it enters



the period, $\sum_{j=1}^n a_{j-1,t} s_{j,t-1}$, and the government's net-of-interest deficit, def_t . Equation 4 breaks the first term on the right side of equation 3 into an interest component and a previous value component. Again, the left-hand side of the budget constraint in equation 4 is the real value of government debt that the government has outstanding at the end of period t . The first term on the right-hand side of the budget constraint in equation 4 represents interest on the government debt, and can be decomposed as

$$5) (v_t - a_{1,t-1})s_{1,t-1} + \sum_{j=2}^n (a_{j-1,t} - a_{j,t-1})s_{j,t-1}.$$

The first term in equation 5 is explicit interest and the second term is implicit interest or the capital gain to the public on its claims on the government. Thus, the term $v_t - a_{1,t-1}$ is the per dollar real capital gain accruing to one-period discount bonds issued at time $t - 1$. The term $a_{j-1,t} - a_{j,t-1}$ is the change in the price in terms of goods between $t - 1$ and t of a claim to one dollar in time $t - 1 + j$; multiplying this change in price by the dollar value of time $t - 1 + j$ claims outstanding, $s_{j,t-1}$ at time $t - 1$, and summing over j gives the capital gain to the public.

These capital gains are not trivial. In figure 3 we plot the per dollar nominal capital gains, $\sum_{j=1}^n (a_{j-1,t} - a_{j,t-1})$, for one-year, seven-year, and 14-year zero-coupon bonds. There are three things to note. First, capital losses can be quite large, and they occur frequently. These losses

occur during periods of rising inflation or rising interest rates. Second, the capital gains and losses of bonds of different maturities move together. So the government could not have eliminated the inflation and interest rate risk inherent in its portfolio by manipulating the maturity structure of the debt. Third, the longer the maturity of the bond, the greater the volatility of the capital gains. Increasing (or decreasing) the average maturity of the outstanding debt increases (or decreases) the government's and the public's exposure to inflation and interest rate risks.

In figure 4 we report our breakdown of the total interest costs on the marketable federal debt between explicit and implicit real interest costs. In general, the explicit interest costs were relatively small and relatively constant from 1960 to 1995. In contrast, the implicit interest costs were substantial, variable, and often negative. Since the real value of the outstanding debt was growing over this period, s_{jt} was growing over time. So the per dollar capital gains are being multiplied by increasingly large numbers. Thus the implicit interest cost became more volatile throughout the sample period.

We compute the total interest costs born by the federal government by simply adding up the explicit and implicit interest costs. Total interest costs as a percent of government outlays are plotted in figure 2. The explicit, implicit, and total interest costs, as well as the total debt outstanding, in millions of 1983 dollars are reported in table 1. In contrast to the Treasury's

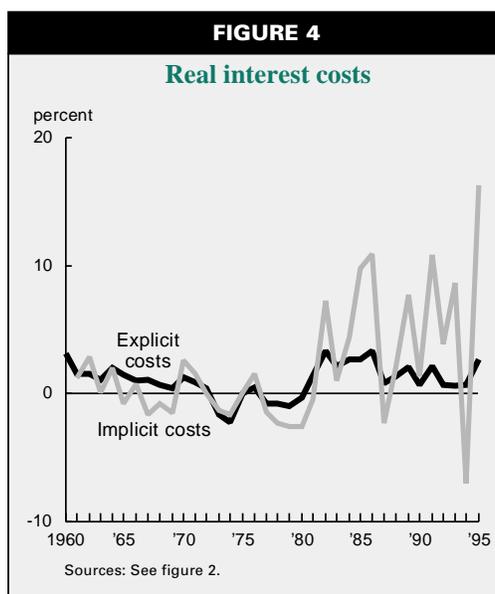


TABLE 1			
Federal government's interest costs in millions of 1983 dollars			
Year	Explicit	Implicit	Total
1960	9,358	0	9,358
1961	4,886	3,863	8,748
1962	5,484	10,142	5,626
1963	3,916	394	4,310
1964	7,536	7,593	15,129
1965	5,809	-2,738	3,071
1966	4,523	3,325	7,848
1967	5,370	-7,843	-2,472
1968	3,440	-3,733	-293
1969	2,027	-7,477	-5,449
1970	6,780	13,596	20,376
1971	5,174	8,640	13,813
1972	2,501	-1	2,500
1973	-9,354	-7,662	-17,016
1974	-13,212	-9,568	-22,780
1975	-3	539	536
1976	3,596	10,573	4,169
1977	-4,796	-10,077	-14,874
1978	-5,321	-16,504	-21,825
1979	-6,629	-17,580	-24,208
1980	-2,081	-17,979	-20,060
1981	10,887	-3,618	7,269
1982	27,383	57,556	84,939
1983	18,009	8,730	26,739
1984	23,430	37,918	61,349
1985	24,336	87,049	111,385
1986	31,339	101,356	132,696
1987	7,496	-20,884	-13,388
1988	12,637	19,428	32,066
1989	19,623	73,032	92,655
1990	6,981	12,851	19,832
1991	20,768	105,116	125,884
1992	7,037	40,695	47,732
1993	5,884	90,648	96,532
1994	6,882	-73,186	-66,304
1995	28,537	173,862	202,399

calculations plotted in figure 1, our computed costs of funds are quite volatile.⁹ These costs were negative during periods of large capital losses in the Treasury bond market (for example, the high inflation episodes of the 1970s and the dramatic fall in bond prices in 1994).

Ultimately how volatile the federal government's interest costs are depends on how the government shares inflation risk and interest rate risk with the public. The Treasury and the Federal Reserve can alter this risk-sharing arrangement between the government and the public by manipulating the maturity structure of the outstanding debt. To illustrate this, we run three counterfactual portfolio strategies.

Evaluating alternative portfolio strategies

Assuming that postwar U.S. interest rates had remained unchanged, how would the government's interest expenses have been affected if it had followed a different debt-management policy? If we restrict the government to issuing from its historically observed menu of instruments, this question can be answered by mechanical calculations. We compose alternative hypothetical portfolio strategies, and track the net costs the government would have incurred at historically realized interest rates.¹⁰ Below we describe how these costs can be calculated, and perform some of these calculations.¹¹

Given historical time series data on $\{a_{jt}, s_{jt}, \text{def}_t, v_t\}_{t=t_0}^T$ we can use equations 4 and 5 to account for interest payments on the government debt. Given $\{a_{jt}, \text{def}_t, v_t\}_{t=t_0}^T$, we can evaluate the effects on the government budget of portfolio strategies $\{s_{jt}\}_{t=t_0}^T$ other than the historical one. These alternative portfolio strategies must be constructed to respect the government budget constraint in equation 3.

The alternative strategies are:

1. Shorts only: Set $s_{jt} = 0$ for $j > 1, \forall t$.
2. Tens only: Set $s_{jt} = 0$ for $j \neq 10, \forall t$.
3. Longs only: Set $s_{jt} = 0$ for $j < n, \forall t$, where n is the longest bond priced by the McCulloch and Kwon (1993) dataset.

The first and third policies represent the poles of proposed debt-management policies.¹² For an economy with only nominal interest bearing debt, the class of feasible financing rules is

$$6) \frac{a_{kt} s_{kt}}{\text{def}_t + \sum_{j=1}^n a_{j-1,t} s_{j,t-1}} = f_{kt},$$

and

$$7) \sum_{k=1}^n f_{kt} = 1.$$

In words, f_{kt} is the fraction of the outstanding debt at time t that is due at time $t + k$.

Restrictions in equations 6 and 7 are algebraic implications of the government budget constraint in equation 3. Let $\sum_{j=1}^n a_{j-1,t} s_{j,t-1} \equiv V_t$ be the value of interest bearing government

debt at the beginning of period t . Given a policy f_{kt} , $k = 1, \dots, n$, together with observed interest rates, equation 5 can be solved for s_{kt} , $k = 1, 2, \dots, n$:

$$s_{kt} = \left(\frac{f_{kt}}{a_{kt}} \right) (\text{def}_t + V_t).$$

This equation can be solved recursively to build up records s_{kt} and decompositions of interest cost under alternative hypothetical debt-management rules.

The first two policies fall into the set of simple rules that are time invariant, that is,

$$f_{it} = f_j \forall t.$$

For the bills only policy, $f_{1t} = f_1 = 1$ and $f_{kt} = f_k = 0$ for all $k \neq 1$. For the tens only policy $f_{10t} = f_{10} = 1$ and $f_{kt} = f_k = 0$ for all $k \neq 10$. Our third policy, longs only, is a time varying policy, which depends on the maturity of the longest bond outstanding each year during our sample period. For each of these policies, the entire debt is purchased and resold to make sure *all* the debt is held in either one-year bills, ten-year zero-coupon bonds, or n -year zero-coupon bonds (depending on the experiment).

For any feasible specifications of f_{jt} , we can evaluate the implicit and explicit interest costs of financing a stream of government deficits. Our three policies will have quite different effects, largely through the behavior of the value of currency, v_t .

The data

The s_{jt} series are computed using data from the CRSP Government Bonds Files. For each Treasury note and bond outstanding, CRSP reports the maturity date, the coupon rate, and the face value held by the public. The original source for these data is table PDO-1 of the *Treasury Bulletin*. Since neither the *Treasury Bulletin* nor CRSP reports the face value of Treasury bills held by the public, these data are backed out of table FD-5 of the *Treasury Bulletin*. All data are as of December 31 of each year.

The value of the currency, v_t is computed by:

$$v_t = \frac{100}{p_t},$$

where p_t is the price level. The price level is the monthly series CPI—all items, from the Bureau of Labor Statistics. The base for the CPI series is 1982–84 = 100. We sample the

December observation of each year to create the annual p_t series.

The yield to maturity series, ρ_{jt} , is constructed by point sampling end-of-month data from McCulloch and Kwon (1993) and Bliss (1996) containing the zero-coupon yield curve implicit in U.S. Treasury coupon bond prices. Hence ρ_{jt} is the yield to maturity on a j -period pure discount bond as of December 31 of year t .

We calculate the prices, a_{jt} , using equation 2:

$$a_{jt} = \frac{v_t}{(1 + \rho_{jt})^j},$$

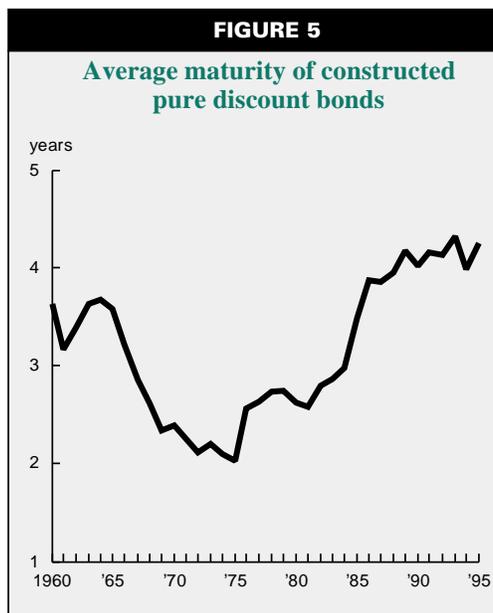
where $j = 1, 2, \dots, 30$ and $t = 1960, \dots, 1995$.

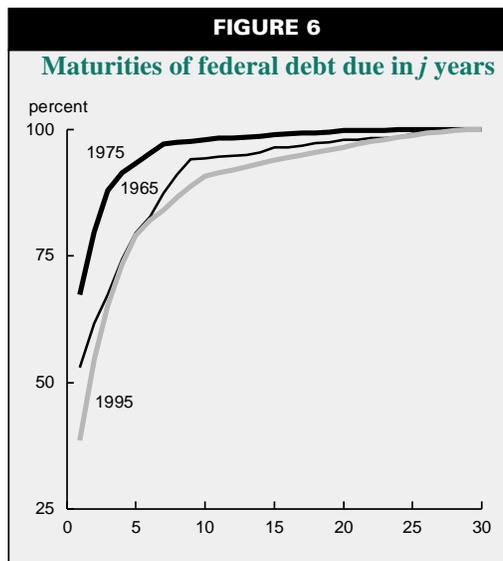
In constructing our counterfactual debt-management figures, we use equations 4 through 7 with the appropriate time-invariant f_{it} . We imputed the real net-of-interest deficit series, def_t , from the government budget constraint, equation 3, using the actual a_{jt} and s_{jt} series.

The results

Below, we discuss some of the properties of the actual s_{jt} and f_{jt} series, review the historical paths for inflation and the term structure of interest rates, and report the results of our experiments.

Figure 5 shows the average maturity for our calculated s_{jt} series. Its variations generally match those of the average maturity of the federal debt series reported by the Treasury, though the levels differ. We believe there are





some problems the Treasury's series (for example, it confines itself to marketable securities only after 1975) and prefer our methodology of reducing each bond to a zero-coupon basis by allocating coupons to the year in which they fall due.

The average maturity falls from the mid-1960s to 1975 and rises steadily for about thirteen years before leveling off at four years for the last seven years of the sample. The steady fall in the average maturity during the late 1960s and early 1970s is partly the consequence of federal legislation, repealed in 1975, which prevented the Treasury from issuing long-term instruments paying interest above a threshold rate that market rates were then exceeding. As we shall see, by causing the Treasury to shorten the average maturity of its debt during the high inflation years of the 1970s, this law prevented the government from fully benefiting from the negative implicit real interest it managed to pay through inflation.¹³

Figure 6 plots the percentage of the federal debt due within j years for 1965, 1975, and 1995. This figure was constructed by taking a cumulative sum of the observed f_{jt} series for each of the three years. Throughout the period we studied, the federal debt was heavily weighted toward securities with maturities of one year or less. In 1995, almost 40 percent of the government's portfolio was due within one year. Only a tiny fraction of the federal debt is financed with long-term bonds.

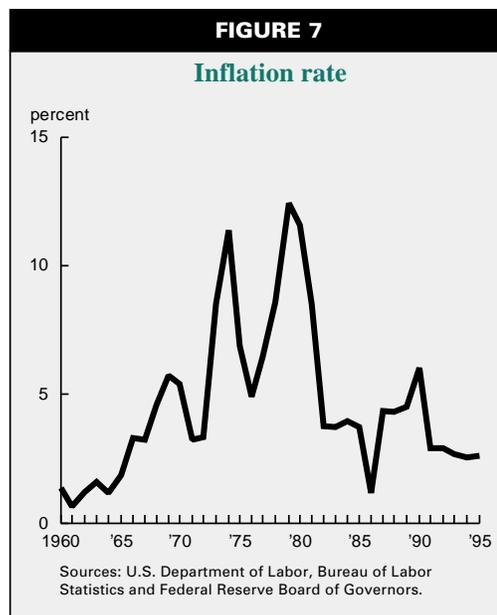
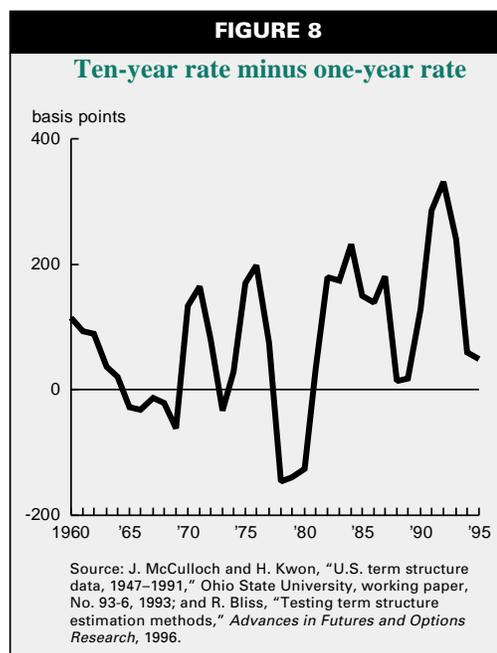
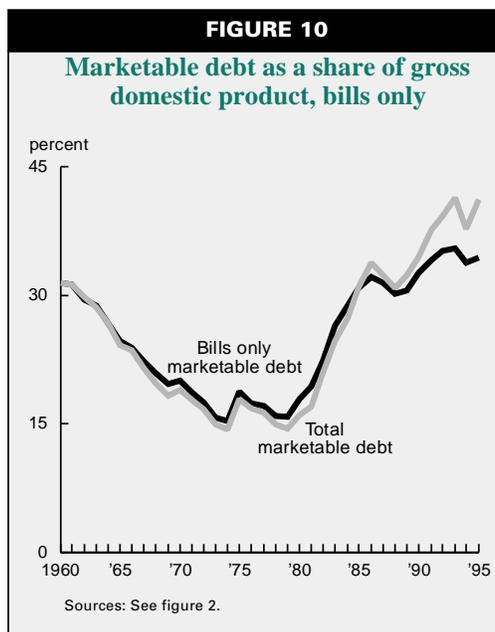
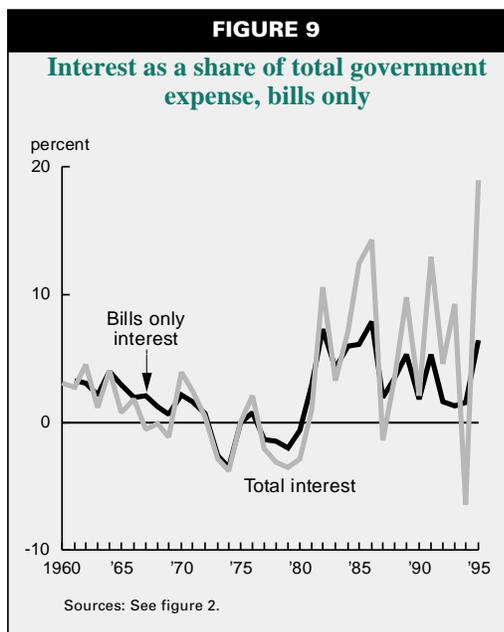


Figure 7 plots the percentage change in the price level, the inflation rate, and is dominated by the high inflation rates of the 1970s. The spread between the ten-year bond rate and the one-year bond rate is plotted in figure 8. When this difference is positive, the yield curve is upward sloping. When it is negative, the yield curve is inverted. In general, the inflation rate and the slope of the term structure moved in opposite directions. The yield curve tended to





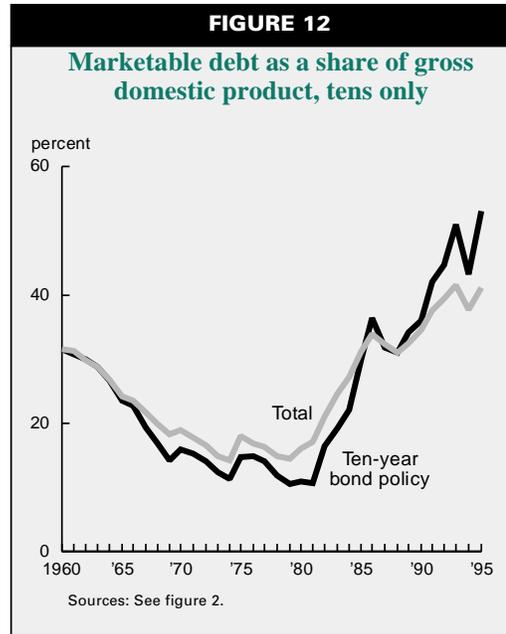
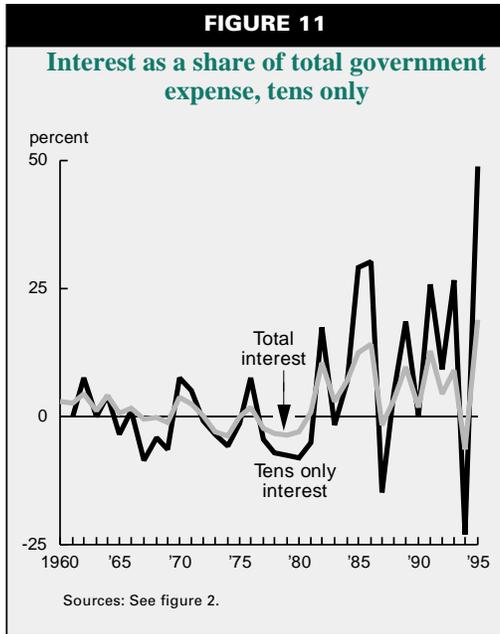
flatten or become downward sloping during periods of rising inflation.

Figures 9 and 10 display the results of our first experiment: a bills only policy. Figure 9 shows that the realized total real interest (explicit plus implicit) would have been somewhat higher during the late 1960s and most of the 1970s under the bills only policy than under the actual policy followed. During the late 1960s the yield curve was inverted, so long-term rates were below short-term rates. But, more importantly, the high inflation of the 1970s substantially decreased the real value of the federal government's outstanding obligations.¹⁴ However, this pattern reversed in the early 1980s; in the second half of the sample, as inflation fell and the yield curve became consistently upward sloping, the interest costs under the bills only policy would have been lower than under the actual policy.

Figure 10 shows that under the bills only policy the real value of the marketable interest-bearing debt would have been higher through the mid-1980s. But by the end of the period the real value of marketable interest-bearing debt would have been lower under the bills only policy than under the actual policy. Had the bills only policy been followed, the outstanding debt would have been 34 percent of GDP. In 1995, the actual debt to GDP ratio was 41 percent.

Figures 11 and 12 show what would have been the total real interest costs and the real value of marketable debt had a policy been in place of leaving only ten-year bonds outstanding at the end of each year. Figure 11 shows that relative to the actual policy, real interest costs would have been much more variable year to year and would have been negative for many years, especially during the inflationary years of the 1970s. Note that as the size of the federal debt grew, following such a policy would have substantially increased the volatility of the federal government's cost of funds. Figure 12 shows that under a tens only policy, real government debt would have been 53 percent of GDP in 1995.

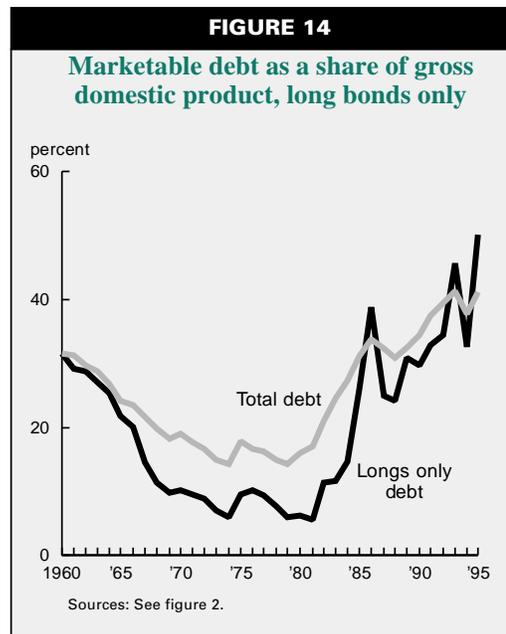
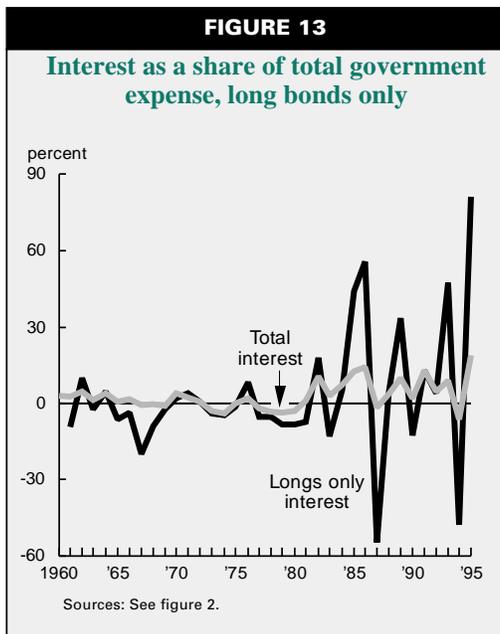
Figures 13 and 14 show the total real interest costs and the real value of the debt under a policy of issuing the longest available maturity (that is, the longest maturity that was actually priced in McCulloch and Kwon's (1993) data set). We see more variable interest costs but less accumulation of debt under the longs only policy than under the tens only policy. Note that in the 1970s, due to the high inflation, the real value of the outstanding debt would have been substantially lower under the longs only than under the actual policy. However, by the end of the sample period, the ratio of the outstanding debt to GDP under the longs only policy would have been considerably higher than the ratio under the actual policy.



These results indicate that debt-management policies weighted toward *longer* maturities would have led to lower interest costs and less accumulation of debt over the period from 1960 to 1980. After 1980, debt-management policies weighted toward *shorter* maturities would have generally lowered interest costs and led to less accumulation of debt. From figure 5 it is clear that the Treasury and Federal Reserve reduced the average maturity of

outstanding debt throughout the 1960s and early 1970s; they then increased the average maturity during the late 1970s and throughout the 1980s. Our analysis indicates that to have minimized its borrowing costs, the government should have engaged in the opposite strategy.

Of course, with hindsight we could have found the portfolio-share policy that would have minimized the government's cost of funds. However, the purpose of these counterfactual



exercises is not to engage in “Monday morning quarterbacking” but to illustrate how the maturity structure of the debt affects how the government and bondholders share inflation and interest rate risk.

Moreover, caution is in order in interpreting the results of an evaluation of a counterfactual debt-management policy. Interest rates are a random process, and the result of following a given strategy is too. What most drives the outcome of our counterfactual exercises is the outcome for inflation. In issuing nominal securities, the government is offering the public a risky instrument whose real return is sensitive to the rate of inflation over the life of the bond. Our results indicate that from 1960 to 1995, inflation came in high with sufficient frequency to let the government often pay negative real interest and sometimes substantially negative real interest. These high inflation rates make the longer maturity portfolio policies come in with lower interest costs during the 1970s. Clearly, the outcome would have been different had inflation come in much lower.

Conclusion

This article makes two points. First, the federal government reports a flawed measure of its own cost of funds. Second, the maturity structure of the debt influences the way inflation risk and interest rate risk are shared by the government and its creditors.

The first point is not just nit-picking. By ignoring the effects of inflation and changes in interest rates on the value of the outstanding federal obligations, the official interest payment calculations make it difficult to evaluate the true cost of various proposals. For example, the introduction of index bonds will change how the government shares inflation risk with its creditors since the government can not induce capital losses on these bonds through inflation. How these bonds can be expected to influence to government’s cost of funds is beyond the scope of this paper; but it should be clear that the Treasury’s accounting methods are inappropriate for evaluating the costs of these new bonds.

The second point is a word of caution regarding periodic calls for the Treasury to “painlessly pare billions from its interest bill by refinancing the government’s existing debt with bonds that mature more quickly.”¹⁵ While our counterfactual experiments demonstrate that shortening (or lengthening) the average maturity of the U.S. debt can at times save the Treasury billions of dollars, these savings depend on the future paths of interest rates and inflation—two series which are notoriously hard to predict. And if the government bets the wrong way, the mistake can be quite expensive.

NOTES

¹This article extends estimates and arguments from Sargent (1993).

²See the article by Nash (1993).

³See Ljungqvist and Sargent (1997) chapter 8, exercise 1; and Blanchard and Sachs (1981).

⁴The series plotted is net interest paid by the federal government from the *National Income and Product Accounts*. The figure displays a series which is remarkably smooth and always positive.

⁵See H.J. Resolution 1, 105th Congress, 1st Session.

⁶The Department of the Treasury calculates the net interest as the sum of coupon payments, accrued interest on bills and zero-coupon bonds, and interest on nonmarketable debt.

⁷We use the yield to maturity series for pure discount bonds constructed by McCulloch (1990) and McCulloch and Kwon (1993). These data were updated by Bliss (1996).

⁸See Sargent and Wallace (1981) for a discussion of this form of the government budget constraint, in particular for a defense of the use of pre-tax real yields on government debt and a net of interest government deficit. Sargent and Wallace use a ‘crowding out’ assumption to justify the use of pre-tax yields.

⁹The Treasury’s calculations include some assets (chiefly savings bonds and some securities issued to state and local governments) that are not included in our analysis. So these two graphs are not strictly comparable. Nevertheless, we expect that adding these assets to our analysis would not change the results in any meaningful way.

¹⁰Under the assumption that historical interest rates would have been unaffected by the switch in debt policy, this accounting exercise involves no use of economic theory. To infer the government’s costs had it issued *different* assets, for example indexed bonds, we would need a theory about the price of pure discount indexed bonds.

¹¹The standard theory of the term structure of interest rates assumes that interest rates on all maturities would be

unaffected by alterations in the maturity structure of the government's debt. This assumption can be justified by appealing to the logic of the Modigliani-Miller theorem from finance.

¹²Actually, not quite the extreme poles. Milton Friedman (1948) advocated the policy that the government finance its deficits and surpluses only by issuing or retiring currency. This is a 'shorts only' policy in which only $j = 0$ maturity debt is issued. At the other end of the spectrum, the classic British policy was to issue only consols, which are infinite maturity bonds, which amount to an infinite stream of pure discount bonds, one for each date in the future.

¹³This is the type of law that Missale and Blanchard (1994) suggest as a device that governments with a large ratio of debt to gross domestic product use to assuage investor inflation fears by reducing the government's returns from inflation.

¹⁴Recall that a Treasury bond is a promise to pay a certain number of nominal dollars at a future date. When inflation increases, the real value of those nominal dollars falls.

¹⁵The quote is from Blinder (1992). Also see Forsyth (1993) and Passell (1993).

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