ECONOMIC PERSPECTIVES

A review from the
Federal Reserve Bank
of Chicago

**Demographic changes,
consumption patterns,
and the Midwest economy**

**Interest rate shocks
and the dollar**

FEDERAL RESERVE BANK
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Contents

Demographic changes, consumption patterns, and the Midwest economy

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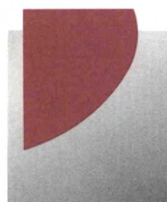
During the last twenty years a variety of factors including oil shocks, technological change, and increased foreign competition have reshaped industries and prompted widespread reorganization. Within the auto, steel, and other durable goods industries that form the core of Midwest manufacturing, many firms have downsized, relocated facilities, reduced wages and profits, and suffered general economic malaise.[1] As these industries have been transformed, the Midwest has undergone a substantial economic adjustment.[2]

The adjustment of the Midwest economy is far from over and in some regards has been accelerating in recent years in response to domestic and international pressures. Moreover, this adjustment is being complicated by substantial changes in the domestic market. Specifically, a number of social and economic developments of the last few decades may be permanently altering traditional domestic consumption patterns, with a particular impact on the market for durable goods. These developments include an aging population and growing disparities in income distribution. This article analyzes these trends and their impact on consumption patterns and on the Midwest economy.

A wide variety of economic and social factors affect the consumption of durable goods. Among the most prevalent are family or household formation rates, income growth, appreciation of financial and nonfinancial assets, prices of durable and nondurable goods,

and factors associated with the goods themselves such as product quality and potential product life.[3] Significant price increases for some products relative to income gains—autos or housing, for instance—may negatively affect consumption of these items by making them unaffordable. On the other hand, stronger economic activity and income gains, different income distribution patterns, and/or demographic age shifts may prompt mini-booms for many industries. Product quality improvements lengthen the life of products and therefore may prompt delays in replacement purchases. Conversely, extended product life expectancy can be offset by design enhancements or technological breakthroughs.

From the standpoint of future consumption patterns, the most significant changes in the U.S. macroeconomic environment are demographic shifts. Of principal concern is the rapid proliferation of nontraditional household units during the last two decades, coinciding with a growing disparity in income distribution. The potential impact of these trends on future income growth and distribution and on consumption patterns is overwhelming; indeed, they could either swamp or intensify other economic, social, and product developmental changes. Clearly, the effect may not be positive. Economic activity, and specifically consumption growth, may be substantially

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ECONOMIC PERSPECTIVES

depressed. The question for policymakers and industry alike is whether this scenario is only a potential risk or a likely outcome.[4]
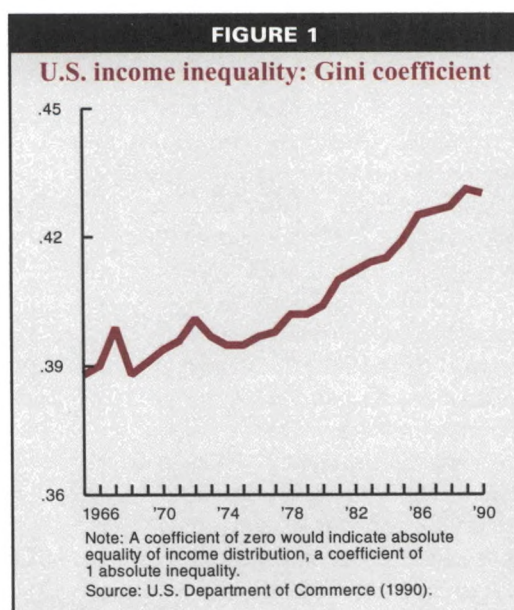
Demographic shifts

The number of two-wage-earner families has increased by 65 percent over the last twenty years. This has increased the proportion of so-called wealthy households in the population. But much more significant has been the greatly increasing proportion of single-parent families and single-person households. In 1970, 77 percent of all households were two-parent families; by 1990 the figure had fallen to 55 percent.[5] Over the same period, the total number of families increased by 23 percent, but single-parent families increased by more than 100 percent—from 6.7 million families to more than 14 million. As a result, by 1990, single-parent families had become 21 percent of all families and 15 percent of all households in the country. The increase in single-parent families was even greater among African-Americans; by 1990, over half of all African-American families were headed by a single parent, usually a woman. Female-headed single-parent families constitute 18 percent of all families and over 43 percent of all African-American families.
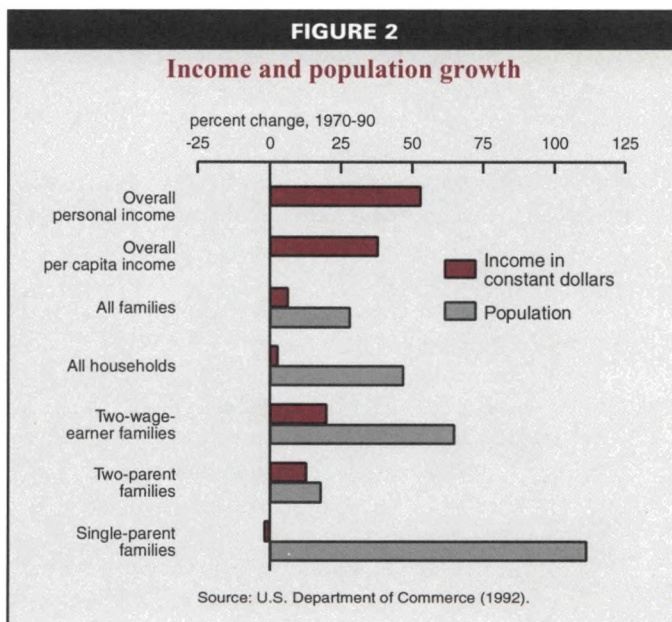
These changes in household composition have a striking impact on income distrbution. Between 1970 and 1990, the median income of all households increased less than 7 percent. Two-parent families have been the recipients of most of this income gain, and this trend will likely continue in the decades ahead. Overall, the median income of two-parent families grew 13 percent from 1970 to 1990, with almost all of the gain occurring after 1980. By 1990, the median income of two-parent families was 135 percent of the median income of all households. This was up appreciably from 1970, when that statistic was approximately 120 percent. Over the same period, the median income of two-wage-earner families—which constitute two-thirds of all two-parent families—increased almost 20 percent, again with most of the gain occurring after 1980.[6] This rise parallels the rise in both personal and per capita income in two-wage-earner families.

The popular media have asserted that the "richer are getting richer, and the poor are getting poorer." This view is substantiated by several measures of income gains and distribution (see figure 1). The Gini coefficient for the U.S. (a measurement of income inequality) has increased substantially since the mid-1960s, and especially since the 1970s; this trend is likely to accelerate during the next decade. Yet, as figure 2 indicates, much of the increasing inequality of income distribution appears to be due to structural changes in U.S. households.

On average, single-parent families and single-person households are socially and economically worse off than other households and are increasingly burdened with disadvantages that hamper improvement in well-being. In 1990, the median income of single-parent families was only about 42 percent of the median income of two-parent families, and only 36 percent of the median income of two-wage-earner families. Furthermore, the relative social and economic status of single-parent families has slipped appreciably in the last two decades.[7] In 1970, their median income was 42 percent of that of two-wage-earner families.[8] Single-parent families on average experienced little or no income growth during the twenty-year period; in fact, their median income declined, with most of the decline occuring in the 1980s. This trend was a principal factor behind the anemic rise in the median income of the overall population. As so-called nontraditional households increase in number, the median and mean incomes of the overall population are depressed, with the median falling

FIGURE 1

U.S. income inequality: Gini coefficient

Note: A coefficient of zero would indicate absolute equality of income distribution, a coefficient of 1 absolute inequality.
Source: U.S. Department of Commerce (1990).

FIGURE 2

Income and population growth

percent change, 1970-90

-25   0   25   50   75   100   125

Overall personal income

Overall per capita income

All families

All households

Two-wage-earner families

Two-parent families

Single-parent families

Income in constant dollars

Population

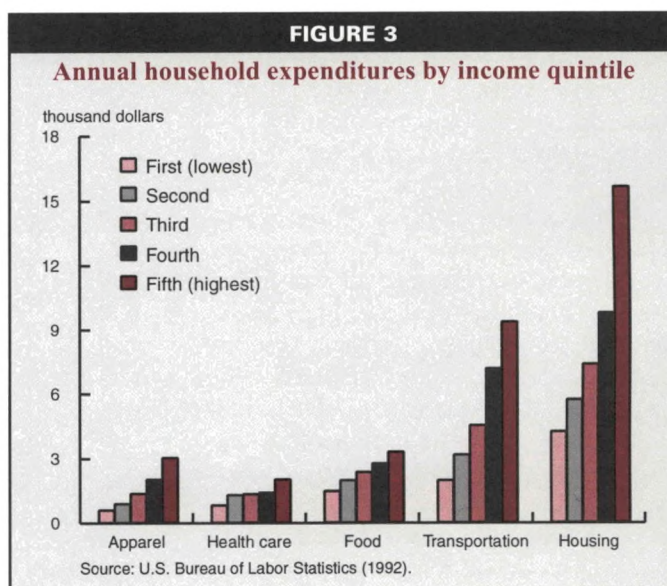Source: U.S. Department of Commerce (1992).

Almost two-thirds of all children in single-parent families are in a household with an income below the poverty level. Firm data tracking these children as they move into adulthood are only now being collected. However, it is expected that the data will show them substantially lagging their peers educationally, and not making up the lost ground between themselves and children in traditional family structures. With their educational achievements depressed, their future economic performance is also likely to be depressed. Given the large number of affected children, this will be a significant erosion in human capital. Thus, whether through diminished consumption expenditures or through negative repercussions on human capital, these structural changes have negative impacts on the macroeconomic environment.

Noting that the structural changes in households account for a large portion of the increasing income inequality and poverty does not remove the concern over the likely impact on future consumption patterns. In fact, if anything, recognizing the causal role of these structural changes intensifies this concern because it makes clear that the only way to neutralize the likely effect on consumption

more than the mean. Although the gap between the median and mean does reflect changes in income distribution, it is not due so much to the rich getting richer and the poor getting poorer, but rather, to the growth in nontraditional households.

While single-parent families as a whole tend to be less well-off than other households, female-headed families are even worse off, with almost half reporting annual incomes below $15,000 a year. By 1990, the median income of female-headed families was only about 47 percent of the median income of all households and 42 percent of the median income of two-parent families.[9] These figures reflect an erosion from 1970. In that year, the median income of female-headed families was 59 percent of the median income of all households.

Evidence of "losing ground" during the 1970s and 1980s is also reflected in the number of nontraditional households below the poverty line. Since 1970 the number of married couples with children below the poverty level has remained constant, but the number of single parents with children below the poverty level has doubled. Single-parent families represent over 60 percent of all households with children below the poverty level.

FIGURE 3

Annual household expenditures by income quintile

thousand dollars

18

15

12

9

6

3

0

First (lowest)

Second

Third

Fourth

Fifth (highest)

Apparel   Health care   Food   Transportation   Housing

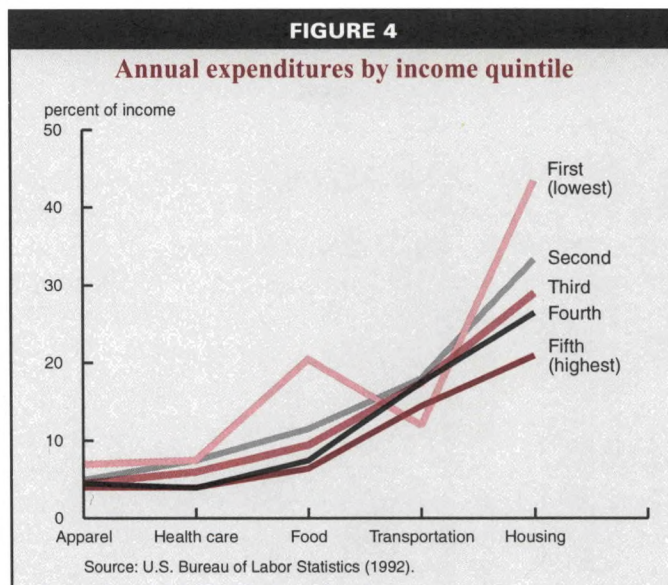Source: U.S. Bureau of Labor Statistics (1992).

patterns would be to break the cycle of poverty—a very tall order. If a steadily growing portion of the population is less able to spend because its standard of living is stagnating or declining, the implications will be enormous for certain sectors, especially durable goods. Because economic hardship is reinforced by social, cultural, and environmental factors, resolution of these problems does not appear probable in the near future.

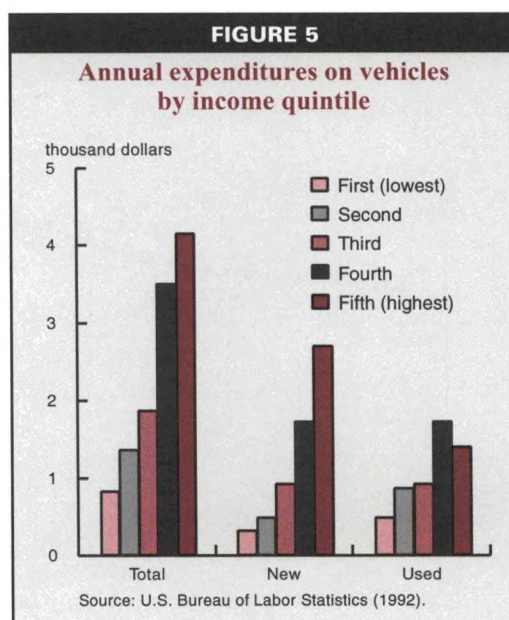## Changing consumption patterns

Consumption patterns vary significantly by income and household composition (see figure 3). Not surprisingly, households with higher incomes spend more on luxury items relative to necessities. Lower income units spend significant percentages of their income on food, clothing, and housing, with very little left over for other purchases (see figure 4). By 1990, households in the lowest income quintile spent almost two-thirds of their total income on food and housing. In contrast, households in the highest quintile spent less than 30 percent of their income on food and housing, a level that would be even lower if it were not for a large investment in high-quality housing and the amount spent on food prepared outside the home.
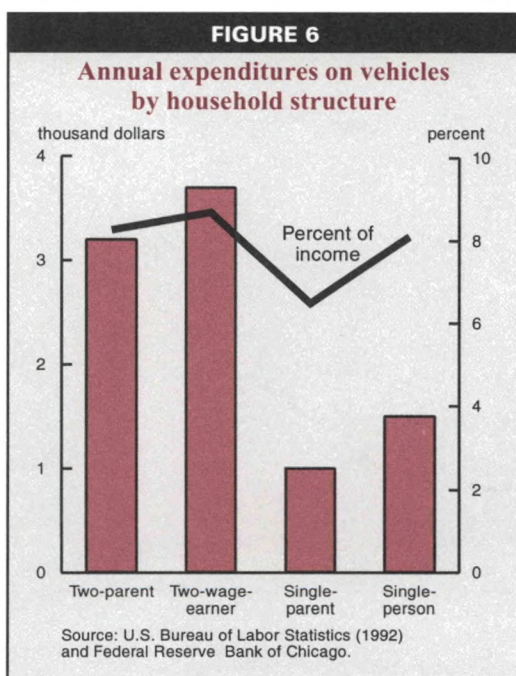
If present trends continue, these spending patterns may spell trouble for the durable goods industry. For instance, as figure 5 indicates, spending both as a percentage of income and in annual dollar amounts for one of the principle big ticket items, autos, is positively correlated to income level and two-parent families. Two-wage-earner families spend over $3,000 a year on vehicles, two-parent families slightly below $3,000, and single-parent families less than $1,000 (see figure 6). With little or no income growth in the last few decades, the affordability of items such as vehicles is becoming a major concern for nontraditional households. As figure 7 shows, between 1970 and 1990, vehicle affordability remained relatively unchanged for two-parent families. But vehicles became substantially less affordable for single parents, a trend that has accelerated over the last decade.[10] Conse-

quently, nontraditional households have become less inclined to purchase vehicles in the last few decades, and the proportion of their income spent on durable goods as a whole is declining. In 1960, for instance, single-parent families spent 7.5 percent of their income on vehicles annually; by 1990, this figure had fallen below 6 percent.

While the growth in nontraditional households has led to a decline in the consumption of durable goods, two-parent families have been increasing their consumption of both durable and nondurable goods. These house-

FIGURE 4

Annual expenditures by income quintile

percent of income

First (lowest)
Second
Third
Fourth
Fifth (highest)

Apparel   Health care   Food   Transportation   Housing

Source: U.S. Bureau of Labor Statistics (1992).

FIGURE 5

Annual expenditures on vehicles by income quintile

thousand dollars

☐ First (lowest)
☐ Second
☐ Third
☐ Fourth
☐ Fifth (highest)

Total   New   Used

Source: U.S. Bureau of Labor Statistics (1992).

FIGURE 6

Annual expenditures on vehicles by household structure

thousand dollars   percent

Percent of income

Two-parent   Two-wage-earner   Single-parent   Single-person

Source: U.S. Bureau of Labor Statistics (1992) and Federal Reserve Bank of Chicago.

holds have traditionally spent a greater proportion of their total expenditures on durable goods, and that proportion has been rising, albeit gradually, in recent years. Although two-parent families are likely to maintain relatively high levels of consumption of durable goods in the future, certain factors may affect these income and consumption trends.

It is not clear whether traditional households will be able to compensate for the spend-

FIGURE 7

Weeks of family income required to purchase average new vehicle

weeks

Single-parent

Two-parent

All families

Two-wage-earner

1970   '75   '80   '85   '90

Source: Federal Reserve Bank of Chicago.

ing shortfall from nontraditional households in order to maintain spending on durable goods in the future. First, existing debt levels may dampen consumption if they lead to a permanent restructuring of the household balance sheet. Of course, these debt levels may be partially offset by leasing, new financing mechanisms, refinancing, longer contract terms, and other financial innovations. Furthermore, although two-parent families received most of the income gains of the last two decades, those gains were only modest. Moreover, their distribution was increasingly skewed toward college graduates. For instance, the Bureau of Labor Statistics estimates that the number of two-parent families with one spouse earning an income below the poverty line increased from 12 percent to 18 percent of all two-parent families during the last twenty years. During this period the average wage of high school graduates with less than five years' experience fell by almost 30 percent. The differential between annual wages for college graduates versus high school graduates currently exceeds 155 percent. Recent census data also indicate that two-parent families are on average older than other households. Consequently, if the life-cycle theory holds, these units may be moving away from their peak consumption years toward the saving period of their lives.[11] Finally, two-parent families are an increasingly smaller proportion of total households.
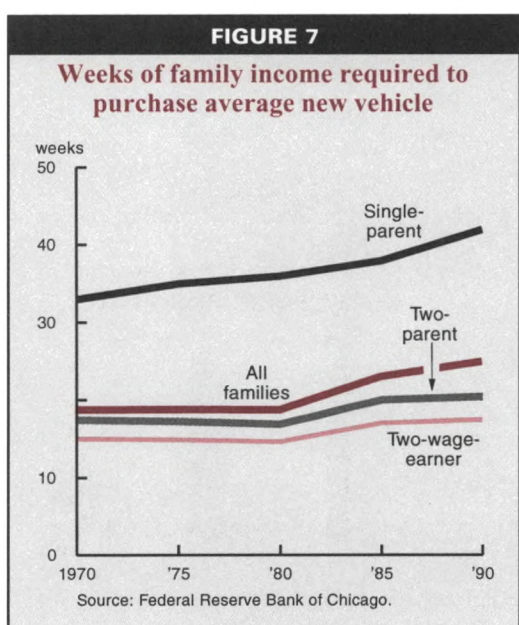
The "consumption gap"

A complimentary concern to distributional questions involves current and future income growth patterns. Income trends over the last twenty years do not bode well for domestic consumption in the 1990s. Per capita disposable income growth over the last twenty years slipped below an annualized rate of 1.5 percent, a modest level below the trend of the postwar era. These aggregate data mask the fact that for a large segment of the population, income is growing very slowly or actually declining. For instance, the real incomes and wages of many segments of the manufacturing sector have declined significantly during the last twenty years. Wages for high school graduates, according to some estimates, have declined more than 15 percent on average over the same period.[12]

Although disposable income growth lagged relative to the historical norm, consumption expenditures continued to increase at rates comparable to their pre-1970s level, with the relationship to historical patterns somewhat stronger in the more robust 1980s than in the 1970s (see figure 8). This level of consumer expenditure with lower income growth resulted in a stronger propensity to consume during the last two decades compared to the 1950s and 1960s. This led to a proliferation of consumer debt and reduced savings during the 1980s. In fact, consumer debt rose both as a percentage of GDP and as a ratio of debt service payments to income. By the end of the decade, the debt burden had risen significantly and payment levels were constraining for some segments. The total household leverage ratio exceeded 90 percent of income by 1990, up from approximately 70 percent in 1980.

Overall, the continued growth of consumer spending in the face of slower income growth produces what can be labeled a "consumption gap"—the differential between annual growth in disposable personal income and annual growth in consumption expenditures.[13] To some extent, this phenomenon may be simply a consequence of rapid household formation rates and the aging of households. The life-cycle hypothesis suggests that debt growth in the 1970s and 1980s may be due to "baby boomer" households' moving into peak consumption years. If this reasoning is true, it implies that in future decades there will be an eventual readjustment as those households pay off their accumulated debt and move into the saving stage of life to prepare for retirement.

No matter what the cause, the increasing levels of debt may constrain future consumption.[14] Households may restructure their balance sheets permanently or make ongoing efforts to lower their debt servicing burdens. The recent atypical recession and recovery are at least partly due to consumers' making these adjustments already. Debt, or at least debt servicing costs, have been reduced, consumption expenditure growth has been modest, and the pace of recovery has been constrained as a result.[15] Of course, recent economic behavior has also been affected by pessimism due to cyclical factors and other economic problems such as abnormal weakness in labor markets.[16] To the extent that this is the case, the constraint

FIGURE 8

Consumer expenditures relative to disposable income

index, 1970=100

Source: U.S. Bureau of Labor Statistics (1992).
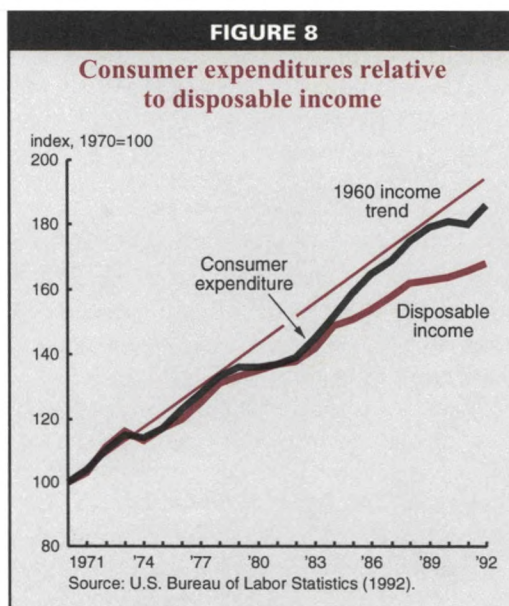
on economic recovery may be merely transitory, due in large measure to the restructuring of consumer debt in the last few years and the delay in purchasing many big-ticket items.

A related issue is the question of product affordability. Especially because of income declines, many consumer items have become less affordable over the last twenty years, including housing, medical care, and education. Price increases for these items have exceeded the consumer price index by more than 40 percent since the mid-1980s. Given the consumption gap, the prospect of slower growth in net worth (especially housing values), and declines in affordability, permanent shifts in consumption patterns seem very likely.[17]

Declining consumption of durable goods

Because the number of nontraditional households is continuing to grow relative to other households, the impact of these spending patterns can be particularly great within specific industries. For instance, holding family composition constant as a share of total households allows one to project the potential level of annual expenditures relative to the actual level. The difference is in excess of $22 billion, or $22 billion less spent annually on vehicles because of shifts in family composition. Looked at differently, if all households spent the same percentage of their annual income on new vehicles and parts as did two-parent families, it would increase the spending on new

vehicles and parts by approximately $10 billion annually, or 5 percent.[18]

These trends cause more than just a drag on overall consumption; they also motivate shifts in product composition in the marketplace. For example, by 1990 nontraditional households accounted for over 25 percent of the total annual expenditures for vehicles, up from less than 15 percent in 1970. This shift, and future market shifts, will likely continue to prompt adjustments by manufacturers to meet the special demands of this segment of the population. Among other changes are potentially increased demand for economy vehicles and used vehicles. Major adjustments in product lines are also likely in the next decade in response to the aging of the U.S. population.

For single-parent families and even two-parent non-college-graduate families, the extended economic outlook is not bright. Intense competition in the marketplace continues to depress wages, and state and local budget difficulties will take their toll on aid payments. Given these trends, the future could bring a period of sales stagnation for the country's producers of expensive durable goods.[19]

Implications for Midwest producers

Projecting trends and their impacts is risky activity, especially when those trends involve changes in individual behavior. Yet it seems clear that the demographic changes sketched above have set in motion a substantial alteration of the U.S. social and economic fabric. Sales of durable goods over the next few decades will be weak to modest at best.

Although diversification has been discussed extensively in the Midwest since the 1970s, durable goods still account for a significant proportion of the employment and income in the region. If the domestic sales environment slumps during the next few decades, the implications for the region will continue to be profound. Even with a best-case scenario of modest sales growth, the challenges for these industries and the Midwest are numerous:

1) Competitive pressures will continue to intensify. The U.S. marketplace has become significantly more competitive during the last few decades as domestic operations have streamlined and foreign firms have penetrated the market. As long as the domestic market was expanding, the impact

of these competitive pressures was partially muted. When demand is flat, it is much more difficult for producers to compete, as market share becomes the primary goal.

2) Given the demographic trends, nontraditional development approaches become important. Of necessity, Midwest producers have attempted to diversify during the last few decades. These efforts have been somewhat successful and have contributed to the region's above-average growth in the last few years. The region has also benefited from a more competitive, revitalized domestic manufacturing base. While this renewed competitiveness has lessened the pain of a weak market, it cannot fully offset that weakness; a revitalized manufacturing base will still struggle if the sales environment remains weak. Given a flat market, economic development agencies must work harder and more inventively to encourage growth and change in the region.

3) Exports may become an important element in this strategy. Exports made important contributions to the economic activity in the nation and the region in the late 1980s. In a domestic market not experiencing sales growth and facing substantial pressure to restructure and downsize, exports take on renewed importance as a source of regional growth.

4) Export growth requires alternative development strategies. In formulating a comprehensive export strategy, policymakers must address a variety of factors such as trade barriers or agreements, factor mobility, general locational concerns, and a highly competitive environment—relatively new developments that must be taken into account in the formulation of future government policies. Perhaps of greatest concern for policymakers, the same elements depressing domestic consumption may also be large hurdles to developing a successful export-oriented strategy.

The dynamics of sweeping structural changes have significantly altered past patterns of market activity and the Midwest's economy. Demographic shifts, the prevalence of structural dislocation, and the heightened importance of global competitiveness have transformed the

economic setting for all individuals and institutions. Public and private policy that fails to recognize these underlying shifts may yield disappointing results. These changes are particularly important to the Midwest because of the major impact on the region's core industries.

NOTES

[1] Traditional analyses of durable goods sales assume that short-term sales are disproportionately affected by cyclical factors, including income, employment growth, and consumer sentiment. Long-term sales trends are linked to a variety of demographic factors such as long-term income growth and household formation rates, as well as technological factors.

[2] While often stressful, this transition has also had positive effects on these industries and on the region. In fact, the restructuring of the last twenty years may prove invaluable as the economy adjusts to potentially slow domestic growth and fast-paced external growth.

[3] Analysts increasingly use households rather than families as their unit of observation because of the proliferation of nontraditional family units. We do the same in this article.

[4] Immigration growth and an increase in birth rates have partially offset the limited population growth in the last few decades. However, the effects of these changes did not entirely offset the aging of the population, at least not initially.

[5] See U.S. Department of Commerce, Bureau of the Census, *Current Population Reports.*

[6] Ibid.

[7] The principal causes of this anemic income growth are complex. On average, the heads of single-parent families have lower educational attainment and other barriers to well-paid external employment. Additionally, a disproportionate number of single-parent families receive government assistance. The level of assistance has been declining in relation both to income growth and to the officially defined poverty level. In Michigan, for instance, maximum AFDC payments fell throughout the 1980s to 75 percent of the federal poverty threshold, a trend also occurring in other states. Average monthly AFDC payments during this period went up by only 6 percent, while the CPI increased by almost 30 percent.

[8] Further complicating any analysis of household income trends is the fact that single-parent families have an income distribution diametrically opposite that of traditional households. Almost 30 percent of single-parent families have annual incomes below $10,000 and almost 45 percent below $15,000. Female-headed families are even worse off, with a median annual income of only $17,000 and almost 40 percent of these families below the official poverty line. Two-parent families reflect the opposite concentration, with over 30 percent earning more than $50,000 per year and over half earning more than $35,000.

[9] From the perspective of net worth, distribution of wealth appears similar to that of income. Of two-parent families, almost 55 percent have a net worth in excess of $50,000, over 33 percent in excess of $100,000. Of single-parent families, almost half have a net worth of less than $10,000 and over 40 percent have a net worth of less than $5,000.

[10] Single-parent families are the only household classification in which annual consumer expenditures exceed the median income level. (On average, it is said that these units are currently "dissaving.") These families spend almost two-thirds of their income for food and shelter.

[11] The effects of an aging population will be even more pronounced in the first two decades of the next century. For example, given current expenditure levels, by the year 2010 people over 45 years old will account for 53 percent of all vehicle expenditures, compared with the current level of approximately 44 percent. The impact on product mix as well as the overall market is likely to be significant.

[12] Office of Technological Assessment estimates (1992).

[13] Note that aggregate data for households is being used in an attempt to explain broader consumer behavior. Specific household segments diverged substantially during this period in terms of both spending activity and income growth. Given this divergence, the "consumption gap" is probably even greater than the aggregate data suggest, and the potential adjustment in consumption patterns is likely also to be that much greater.

[14] The economic recovery in 1991-92 was significantly affected by limited consumer spending growth because of financial restructuring, structural unemployment, and the weight of existing debt. Without the consumer leading the recovery, economic growth has been tepid.

[15] There has been much debate about how much debt restructuring has occurred. For instance, when one includes the switch toward home equity debt and leasing of autos, there seems to have been only minimal reduction of consumer debt. Unfortunately, current statistics in this area are sparse; see Eugeni (1993).

[16] The changes in the labor markets may be not only short-term but long-term as well. For instance, the amount of structural unemployment, the movement from high-paying industries (such as defense, aerospace, and autos), and other developments will have profound implications for the economy over the next few decades.

[17] One interesting recent area of analysis is an attempt to gauge how consumers and business respond to past periods of economic uncertainty and hardship. In today's

rapidly changing marketplace, the potential for uncertainty over employment, revenue, and other factors is great. Eventually individuals may accept this as normal, but such a conclusion may come slowly and only after some painful adjustment.

[18]Based on 1990 data.

[19]A related concern is the fact that on average, nontraditional families are younger than two-parent families and have more children. In addition, almost one-third of all children born in 1990 were born to single women. These characteristics will affect the macroenvironment significantly in the decades ahead.

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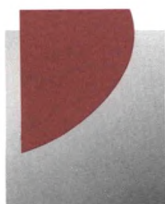
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Interest rate shocks and the dollar

Charles L. Evans

From February through June 1994, the dollar depreciated 9.9 percent against the German mark and 10.2 percent against the Japanese yen. This depreciation has occurred during a period when (1) the Federal Open Market Committee (FOMC) announced a tightening of reserve positions on four occasions, which resulted in an increase in the federal funds rate of 125 basis points; (2) the Bundesbank lowered its discount and Lombard rates by 50 basis points in May; and (3) the prime minister of Japan resigned. Instead of the yen weakening, the dollar hit a then postwar low against the yen at the end of June.

Episodes like this are harsh reminders that exchange rate movements are virtually impossible to forecast over short horizons. Since the mid-1980s, international economists have often reminded us that sophisticated models for forecasting exchange rate fluctuations cannot outguess a simple forecast of *no change*. Meese and Rogoff (1983), for example, argued this point exhaustively for forecasting horizons under two years.

However, there is increasing evidence that exchange rate movements are in fact predictable at longer horizons. Eichenbaum and Evans (1992) find evidence that unexpected increases in the federal funds rate lead to an eventual appreciation of the dollar against the German mark, French franc, Italian lira, Japanese yen, and British pound, but it often takes over two years for this effect to take noticeable hold.[1] Indeed, Evans (1994) finds that a large part of the dollar's recent depreciation against the mark and the yen may be due to the unusually low federal funds rate during the period following the recent U.S. recession—over two years ago. Similarly, Mark (1993) finds that changes in exchange rates over a four-year period have a predictable component, but not for time periods shorter than this. Specifically, taking account of relative monetary policies and the state of real income in Germany and the United States helps predict four-year movements in the German mark against the dollar.

This article examines the relationship between shocks to short-term interest rates in the United States, Germany, and Japan and movements in the yen/dollar and mark/dollar exchange rates since 1979. The evidence indicates that much of the dollar's recent depreciation against the yen is consistent with the behavior of the U.S. federal funds rate and short-term interest rates in Japan since 1991.

A random walk through the currency markets?

Since the Bretton Woods era ended in 1973, most major currencies have floated against the U.S. dollar. One rationale behind this change was that it would allow countries to pursue alternative monetary policies independent of U.S. policies. Countries that pursue higher inflation rate policies will simply allow their currencies to depreciate against the currencies of countries with lower inflation. Con-

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sequently, knowing a country's monetary policy, the state of its real economy, relative inflation, and interest rate differential should help one forecast future movements in the exchange rate between its currency and the dollar.

An influential study by economists Richard Meese and Kenneth Rogoff (1983) concluded that sophisticated models of exchange rate determination make poor forecasts. In fact, the forecasts produced by these models were not consistently better than the simple random walk forecast of *no change*. Meese and Rogoff's findings are especially sobering today. Imagine trying to forecast the future path of the dollar following Chairman Greenspan's February 4 announcement that the FOMC had decided to increase slightly the degree of pressure on reserve positions. From that date through June, the federal funds rate has increased by 125 basis points, so it would have been tempting to forecast a dollar appreciation—and even more tempting with the additional knowledge that the Bundesbank would lower its discount and Lombard rates in May. Yet over this period, the dollar has depreciated from 1.752 to 1.58 German marks and from 109.0 to 98.6 yen.

In this period, forecasting *no change* would have been more accurate than forecasting an appreciation of the dollar. Apparently, over relatively short forecasting horizons such as these, exchange rate fluctuations are largely composed of random movements that can push the dollar up or down, in spite of the current state of monetary policies or the real conditions of the relevant countries' economies.

Recent evidence on U.S. monetary policy shocks and the dollar

In contrast to the above literature focusing on short-run exchange rate forecasts, recent studies have found a stronger, more predictable relationship between monetary policy actions and movements in exchange rates at longer horizons. Eichenbaum and Evans (1992) investigated monthly movements in bilateral exchange rates between the U.S. and Japan, Germany, France, Italy, and the United Kingdom. The analysis focused on the post-Bretton Woods era (1974 to 1990), when these countries' currencies floated against the dollar. A controversial aspect of this research is the necessity of characterizing U.S. and foreign monetary policy actions. We addressed this

concern by considering several measures of U.S. monetary policy variables: exogenous shocks either to the federal funds rate or to the ratio of nonborrowed reserves to total reserves, and movements in the Romer and Romer index of monetary policy contractions.[2] A robust finding across these monetary policy measures was that an expansionary U.S. monetary policy shock leads to a reduction in short-term U.S. interest rates and a statistically significant depreciation of the dollar against these five major currencies. This depreciation, however, occurs slowly over the course of two to three years, and the maximum impact is estimated to take effect after two years. An implication of these estimates is that predictions of movements in the dollar based upon perceived shifts in U.S. monetary policy are likely to be reliable only at long forecast horizons.

Clarida and Gali (1994) identified monetary policy shocks in an alternative way. Using a structural vector autoregression (VAR) modeling strategy and quarterly data, these economists econometrically identified monetary policy shocks by assuming that they have no long-run effects on real variables. This is an appealing assumption to most economists who believe that the long-run Phillips curve is vertical and that the natural rate of unemployment is unaffected by monetary policy.[3] Like Eichenbaum and Evans, Clarida and Gali found that expansionary U.S. monetary policy actions led to a depreciation of the dollar against most major currencies. Because the latter's model considered only a small number of variables, their measures of monetary policy could be capturing additional nonmonetary shocks that have only transitory effects on real variables.[4] Nevertheless, using two alternative identification strategies, the Clarida-Gali and Eichenbaum-Evans results produced a similar picture of the effects of monetary policy shocks on the dollar.

Analyzing monthly data, Eichenbaum and Evans were able to control for a variety of nonmonetary variables that are likely to affect monetary policy and exchange rates. These control variables are not generally available in weekly data. Nevertheless, in weekly data covering 1985-90, Lewis (1993) found complementary evidence that the dollar depreciates against the mark following reductions in the federal funds rate, increases in M1, or increases

in nonborrowed reserves. This indicates that the effects of monetary policy on exchange rates are robust across different time periods.

Germany and Japan, 1979-94

To investigate these relationships further for Germany and Japan, I considered a three-variable VAR for each country. For Japan the data are the yen/dollar exchange rate (expressed in yen per dollar), the federal funds rate, and a two-day call money rate in Japan. I used analogous data for Germany. The data are weekly, covering the period March 2, 1979, through June 24, 1994. All observations are from Friday of the given week unless one market was closed on that day, in which case the observations are from Thursday. I transformed the data so that the three variables in the VAR are:

1) the federal funds rate (FF);

2) the difference between the foreign interest rate and the federal funds rate (RGER-FF and RJAP-FF, respectively, at annualized percentage rates); and

3) 100 times the logarithm of the exchange rate (mark/dollar and yen/dollar, respectively).

Each equation in the VAR contains 26 weekly lags of the three variables plus a constant.

Three shocks are identified as transformations of the three error terms in the VAR, one from each autoregression. A positive shock to the federal funds rate (FF shock) is defined as an unforecast increase in the federal funds rate that induces contemporaneous movements in the foreign interest rate and the exchange rate. Under certain sets of assumptions, a shock such as this can be interpreted as contractionary U.S. monetary policy. Specifically, suppose that the federal funds rate were the instrument of monetary policy. The Federal Reserve considers myriad types of data before deciding on the final setting of this policy instrument. To the extent that the Fed's policy setting deviates from the value dictated by this information set and the reaction function, a positive deviation of the federal funds rate can be interpreted as a contractionary U.S. monetary policy shock. The weekly data in the three-variable VARs do not contain as much information as the data employed in the Fed's reaction func-

tion. However, to the extent that much of the important variation in the economy's fundamentals is captured by variation in these three variables, the measured FF shock may have many of the same attributes as a U.S. monetary policy shock.[5]

A positive RGER-FF (or RJAP-FF) shock is an unforecast increase in RGER-FF (RJAP-FF); it induces a contemporaneous movement in the exchange rate but no contemporaneous movement in the federal funds rate (by assumption). Under a similar set of assumptions as above, the RGER-FF shock can be interpreted as a contractionary German monetary policy shock.

A positive MARK (or YEN) shock is an unforecast increase in the mark/dollar exchange rate (or yen/dollar rate) that induces no contemporaneous movement in the federal funds rate or the German interest rate spread (RGER-FF).[6] This is a catch-all shock, capturing contemporaneous variation in the exchange rate that cannot be accounted for by the two interest rate shocks. A few possible causes of these exchange rate shocks are increasing fears of a trade war, the collapse of a government's ruling party, or a coup attempt.

An interesting question that these VAR estimates can address is, how do average-size shocks affect the federal funds rate, the German and Japanese interest rate spreads, and the exchange rate over time? For Japan, figure 1 plots the estimated effects of the three shocks on each of the three variables for three years of weekly data. The red lines are one-standard-error bands around the estimated impulse response functions.[7] Figure 2 plots the analogous effects for Germany. As Lewis' (1993) empirical analysis suggested, the weekly data results presented here are broadly consistent with the analysis of monthly data by Eichenbaum and Evans (1992). A positive FF shock (interpreted as a contractionary U.S. monetary policy shock) leads to a persistent increase in the federal funds rate. In both cases, the initial one-standard-deviation FF shock induces an increase in the federal funds rate of about 50 basis points. Since many movements in the federal funds rate over time are on the order of 25 basis points, this estimate may be somewhat high for a one-standard-deviation shock. A possible explanation for this large estimate is that the sample period is dominated by the
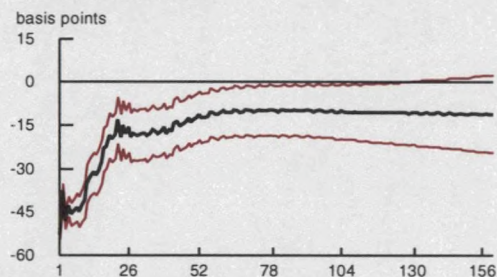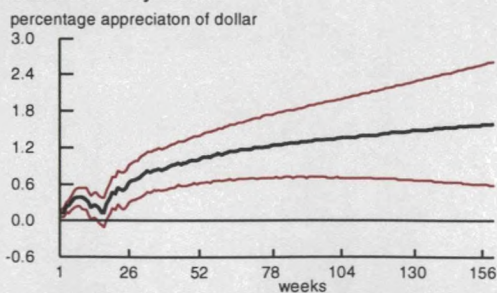
FIGURE 1

Effects of FF, RJAP-FF, and YEN shocks
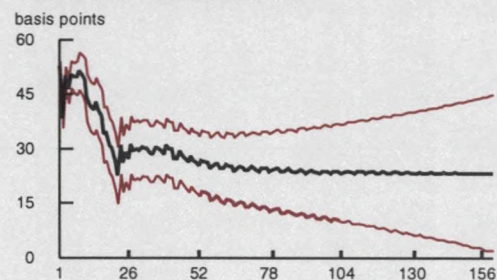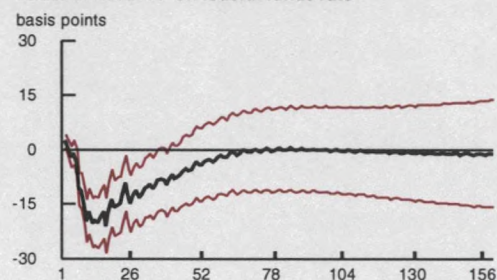
Effect of FF on federal funds rate

basis points

Effect of RJAP-FF on federal funds rate

basis points

Effect of YEN on federal funds rate

basis points

Effect of FF on RJAP-FF

basis points

Effect of RJAP-FF on RJAP-FF

basis points

Effect of YEN on RJAP-FF

basis points

Effect of FF on yen/dollar

percentage appreciaton of dollar

weeks
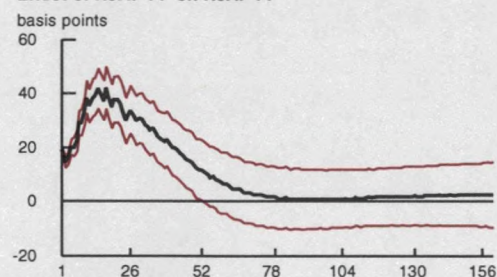
Effect of RJAP-FF on yen/dollar
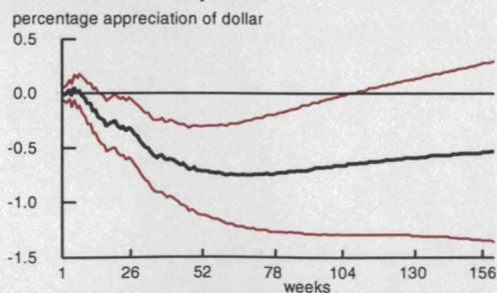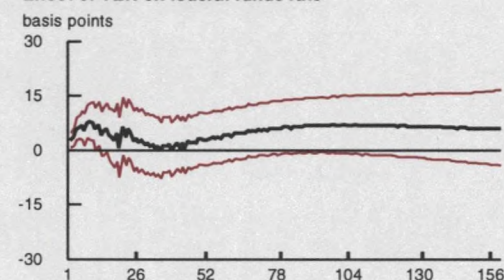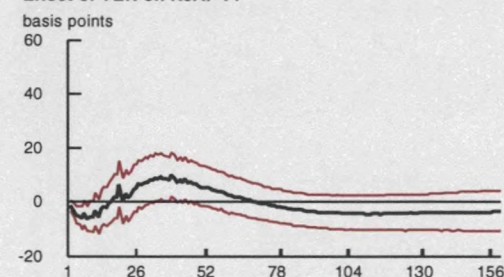
percentage appreciation of dollar

weeks

Effect of YEN on yen/dollar

percentage appreciation of dollar

weeks
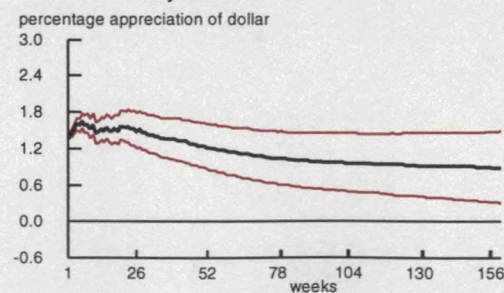
Note: Impulse response functions estimated from three-variable vector autoregression of federal funds rate, Japanese call money rate, and yen/dollar exchange rate. Data cover March 1979 through June 1994. The red lines represent one-standard-error bands.

FIGURE 2

Effects of FF, RGER-FF, and MARK shocks

Effect of FF on federal funds rate

Effect of RGER-FF on federal funds rate

Effect of MARK on federal funds rate

Effect of FF on RGER-FF

Effect of RGER-FF on RGER-FF

Effect of MARK on RGER-FF

Effect of FF on mark/dollar

Effect of RGER-FF on mark/dollar

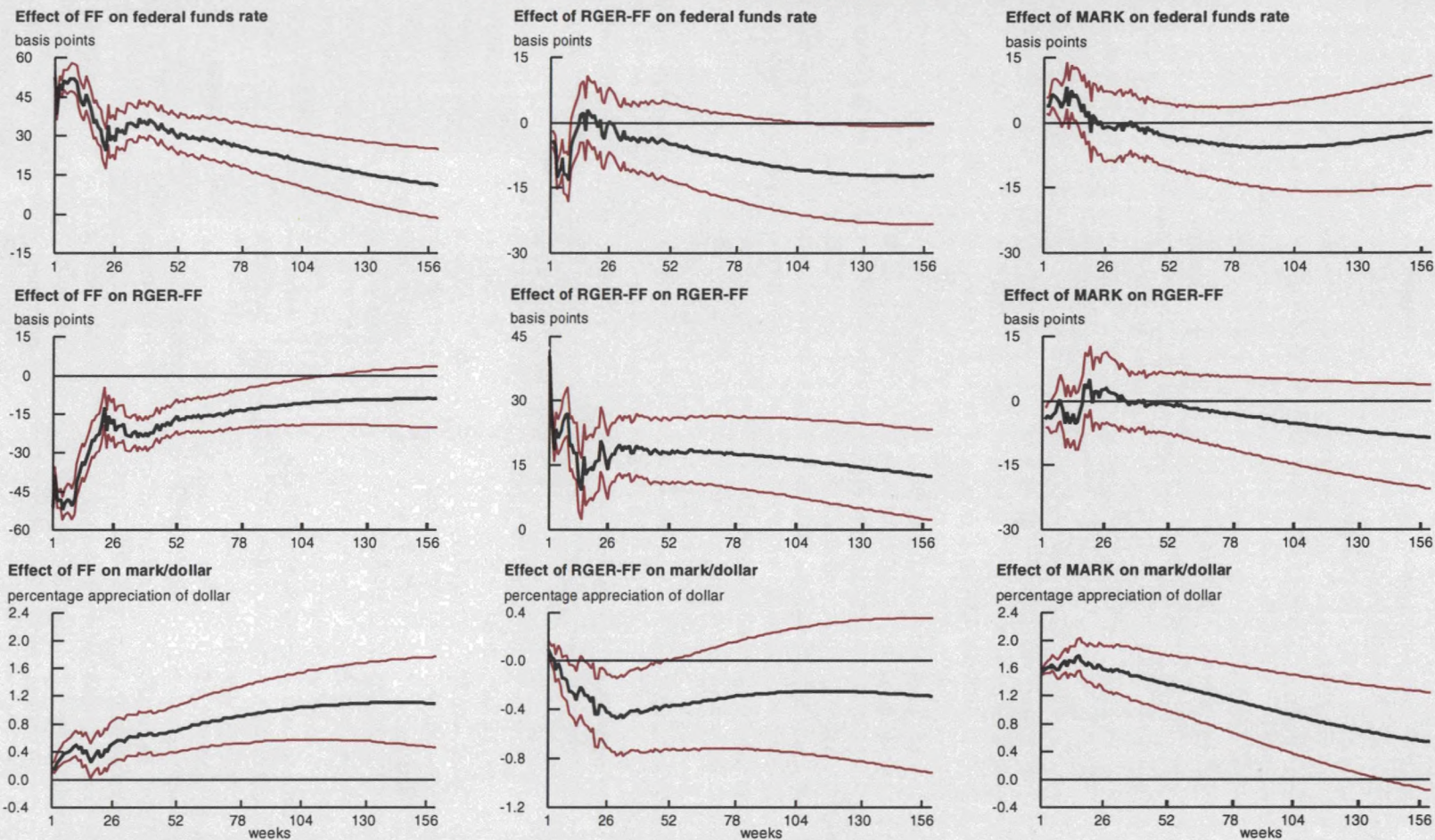Effect of MARK on mark/dollar

Note: Impulse response functions estimated from three-variable vector autoregression of federal funds rate, German call money rate, and mark/dollar exchange rate. Data cover March 1979 through June 1994. The red lines represent one-standard-error bands.

years 1979 to 1984, when interest rate movements were quite large. The smaller estimated effects for the 1987-94 period (reported below) are consistent with this possibility.

The spread between short-term foreign interest rates and the federal funds rate is negative following a positive FF shock. The point estimates indicate that initially the foreign interest rates do not respond strongly to the increase in the federal funds rate. After about one year, the estimated spread is about 15 basis points rather than the initial 50 basis points. If the German and Japanese monetary authorities use these short-term interest rates as the instruments of their monetary policies, then the impulse response functions indicate that the foreign authorities tighten a bit following a U.S. tightening. But the foreign response is not one-for-one with the U.S. contraction.

A positive FF shock leads to a persistent appreciation of the dollar against both the mark and the yen.[8] Notice that the effect of the FF shock on both the mark and the yen is delayed, in both cases reaching its maximal effect after at least two years. The initial effect is extremely small compared with the estimated effect after three years. This finding turns out to be quite consistent with the short-horizon forecasting results documented by Meese and Rogoff. Thus a shock to the federal funds rate does not imply a substantial revision to the forecast for the near-term path of the exchange rate.

The foreign interest rate shocks are measured by the RGER-FF and RJAP-FF shocks. According to the identifying restrictions, a positive shock to RGER-FF induces no contemporaneous change in the federal funds rate. Consequently, a shock to RGER-FF (RJAP-FF) represents a shock to the German interest rate, RGER (or the Japanese interest rate, RJAP). The shocks induce smaller effects than the FF shock on the federal funds rate, the foreign interest rate spreads, and the exchange rate. In the German system, the federal funds rate is not significantly altered by an RGER-FF shock. In the Japanese system, an increase in Japanese short-term interest rates leads to a modest reduction in the federal funds rate. For both countries, however, a persistent positive spread opens up between the foreign interest rate and the federal funds rate that is estimated to be about twice as large for Japan as for

Germany after six months. Interestingly, the dollar is estimated to depreciate against both the mark and the yen, but the larger and more significant effects are again with the latter. After one year, a one-standard-deviation shock to Japanese interest rates (about 20 basis points) leads to a 0.75 percent depreciation of the dollar against the yen.

Finally, the exchange rate shocks have a large, persistent, and significant effect on the mark/dollar and yen/dollar exchange rates (MARK and YEN, respectively). In the early phases of a positive exchange rate shock, the dollar appreciates by a little over 1.5 percent for both currencies. One year later, the dollar continues to be about 1.25 percent higher than before the shock. These shocks seem to dampen out after about two to three years, at least in terms of statistical significance. That is, there seems to be little evidence against the hypothesis that the dollar's initial appreciation has been completely unwound three years later. In response to these exchange rate shocks, the evidence suggests that the dollar's time path exhibits reversion to the mean over a long horizon. Interestingly, there is somewhat less evidence of this type of mean reversion in response to an FF shock at the three-year horizon. Much as a one-time shock to monetary policy would be expected to have a permanent effect on prices, an FF shock seems to have a long-lasting effect on the level of the dollar against the mark and the yen.

Another way of measuring the long-horizon predicability of exchange rates is by examining the variance of particular forecast errors. Specifically, suppose we were forecasting the mark/dollar exchange rate for 52 weeks from now. At the end of 52 weeks, we would know how far wrong the forecast was. We would like to know what events had occurred during those 52 weeks to cause the forecast to be wrong, and we would like to quantify the impact of those events on the forecast's error. Suppose the forecast was very wrong, say by 5 percent. Since the average MARK shock has a relatively large effect on the mark/dollar exchange rate, the impulse response functions indicate that a small number of these shocks could lead to a 5 percent shift in the exchange rate after only 52 weeks. However, the average FF and RGER-FF shocks have a smaller impact effect on the mark/dollar; so a larger

(and less probable) number of these shocks would be required for this to happen. Consequently, at short horizons, we would expect most of the forecast error variance to be explained by exchange rate shocks. At longer horizons, however, the FF shocks are likely to have more explanatory power. The effect of the FF shocks is delayed and builds over time, while the exchange rate shocks dampen.

Table 1 reports this decomposition of forecast error variances for Germany and Japan. Two observations are in order. First, at extremely short forecast horizons, virtually all of the forecast errors are due to the realization of exchange rate shocks. Since these shocks are not easily or readily identified with real-world events, this large percentage demonstrates our inability to explain exchange rate movements. This finding is consistent with Meese and Rogoff's finding that sophisticated models of exchange rate determination cannot outperform a random walk forecast at short horizons. Second, at longer horizons the explanatory power of these exchange rate shocks is smaller. This seems to be due to the mean reversion in these unknown shocks. This is an indication as to why long-horizon movements in exchange rates have a forecastable component.

Historical decomposition of exchange rates, 1979-94

The statistical analysis assumes that variations in YEN and MARK are due to the three shocks discussed above. An interesting question that this statistical model can address is, how much of the dollar's depreciation against the yen since 1991 is due to shocks to the federal funds rate? A historical decomposition can provide an answer.

The VAR estimates imply that the exchange rate can be expressed as a moving average of current and past FF shocks, foreign interest rate shocks, and exchange rate shocks, plus a constant term. How much of the exchange rate's fluctuations over a particular time period are accounted for by the FF shock? One way to answer this question is simply to assume that the historical values of the foreign interest rate and exchange rate shocks are identical to zero for each time period, and then to plot the fitted exchange rate autoregression using the FF shocks as the only nonzero explanatory variables. If all of the variation in exchange rates were accounted for by the FF

TABLE 1			
Percentage of yen/dollar forecast error variance explained by:			
Forecast horizon	FF shocks	RJAP-FF shocks	YEN shocks
1 week	0.8	0.0	99.2
6 weeks	2.5	0.0	97.5
13 weeks	3.3	0.3	96.4
26 weeks	4.9	1.8	93.3
1 year	16.2	7.2	76.6
2 years	33.1	11.7	55.2
3 years	45.4	10.6	44.0
Percentage of mark/dollar forecast error variance explained by:			
Forecast horizon	FF shocks	RGER-FF shocks	MARK shocks
1 week	1.0	0.4	98.6
6 weeks	2.8	0.1	97.1
13 weeks	5.0	1.0	94.0
26 weeks	5.1	2.4	92.5
1 year	9.7	4.3	86.0
2 years	21.0	4.2	74.8
3 years	33.2	4.0	62.8

Note: FF shocks represent an unforecasted movement in the federal funds rate. RJAP-FF shocks (RGER-FF shocks) represent an unforecasted movement in the foreign interest rate spread. YEN shocks (MARK shocks) represent an unforecasted movement in the exchange rate.
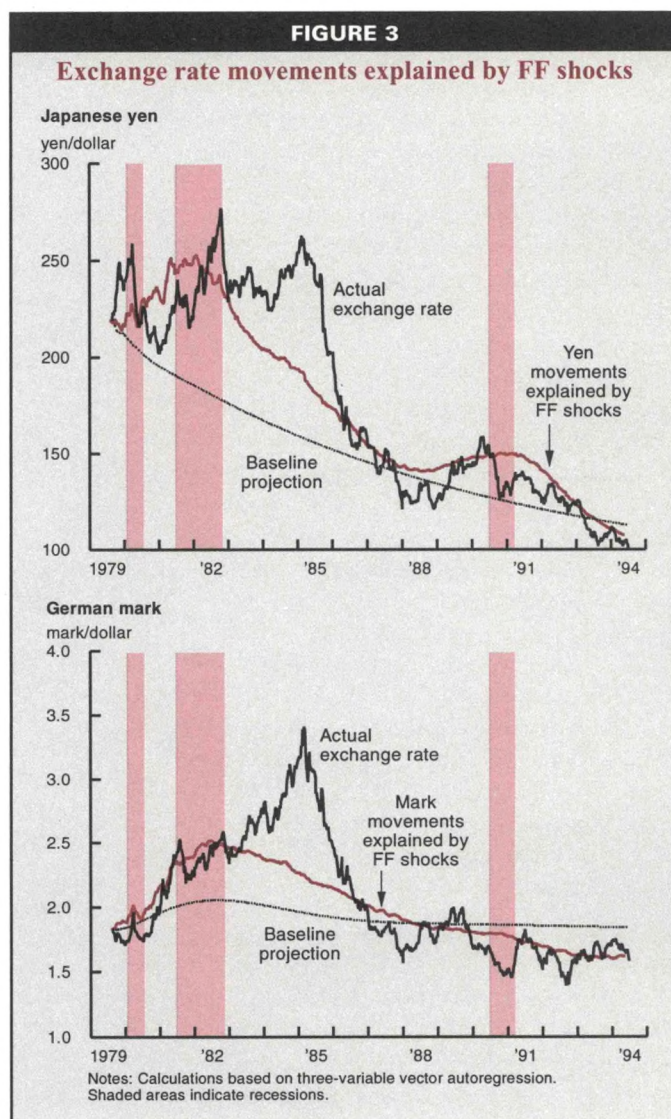
shocks, the fitted values would be identical to the actual exchange rate series. If the FF shocks were statistically independent of the exchange rate, and consequently explained none of its fluctuations, then the fitted values would be a smooth path relative to the volatile exchange rate path. Obviously, this analysis can be done for each of the shocks. The three resulting paths for the exchange rate represent a historical decomposition of the exchange rate fluctuations that are explained by the FF, foreign interest rate, and exchange rate shocks.

Initial conditions at the beginning of the data present an additional difficulty to any interpretation. For example, imagine that for some unexplained reason, the dollar were overvalued at the beginning of the sample period, say March 1979. If no other shocks were to hit these economies, then the dollar would be expected eventually to depreciate to eliminate

the overvaluation. Depending on the reasons for the overvalued dollar and the structures of the U.S. and foreign economies, this transition might take two weeks, two years, or two decades. In the historical decompositions, no matter which path the FF shocks take over the period 1979-94, the effects of this depreciation will be superimposed on the path explained by the FF shocks. To continue with a hypothetical example, suppose that the initial realizations of the FF shocks implied that U.S. monetary policy shocks were extremely contractionary. Monetary theories of exchange rate determination predict that the dollar should appreciate relative to currencies with more expansionary monetary policies. Since the underlying tendency for the dollar in this example was to depreciate prior to the FF shock realizations, the actual path of the exchange rate will depend on the relative strengths of these two competing effects.

Figure 3 displays the weekly time paths of YEN and MARK from March 1979 through June 1994. The line labeled baseline projection in each panel displays the effects of the initial conditions on the projected exchange rate path. For the mark, initial conditions in 1979 projected the dollar would appreciate from around 1.80 marks to above 2 marks in 1982, then settle down to an average level of about 1.85 marks by the end of the sample period in 1994. Essentially, the VAR is estimating MARK to be a stationary process with a well-defined mean value of about 1.85 marks.

For the yen, on the other hand, initial conditions project a continual depreciation of the dollar from 1979 through 1994. This phenomenon seems to be due less to the initial conditions in 1979 and more to the nonstationary behavior of YEN over this sample period. From 1979 through 1985, the dollar traded between 200 and 280 yen; from 1988 through June 1994, the dollar was between 100 and 160 yen. The VAR estimates indicate that YEN

FIGURE 3

Exchange rate movements explained by FF shocks

Notes: Calculations based on three-variable vector autoregression.
Shaded areas indicate recessions.

has no well-defined mean over the longer sample period. Apparently, the estimates are fitting a unit root with negative drift; this means that the fitted values for YEN will trend downward in the absence of any shocks. It also implies that the end points of the projected path will fit the data's end points very closely, irrespective of the paths of monetary policy.
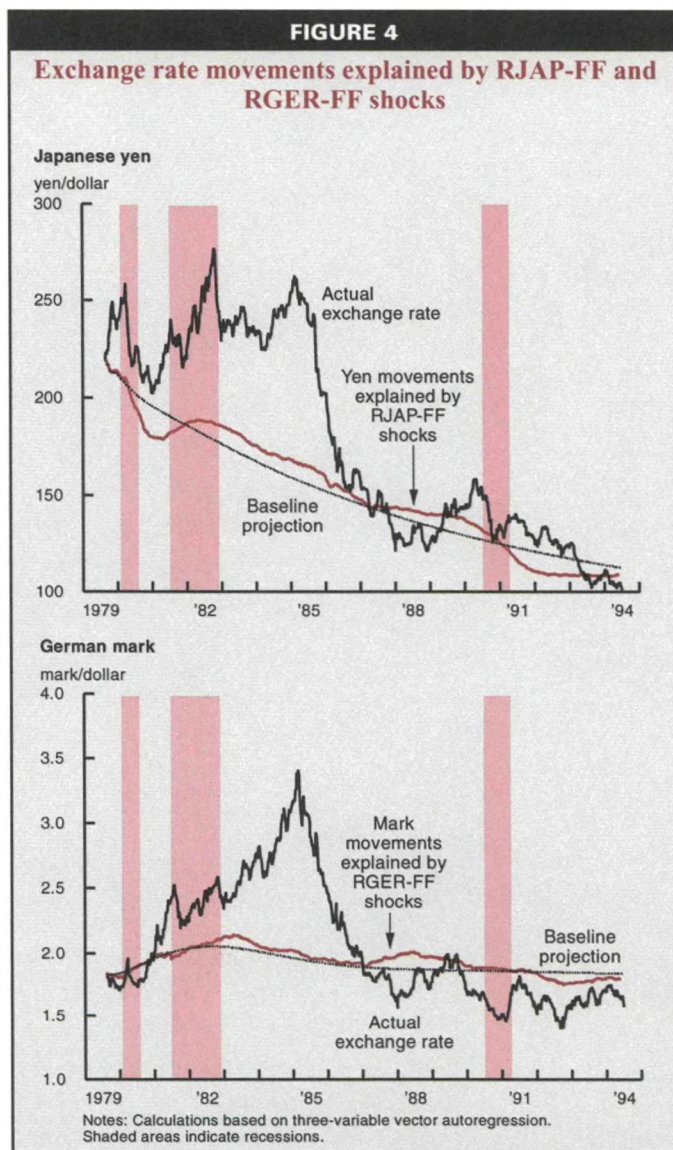
Figures 3, 4, and 5 display the projected path of the exchange rate that is due to realizations of the FF shock, the foreign interest rate shock (RJAP-FF and RGER-FF), and the exchange rate shock (YEN and MARK shocks), respectively. Recall from the impulse response functions in figures 1 and 2 that the FF shocks accounted for mainly long-horizon movements in the dollar, specifically, the one to three-year

horizons. Figure 3 indicates that for both the yen and mark, FF shocks account for long, slow movements in the exchange rate. Relative to the projected path from the initial conditions, the FF shocks account for higher levels of the dollar over the period 1980-85. One interpretation of this path is that contractionary monetary policy shocks led the dollar to appreciate through 1982, and the subsequent depreciation represents either a reversion to the mean for the mark or a resumption of the negative drift for the yen.

In figure 4, the foreign interest rate shocks account for relatively small deviations of the exchange rate from the initial projected path. For the yen, RJAP-FF shocks do account for part of the dollar's depreciation from the peak of the last business cycle in 1990 through 1992, but their total explanatory power remains small over the full sample period. The RGER-FF shock has virtually no explanatory power for the mark.
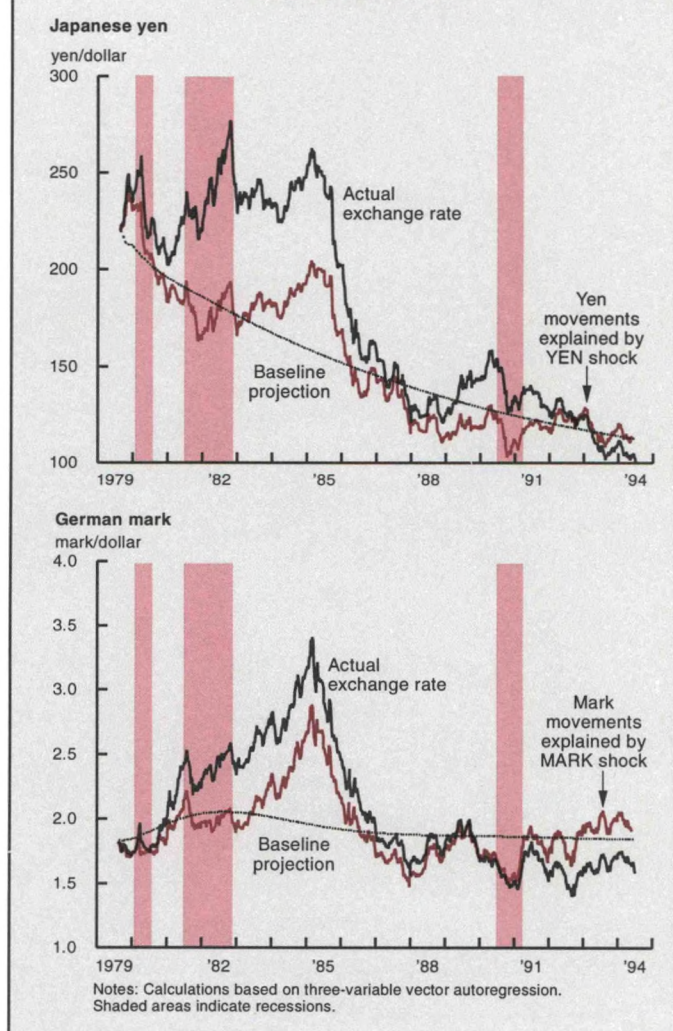
As the impulse response functions indicated, most of the short-term variation in these two exchange rates is due to the unexplained YEN and MARK shocks, and this is evident in figure 5. Specifically, the projected path from these shocks reflects the jaggedness of the actual exchange rates. This occurs even though the overall level of the exchange rate is not well captured by the shocks, especially for the yen. For example, from 1980 through 1985, the average value of the dollar was around 240 yen, but the YEN shocks projected it to be around 180 yen.

Two conclusions seem to follow. First, accurately forecasting exchange rate movements over short time horizons (under one year) requires knowledge and an understanding of unexplained YEN and MARK shocks. Considering the persistence of these shocks, as displayed in the impulse response functions, it is not surprising that a random walk forecast of exchange rate movements does reasonably well by comparison. That is, after a YEN shock,

FIGURE 4

Exchange rate movements explained by RJAP-FF and RGER-FF shocks

Japanese yen
yen/dollar

Actual exchange rate

Yen movements explained by RJAP-FF shocks

Baseline projection

German mark
mark/dollar

Mark movements explained by RGER-FF shocks

Baseline projection

Actual exchange rate

Notes: Calculations based on three-variable vector autoregression. Shaded areas indicate recessions.

YEN does not change much for 12 months, so forecasting *no change* will not be far wrong. Second, FF shocks seem to explain longer-run movements in exchange rates. The information content in short-term interest rates is more likely to improve exchange rate forecasts at the two-year horizon and beyond.

One caveat in the analysis of Japan is the estimated negative drift in YEN over the entire 1979-94 period. This drift term implies that the out-of-sample forecasts will be for the dollar to continue depreciating indefinitely, but that seems implausible despite the recent depreciation. The likely source of this nonstationarity is the behavior of YEN in 1985 and 1986. From 1987 to the present, this exchange

FIGURE 5

Exchange rate movements explained by YEN and MARK shocks

Japanese yen

yen/dollar

Actual exchange rate

Baseline projection

Yen movements explained by YEN shock

German mark

mark/dollar

Actual exchange rate

Mark movements explained by MARK shock

Baseline projection

Notes: Calculations based on three-variable vector autoregression. Shaded areas indicate recessions.

versus 50 basis points for the 1979-94 period. This means that a 25-basis-point FF scale was less likely in the 1987-94 period than in the 1979-94 period. However, the effect of this shock on the federal funds rate is more persistent over the first year. Second, the initial effect of the 18-basis-point FF shock on the dollar is small and uncertain for the first nine months; that is, the standard errors are large relative to the estimated effect. Over the second year, however, the dollar has appreciated on the order of 0.5 percent. Taking into account the smaller size of the FF shock over the 1987-94 period, a 50-basis-point shock is estimated to translate into an approximately 1.5 percent appreciation of the dollar in the second year; this is comparable to the estimates reported in figure 1 for the 1979-94 period.

Third, the RJAP-FF shock is estimated to have a more delayed effect on the federal funds rate and the dollar. At the end of the second year, an initial 15-basis-point increase in the short-term Japanese interest rate is estimated to reduce the federal funds rate by about 10 basis points. Since the spread RJAP-FF is estimated to be less than 10 basis points at this time, the Japanese interest rate

rate has traded in a narrower band. So it is an interesting robustness check to see how the exchange rate analysis changes for this period.

Japan, 1987-94

Figure 6 displays estimated impulse response functions for Japan from a VAR based on weekly data from July 1987 through June 1994. While the qualitative effects are similar, there are some interesting differences between these responses and their full-sample counterparts in figure 1. First, because the period 1979 to 1984 was excluded, average changes in the federal funds rate were smaller. Consequently, the estimated one-standard-deviation FF shock is smaller, about 18 basis points

has declined on net from its initial increase. The statistical analysis here is too simple to allow an evaluation of the underlying causes of these interest rate changes, but the results are suggestive. For instance, the response pattern could be consistent with a monetary contraction in Japan that reduces economic activity in both Japan and the United States; the U.S. monetary response might be to reduce U.S. short-term interest rates somewhat to accommodate the reduction in activity. To assess that possibility would require a statistical analysis that examines economic activity simultaneously with interest rate shocks. Another possibility is that the RJAP-FF shock represents an attempt by Japanese monetary authorities to
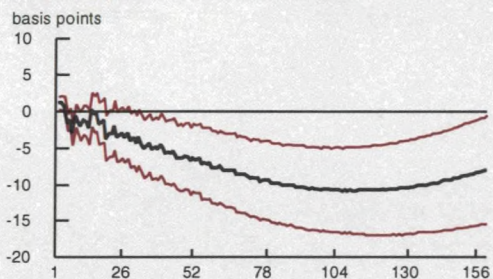
FIGURE 6

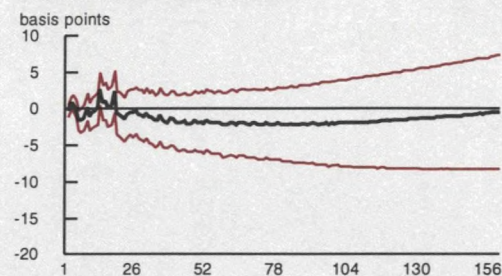### Effects of FF, RJAP-FF, and YEN shocks
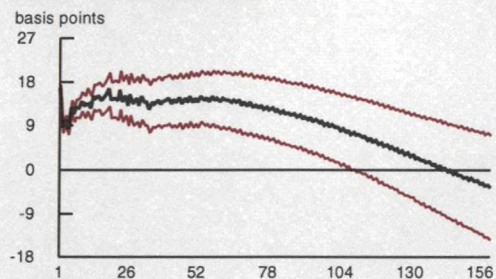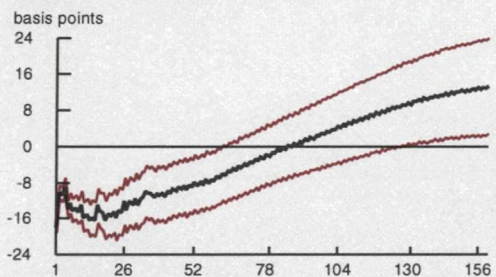
Effect of FF on federal funds rate

basis points

Effect of RJAP-FF on federal funds rate

basis points

Effect of YEN on federal funds rate

basis points

Effect of FF on RJAP-FF

basis points

Effect of RJAP-FF on RJAP-FF

basis points

Effect of YEN on RJAP-FF

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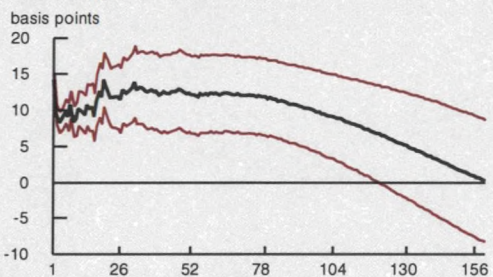
Effect of FF on yen/dollar
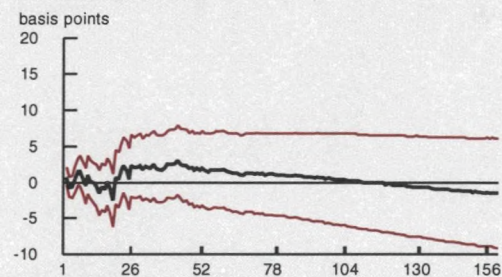
percentage appreciation of dollar
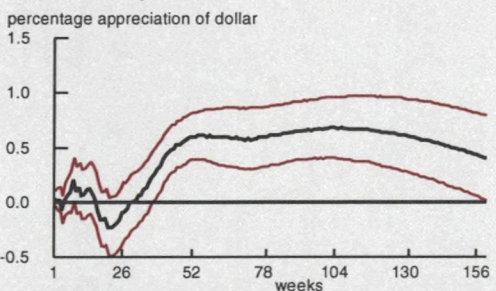
Effect RJAP-FF on yen dollar
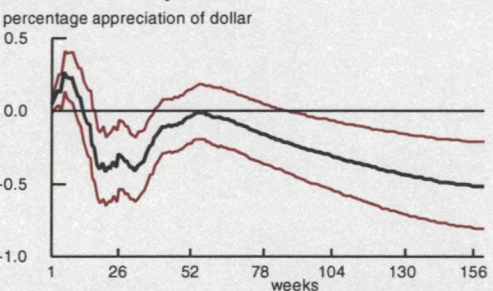
percentage appreciation of dollar

Effect of YEN on yen/dollar
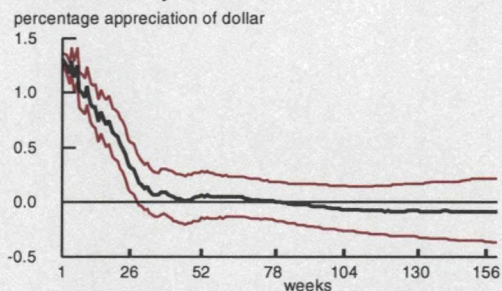
percentage appreciation of dollar

Note: Impulse response functions estimated from three-variable vector autoregression of federal funds rate, Japanese call money rate, and yen/dollar exchange rate. Data cover June 1987 through June 1994. Red lines represent one-standard-error bands.
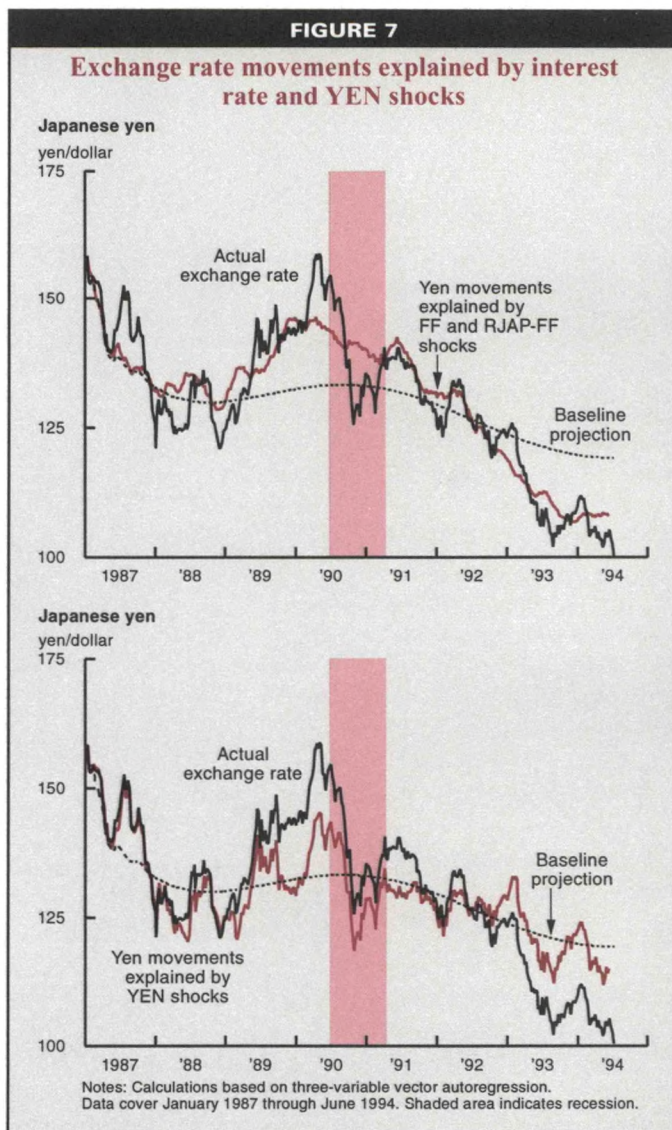
reduce the value of the dollar, and these efforts are accommodated by the U.S. In fact, the dollar does decline by 0.5 percent after three years following an RJAP-FF shock; this estimated effect is more delayed than over the full-sample period (figure 1).

Fourth, the initial effects of the unexplained exchange rate shock continue to be large. Interestingly, the shocks only persist for about six months, after which their estimated effect on the dollar is about zero. This reduced persistence relative to the full-sample period means that a smaller percentage of the long-horizon forecast error variance can be explained by YEN shock. For example, at the two-year forecast horizon, YEN shock explains 42 percent of the forecast error variance in YEN versus 55 percent over the entire 1979-94 period. At the three-year forecast horizon, YEN shock explains only 27 percent versus 44 percent. At this horizon, the FF shock now explains 54 percent versus 45 percent previously, and RJAP-FF shock accounts for 19 percent versus 11 percent.

Finally, figure 7 displays the historical decomposition of YEN movements over the 1987-94 period from the estimated VAR. The projected paths explained by the FF and RJAP shocks have been combined in the top panel of figure 7. Individually, these shocks account for a substantial portion of the YEN movements; combining these explanations leads to a clearer depiction of the role of interest rate shocks over the period. Notice that the projected path from the initial conditions in 1987 oscillates gently around a better-defined average value in the range of 120 to 130 yen. From 1987 through 1988, the unexplained YEN shock accounts for most of the dollar's fluctuations against the yen; in other words, the interest rate shocks explain virtually none of these movements.

Beginning in 1989, the FF and RJAP-FF shocks account for a substantial part of the dollar's appreciation relative to the path projected from the initial conditions in 1987. The dollar's appreciation beginning in February 1990 and its subsequent depreciation through September 1990 are not explained by the interest rate shocks. Credit this volatile period to YEN shock again, and note again that the unexplained YEN shock is capturing some portion of the effects of the Iraqi invasion of Kuwait on the dollar.

From 1991 to the present, the interest rate shocks account for virtually all of the long-horizon variation in the dollar. The FF and RJAP-FF shocks account for the initial dollar level in the spring of 1991. In March 1991, the dollar was at 134.55 yen and the interest rate shocks accounted for a level of

FIGURE 7

Exchange rate movements explained by interest rate and YEN shocks

Notes: Calculations based on three-variable vector autoregression.
Data cover January 1987 through June 1994. Shaded area indicates recession.

138.34. By the end of May 1994, the dollar was at 104.3 yen and the interest rate shocks projected a level of 108.0. This implies that the dollar's 25 percent decline during this period is consistent with the interest rate shocks that occurred in the United States and Japan during the most recent recesssion and the subsequent recovery. Of course, there have been many large short-term swings in the exchange rate that are not explained by the interest rate shocks; these are accounted for by the YEN shock.

Conclusion

The dollar's recent depreciation against both the mark and the yen has been dramatic. Accurately forecasting short-term changes in exchange rates is a nearly impossible task. However, at longer forecast horizons, the evidence indicates that the stance of monetary policy, as measured by unexpected movements in short-term interest rates, affects the dollar significantly. The vector autoregression analysis indicates that interest rate shocks account for a substantial part of the dollar's depreciation against the yen from 1991 through June 1994. Apparently, the relatively low federal funds rate over this period has contributed to the dollar's decline. The statistical analysis implies that the recent 125-basis-point increase in the federal funds rate should ultimately lead to a stronger dollar, but those effects will likely go unnoticed for some time.

NOTES

[1] Meese and Rogoff (1984) also documented evidence that long-horizon exchange rate movements are substantially easier to forecast than short-horizon changes.

[2] In the vector autoregression analysis, monetary policy actions are identified with orthogonalized innovations in either the funds rate or the ratio of nonborrowed reserves to total reserves. Bernanke and Blinder (1992) and Sims (1992) identify monetary policy shocks with orthogonalized innovations in short-term interest rates; Christiano and Eichenbaum (1992) and Strongin (1992) identify these shocks with orthogonalized innovations in nonborrowed reserves and the ratio of nonborrowed reserves to total reserves, respectively. The Romer index is taken to be exogenous, as assumed by Romer and Romer (1989).

[3] See Campbell and Rissman (1994) for a recent discussion of the Phillips curve.

[4] The statistical analysis in this article is also unable to control for a variety of nonmonetary phenomena, such as the condition of labor markets or changes in relative prices that may be reflected in commodity price movements.

[5] Eichenbaum and Evans (1992) considered a much larger set of conditioning variables for the federal funds rate equation. In one case, we allowed the policy instrument to respond systematically to U.S. industrial production, foreign industrial production, the U.S. price level, the ratio of nonborrowed reserves to total reserves, the federal funds rate, the foreign interest rate, and the exchange rate. Clearly, this set of variables can capture a greater amount of variation in the economy's underlying nonmonetary fundamentals than simply interest rates and the exchange rate. Still, many of the results are comparable to the weekly estimates here. For an elaboration, see Eichenbaum and Evans (1992) and Christiano, Eichenbaum, and Evans (1994).

[6] In technical terms, the shocks are identified as orthogonalized innovations from the VAR, where the order of the Wold causal chain is the federal funds rate, the foreign interest rate spread, and the exchange rate.

[7] The standard errors were computed using Monte Carlo methods described in Eichenbaum and Evans (1992). The number of Monte Carlo draws in this study was 200.

[8] See Eichenbaum and Evans (1992) for a more detailed analysis of the statistical significance of these types of impulse response functions.

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