Foreign growth, the dollar, and regional economies, 1970–97

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Introduction and summary

Midwestern manufacturing industries have undergone a substantial transformation during the past two decades that has positively influenced the region's economic growth. Extensive industrial restructuring and technological innovation (both of which contribute to increased productivity) have contributed to this transformation. In addition, the region's economic growth, as well as that of other U.S. regions, is often associated with economic developments external to the domestic market, such as expansion in foreign market demand, and favorable movements in the dollar exchange rate (that is, a dollar depreciation) during the 1970s and from the mid-1980s to the mid-1990s.

Since the mid-1980s, international markets have received considerable attention as drivers of growth in manufacturing for the Midwest and other U.S. regions. In particular, the coincidence of the recovery of the Midwest economy,[1] expanding foreign markets, and the U.S. dollar's depreciation in foreign exchange markets since 1985 has led some observers to forge a link between the recovery and foreign growth and the dollar's depreciation. From the late 1980s well into the 1990s, an association between the nation's industrial recovery and expansion, especially in the Midwest, and the dollar's depreciation was a common topic of discussion, especially in the popular press. Examples of this view are expressed by Koretz (1988) and Prowse (1995).

In this article, we examine the impact on U.S. regional economies of exchange rate change and foreign demand growth. We address the following questions: Are there differences in the exchange rates that regions face? Did depreciation in the dollar exchange rate measurably influence economic growth in the Midwest and other regions in 1970–97? Does growth abroad faced by the regional economies differ by region? And to what degree did foreign economic activity influence U.S. and regional economies in 1970–97? It is clear that different regions have different industrial structures. We expect these differences to reflect regions' trading partners and the industrial makeup of their export basket. Therefore one would expect these differences to be reflected in the foreign exchange rates and foreign demand faced by different regions.

We construct region-specific indexes for exchange rates and foreign economic growth. We then examine trends in these indexes. Next, we incorporate the two region-specific index measures into a regression analysis that addresses their impact on economic growth in U.S. regions in 1970–97.[2]

The dollar experienced substantial variability in its foreign exchange value during the period under review; and the expected regional differences appear prominently in our region-specific exchange rate indexes. The period was characterized by dollar depreciation from mid-1971 to mid-1980 and again from early 1985 to mid-1995. The bulk of the latter movement occurred from 1985 to 1988, although the dollar continued to depreciate relative to several major currencies into the mid-1990s. However, our analysis suggests that Midwest manufacturing goods exporters, in the aggregate, faced an appreciating dollar exchange rate in 1988–96, rather than a continuation of the depreciating trend reflected in movements of the dollar relative to several major currencies. The Midwest-specific

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exchange rate indexes reflect the heavy concentration of the region's export trade to other North American markets, where the dollar was relatively strong. According to this index, manufactured goods export industries faced a real aggregate dollar exchange rate that was higher (that is, had appreciated) at the end of 1996 than in 1988 or even in 1970, the last full year before the 1971 dollar devaluation and the subsequent floating of the dollar.[3] The appreciation of the dollar exchange rate index observed for the Midwest, however, was not characteristic for all regions of the country. For example, the Far West indexes reflect the relatively greater importance of the Pacific Rim markets, and, consequently, show a weaker region-specific dollar than the Midwest indexes. Far West manufacturing industries experienced a marked dollar depreciation through the mid-1990s.

The measurable economic impact of change in the dollar exchange rate on overall regional economic activity is less clear. Our statistical analysis examines the relationship between regions' output growth (gross regional product—GRP) and the aggregate dollar exchange rates they face. It suggests that while region-specific exchange rates may exhibit different trends for different regions of the country, variation in these region-specific dollar measures may not be an important factor explaining economic activity in manufacturing industries. The ability of these regional indexes to explain change in the gross measures of regional economic activity is weak. On the other hand, these foreign market indicators are significant with regard to explaining change in *total* U.S. growth, although the direction of the impact is apparently through the import sector rather than the export sector. By reducing the dollar cost of imported factors of production, such as raw materials and components, an appreciating dollar may contribute to additional domestic value-added output.

We also examine the relationship between changes in regions' output and their region-specific foreign demand, that is, average economic growth in those markets to which specific regions export goods. The intuition is that the stronger the economic growth in a region's foreign markets, the greater the region's growth in exports to those markets will be and, in turn, the greater the impact on the region's economic growth. Our results suggest that positive growth in a region's foreign markets tends to exert a positive impact on a region's manufacturing activity. However, the statistical significance of the link is weak. Region-specific foreign growth rates vary substantially. The concentration of the Midwest's foreign markets in the Americas results in that region showing a substantially lower rate of foreign income growth than most other U.S. regions. In contrast, the Far West's strong concentration in Pacific Rim markets is reflected in relatively stronger foreign market growth during the 1970–97 period. For the U.S. as a whole, foreign demand is a positive and highly significant contributor to growth.

We include within our statistical analysis a one-period lag measure of U.S. economic activity for each of the regions, which turns in positive and highly significant results. This strongly supports the contention that the U.S. economy is still the primary factor influencing regional economic growth; this is especially true for the Midwest. This result supports recent work on regional input–output analysis.

The international economy and the U.S.

International markets have become increasingly important to the U.S. economy during the past three decades. Since 1960 the constant dollar volume of U.S. goods exports has increased about eightfold. Foreign demand for U.S. goods has also increased relative to the total volume of U.S. goods production. This is reflected in a substantial increase over time in the proportion of domestic goods production entering export markets. In 1960, for example, the real value of U.S. goods shipped to foreign markets accounted for about 8.5 percent of domestic goods output. By 1970, the export share of domestic goods output had increased to about 11 percent and by 1995 it had reached about 24 percent.[4] At the same time that exports were becoming a more important component of the U.S. economy, there was also a redistribution of output and exports among U.S. regions.[5] While the dollar value of Midwest exports of manufactured goods increased substantially during this period, the Midwest's share of U.S. manufactured goods exports actually declined, from over 30 percent in the early 1970s to a little over 20 percent in the early 1990s.

The postwar period also saw a change in the world's industrial and trade regime. Seven rounds of multinational trade negotiations, beginning in the late 1940s with the establishment of the General Agreement on Tariffs and Trade (GATT), contributed to an increase in world trade flows. Foreign countries and industries recovering from the devastation of World War II seized the opportunity created by increasingly open markets. Rebuilt and relatively more efficient manufacturing infrastructure in Europe and Japan increased competitive pressure on the older, less efficient U.S. manufacturing industries.

The early postwar period also saw the U.S. dollar emerge as the exchange rate standard in world trade.

The dollar exchange rate standard, which grew out of the 1944 Bretton Woods Agreement, began to break down in 1971 when stress on the fixed exchange rate regime forced the first of two dollar devaluations. Eventual abandonment of the fixed exchange rates regime came with the adoption of a floating dollar in March 1973. Subsequent depreciation of the dollar during the remainder of the decade helped keep U.S. goods prices competitive in world markets and U.S. exports continued to expand, increasing 214 percent between 1973 and 1980. However, the value of goods imports grew 254 percent over the same period. Thus, even with the dollar's depreciation during the 1970s, foreign competition continued to increase.

During the first half of the 1980s, a period of historically high U.S. interest rates, foreign exchange markets abruptly turned around and the dollar appreciated sharply through February 1985. This in combination with the worldwide recession of the early 1980s contributed to a deterioration in the price competitive position of U.S. goods in world markets (that is, the foreign currency cost of U.S. goods rose due to the exchange rate effect). As a result, the value of U.S. goods exports declined 10 percent between 1981 and 1983 and remained below 1981 levels until 1987. On the other hand, import growth slowed, but increased in value by 55 percent from 1981 to 1987.

The increased intensity of international competition contributed to turning the Midwest, the nation's manufacturing heartland of earlier decades, into the Rust Belt during the late 1970s and the first half of the 1980s. An economic recovery in the Midwest that began during the second half of the 1980s coincided with a realignment and restructuring of manufacturing industries and a resumption in the rapid growth in export markets. This confluence of developments spawned the view, noted earlier, that the resurgence in manufacturing was largely attributable to the sharp depreciation of the dollar during 1985–88 and the more gradual dollar depreciation through the mid-1990s. In addition, however, one can not ignore the positive impact of economic expansion in foreign markets and the emergence of rapidly growing markets in Asia and Latin America.

In short, exchange rate change and expansion in international markets are widely held to have become a more important influence on the U.S. and its regional economies during the past three decades.

Exchange rates and economic growth

We examine two factors that influence U.S. international trade, with reference to U.S. regional economies. How do 1) exchange rate changes and 2) changes in foreign demand influence these regional economies? To answer this question, we construct two measures—a region-specific exchange rate index and a region-specific foreign economic growth index.

Our aim is to identify whether different regions of the U.S. face different exchange rates; whether there are differences across U.S. regions in the average economic growth (foreign demand) they face in their export markets; and whether the region-specific measures of exchange rate change and foreign economic growth contribute to explaining changes in regions' economic activity.

Why a regional exchange rate index?

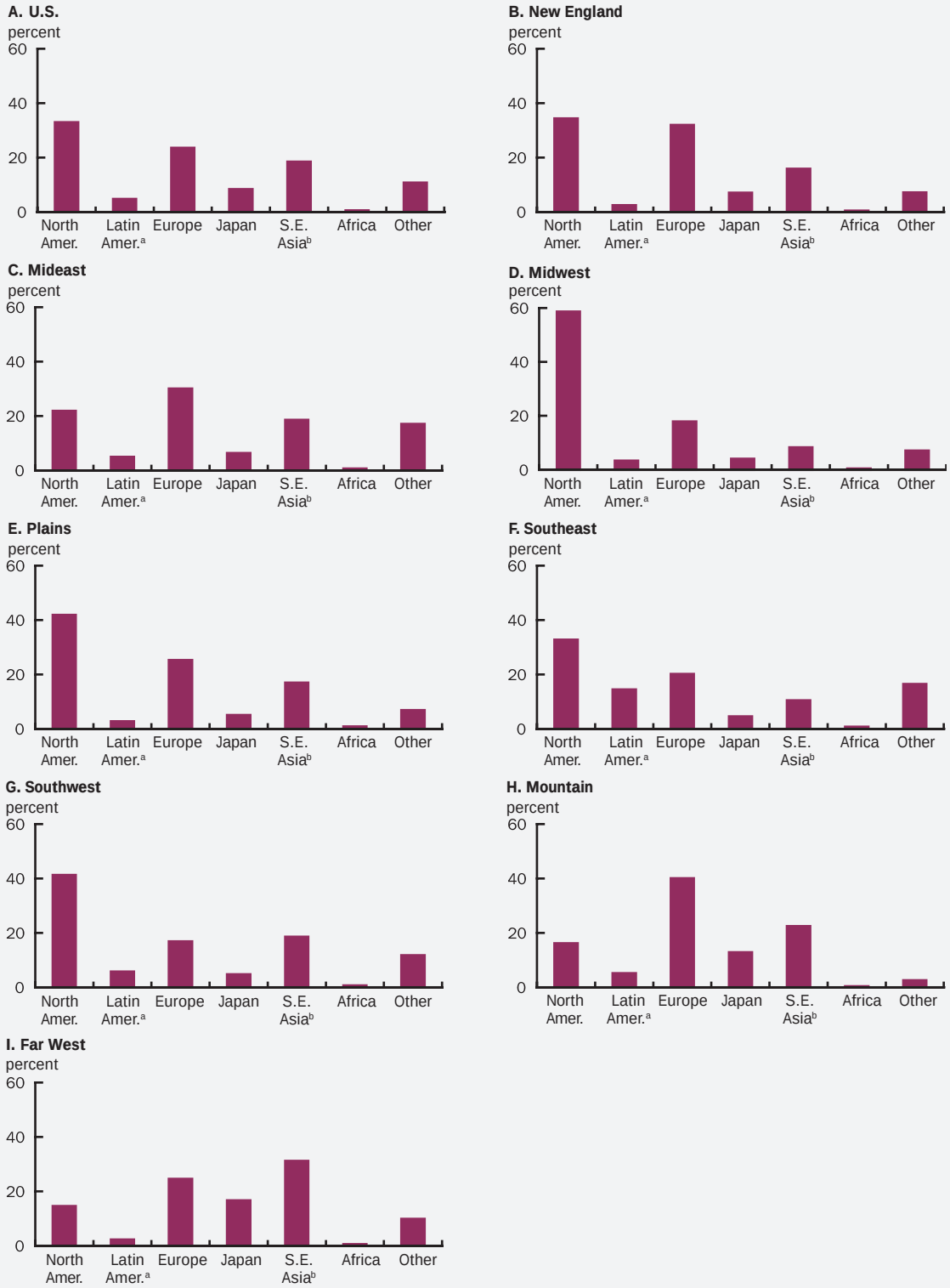
At any time there is only one exchange rate for the U.S. dollar vis-à-vis any other currency. We suggest, however, that different U.S. regions, by virtue of their different industrial makeup and the foreign markets in which their industries are active, face different sets of exchange rates. Thus, a general observation that the dollar is depreciating or appreciating may have different implications from one region to another. We construct a set of aggregate export-weighted dollar exchange rate indexes for selected geographic regions. We identify broad manufacturing industry classifications within each region. We focus on identifying exchange rate variations and the differences in the composition of export markets that influence selected U.S. regions. This is an area of research only beginning to receive attention in the literature; see Clark, Sawyer, and Sprinkle (1997 and 1999),[6] Cronovich and Gazel (1998), and Hervey and Strauss (1996 and 1998).

We can identify potential differences in exchange rates faced by different regions of the country by looking at regional trade patterns. Figure 1 shows manufactured *durable* goods exports to major world markets for the U.S. as a whole and eight regions.[7] For example, the Midwest sends (1993–94 average) nearly 60 percent of its manufactured durable goods exports to markets in which the dollar has been historically strong, that is, other North American markets (46 percent to Canada and nearly 13 percent to Mexico), while only 15 percent of its exports go to European markets and only 4 percent to Japan. On the other hand, durable goods industries in the Far West ship a substantially higher proportion of their exports to markets in which the dollar has depreciated: 17 percent to Japan and 25 percent to Europe.

Clearly, markets in which the dollar has appreciated in recent years (Canada and Mexico) have been more important to durable goods manufacturers in the Midwest than in the U.S. overall. The magnitude and structure of U.S. and Canada/Mexico trade (cross-border trade) is of some concern with regard to

FIGURE 1

Share of durable goods exports by region or country of destination, 1993–94



[a]Excluding Mexico.

[b]Excluding Japan.

Source: Authors' calculations from Massachusetts Institute for Social and Economic Research, 1993 and 1994, *State of exporter location*, series 2, CD-ROM.

the exchange rate and foreign demand growth issues we examine in this article. The degree of integration of these markets, especially in the production processes in the automotive and electronics industries, may substantially reduce the influence of exchange rate change on cross-border trade. Intra-firm trade, while a part of the export–import statistics, may not truly reflect a market exchange. Although there is a large volume of trade, we cannot say how much of it faces an exchange rate transaction (see box 1).

Construction of the regional dollar indexes

We identify nine regions: the U.S. and eight aggregations of states that correspond to the U.S. Department of Commerce, Bureau of Economic Analysis (BEA), geographical breakdown of the United States.[8] Our primary focus is on the BEA's Great Lakes (Midwest) region (Illinois, Indiana, Michigan, Ohio, and Wisconsin). Details of our calculations are in technical appendix 1.

A broad range of regional research examining exchange rates and/or international trade effects has focused on specific state effects, including, for example, Branson and Love (1986), Carlino (1990), Coughlin and Pollard (1998), Hayward and Erickson (1995), and a work by Cronovich and Gazel (1998) that examines the impact of exchange rate and foreign income change on state-defined measures of economic activity, such as employment or exports. We do not report individual state indexes here because of distortions in gross export data that are exaggerated when using state-level data. These distortions arise because the complete manufacture of a product may not take place within one state. More likely, the manufacture of an intermediate component may be carried out in one state, then shipped to another state or several more states for further processing. State export by destination data based on the value added in manufacturing by state are not currently available. Future work building on the regional input–output literature, such as Israilevich, Hewings, Sonis, and Schindler (1997), may provide these data.

We use regional aggregations of states' exports by destination from the U.S. Bureau of the Census, State of export—Location of exporter series.[9] These data are from the shipper's export declaration for the state of location of the exporter, which means that the value of intermediate goods eventually exported may not be attributed to the appropriate state. The aggregation of states into BEA regions should reduce, although it will not fully eliminate, this mismeasurement. The state/region and industry weights in the indexes are based on U.S. exports by country of

BOX 1

Round-trip-trade: Canada and Mexico

Canada is an important market for Midwest manufacturing and, as such, a critical element in the Midwest dollar index. Mexico is similarly important to the Southwest. The unique relationships the U.S. has with Canada and Mexico raise concern about the interpretation of the regional indexes.

In certain industries, there is a high level of integration of production facilities across the borders (in particular, the automotive industry across both borders and the *maquiladoras* industries along the U.S./Mexico border). The question arises whether the effect of a change in the Canadian dollar/U.S. dollar or Mexican peso/U.S. dollar exchange rate is the same for an integrated firm (with cross-border *intra-firm* transactions, or round-trip trade) as for unrelated firms (with cross-border *inter-firm* transactions). Are these transactions booked in U.S. dollars or do exchange rates make a difference?

There appear to be no simple answers to these questions. Conversations with individuals in the auto industry suggest that even for such a cross-border integrated industry, exchange rate change does make a difference, but in the longer-term decisions such as plant investment and location. In that case, the existence of an integrated market across borders might not bias the impact of exchange rate changes on the regional indexes viewed in a *long-term context*. In other integrated industries, transactions are denominated in dollars and the exchange rate translation occurs only if the final product enters a third country foreign market.

For the maquiladoras industries on the Mexico/U.S. border, most cross-border transactions are denominated in U.S. dollars. Thus, change in the peso/dollar exchange rate does not have a direct effect on these transactions. Nonetheless, a peso devaluation, for example, will influence the local value-added portion, that is reduce in terms of dollars (through cheaper labor and components), the dollar value of the transaction if the final product is shipped back (imported) to the U.S. So, even in this case exchange rate change counts to some degree.

destination by industry for 1993 and 1994.[10] The Census location data are adjusted for exports unallocated by state and industry classification and are made available by the Massachusetts Institute for Social and Economic Research (MISER).[11]

To make this project a more manageable size, we grouped the 20 two-digit manufacturing Standard Industrial Classifications (SICs) into three broad classes—total manufactured goods, durable manufactured goods, and nondurable manufactured goods.[12] Our region and industry breakdown results in 27 exchange rate indexes. The full range of regions and industries would have resulted in 180 indexes. However, the size restriction imposes a cost. Further breakdown of the industries might provide more information on the impact of round-trip trade with Canada and Mexico—essentially intra-firm transactions where, at least in the short-term, intermediate goods traverse the border without entering the price/market system.

To provide a known index for comparison at the national level, our regional indexes incorporate the currencies of the same 44 countries as the J. P. Morgan (JPM) real effective exchange rate indexes. These countries account for more than 90 percent of U.S. goods exports.

The use of *export-only* weights is an unusual methodology in the construction of an aggregate exchange rate index. Aggregate exchange rate indexes typically use a weighting mechanism based on bilateral trade weights (as in the JPM noted above), for example, U.S. exports plus imports by country of destination or source, or multilateral trade weights, for example, total world trade (that is, total exports plus total imports) for each country. Due to the lack of the lack of available import data by state, we are constrained to constructing a regional index based on export weights. A multilateral trade weighting scheme (for example, as used in the Federal Reserve Board's nominal trade-weighted index) would be better able to account for the third-country effects of exchange rate changes. However, multilateral weights are not applicable to U.S. regional indexes because the same country weight (that is, its share of world trade) would apply to each region.[13]

The use of export-only weights requires that conclusions be carefully stated. These indexes relate only to an aggregation of exchange rates that exporters face directly. There are two areas of inquiry of interest with respect to exchange rates: 1) the impact of exchange rate change on the regional economy and regional manufacturers through their export markets, and 2) the impact of exchange rate change on the regional economy and manufacturers as influenced by imports. At this stage, we can only address the exporter side.[14]

A final issue of concern in the construction of our regional indexes relates to the 1993–94 period we use for the export and industry weights. It is well established in the literature that there were marked changes in U.S. trade patterns from 1970 through the late 1980s. Hickok and Orr (1989–90), Hervey (1990), and Hickok (1991) document substantial changes in the foreign market shares and industrial composition of U.S. exports during that period. The selection of the fixed period (1993–94) base for trade weights raises a question about the potential bias in the indexes as they move away from the base period. Hervey and Strauss (1987) suggest that export weights that use a moving average (for example, a 12-quarter moving average) to account for change over time in the composition of trade by destination would be a considerable improvement over the fixed-period weights. In addition, Coughlin and Pollard (1998) make a case for the use of chained weights in the construction of aggregate exchange rate indexes to lessen the well-known problems associated with the fixed-period base of the Laspeyres-type index used in most aggregate exchange rate indexes, including the ones in this study. Acknowledging these shortcomings, we are constrained to use fixed-year weights here because of the limited availability of consistent historical state-export data prior to 1993.

An exchange rate is a price of one currency in terms of another. But it is not the only relevant price. Rates of change of within-country prices across countries are also of interest, especially when countries experience marked differences in inflation. A change in the exchange rates tells only half the story. The focus of exchange rate adjustment should be on *real* exchange rates. The preferable *internal* price series for this exercise is one that relates specifically to the goods traded. However, price series with such detail are not available for the spectrum of countries and industry groups included in our regional indexes. We use producer price series provided by J. P. Morgan.[15]

The exchange rate series for countries in the indexes are monthly averages from the International Monetary Fund, *International Financial Statistics* series, except for Taiwan and Hong Kong, which are from the Federal Reserve Board series.

Regional exchange rate indexes

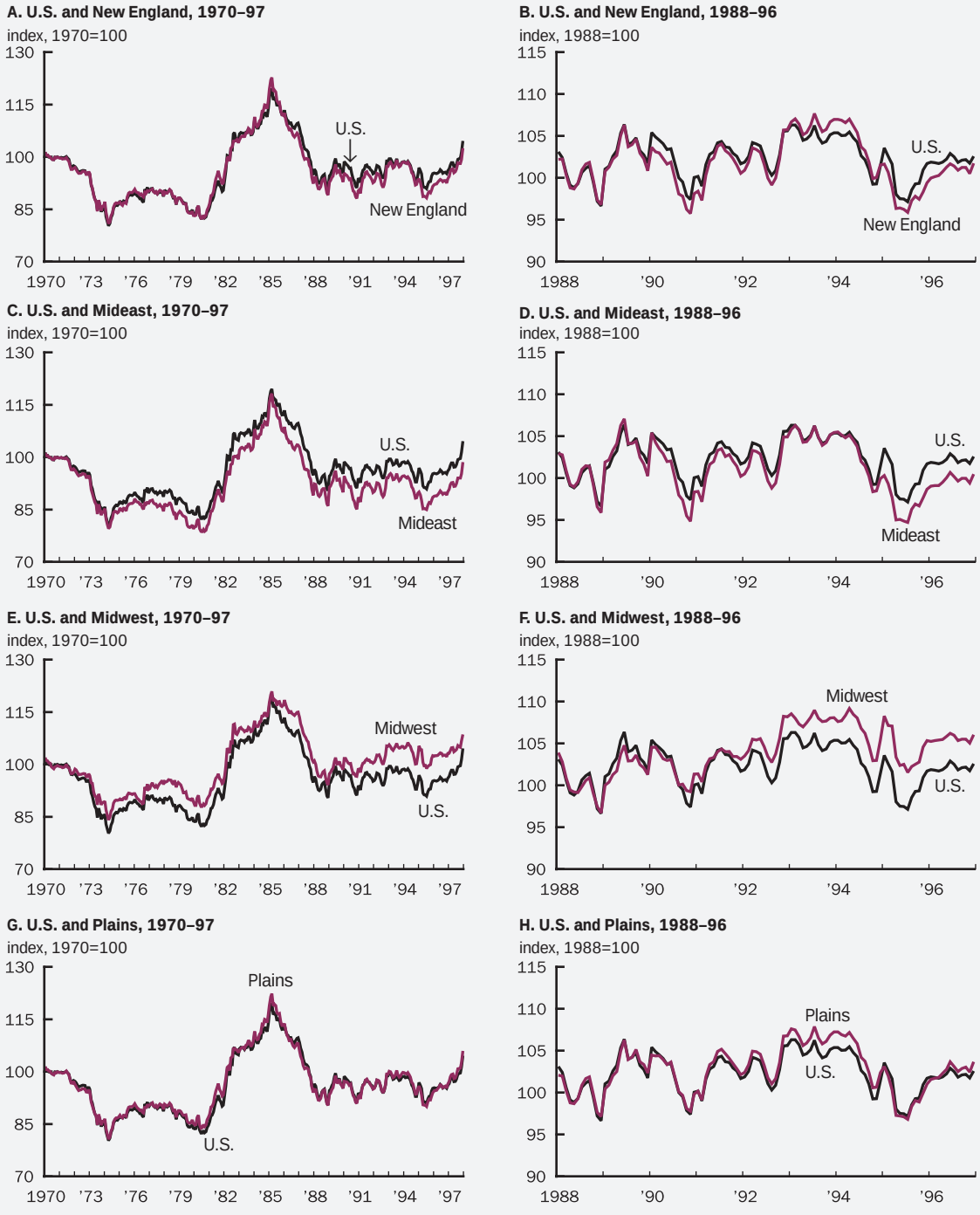
The regional export-weighted dollar indexes in some cases contradict the common perception that the dollar continued to depreciate over much of the period 1970–97, particularly in 1988–96. Figure 2 plots the region-specific dollar and the U.S. dollar for the periods 1970–97 and 1988–96. In the aggregate, the

Midwest index (figure 2, panels E and F) shows an appreciating trend for both periods, particularly for 1974–97.[16]

For 1988–96, divergent trends from that recorded for the U.S. appear primarily in the indexes for the Southwest, the Mountain states, and to some degree the Mideast and Far West. While the differences are not large, the deviations of the regional indexes from the U.S. index are either consistently positive (especially for the Midwest, Southeast, and Southwest) or

FIGURE 2

Regional exchange rate index

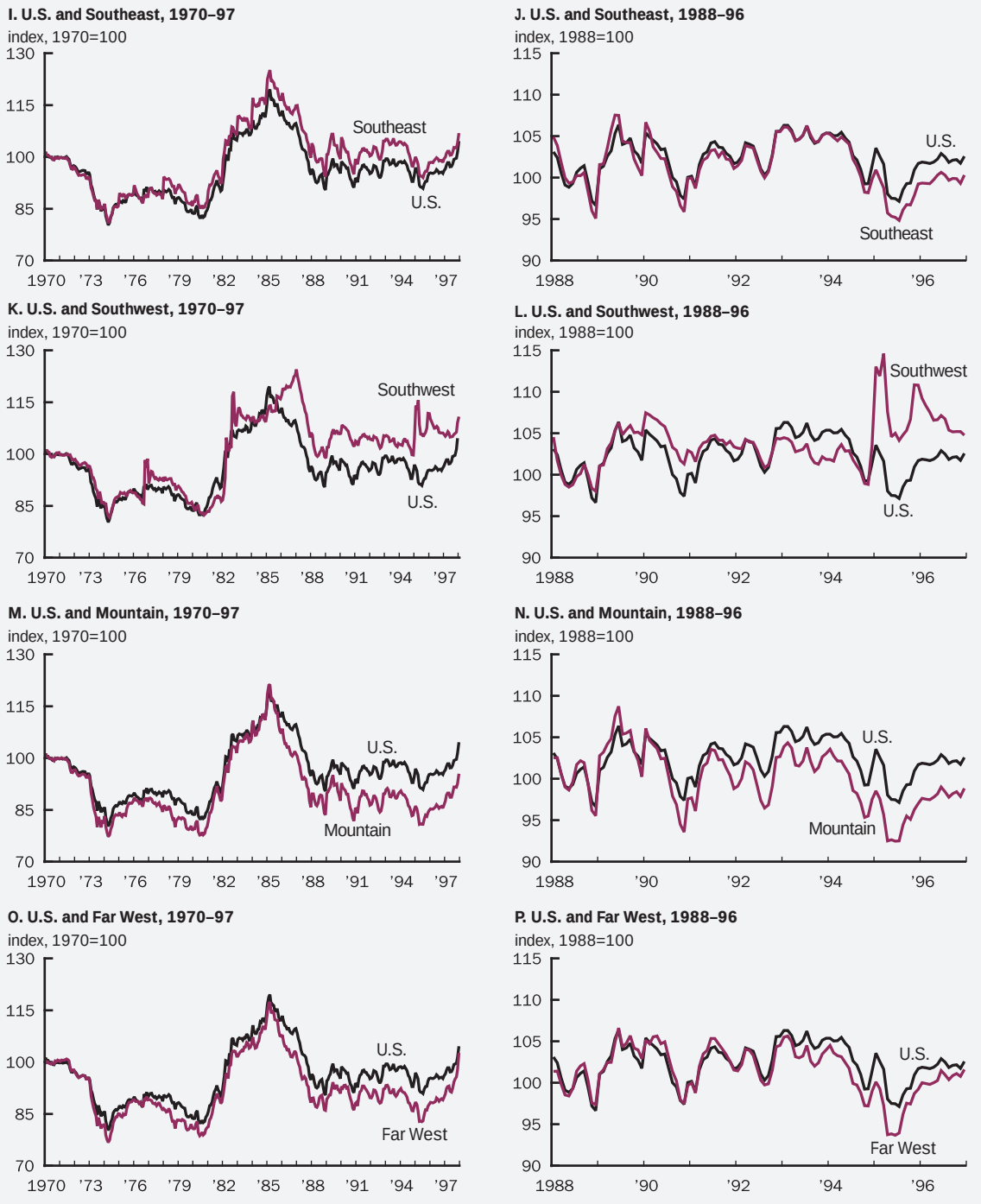


negative (in the case of the Mideast, Far West, and Mountain states) (see figure 3).

Figure 4 provides an interesting perspective on the Midwest's dollar index relative to those of the other regions. In most cases the Midwest dollar index for manufactured goods deviates substantially from the indexes of the other regions and is higher than those of the other region-specific indexes, peaking in 1995 at 20 percent versus the Mountain states, 17 percent versus the Far West, 15 percent versus the

FIGURE 2 (CONT.)

Regional exchange rate index

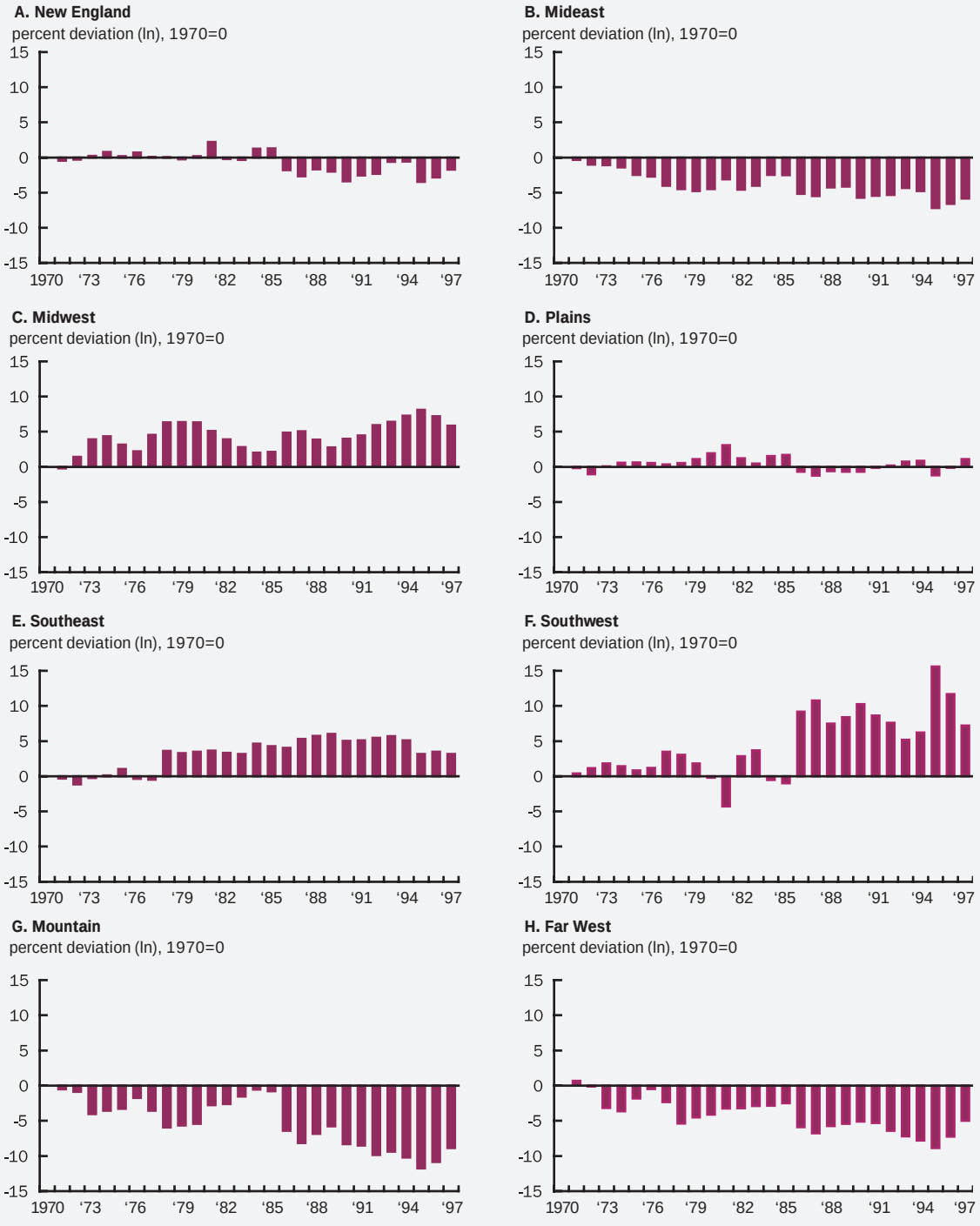


Mideast, and about 12 percent versus New England.[17] On the face of it, this suggests that Midwest exporters of manufactured goods are facing a substantial real exchange rate appreciation (price disadvantage) in their foreign markets, relative to other regions.

The industrial composition of exports also appears to influence the regional exchange rate pattern. The U.S. export-weighted real indexes for durables and nondurables are virtually identical. Figure 5 plots the percentage deviation in the regions' durables and

FIGURE 3

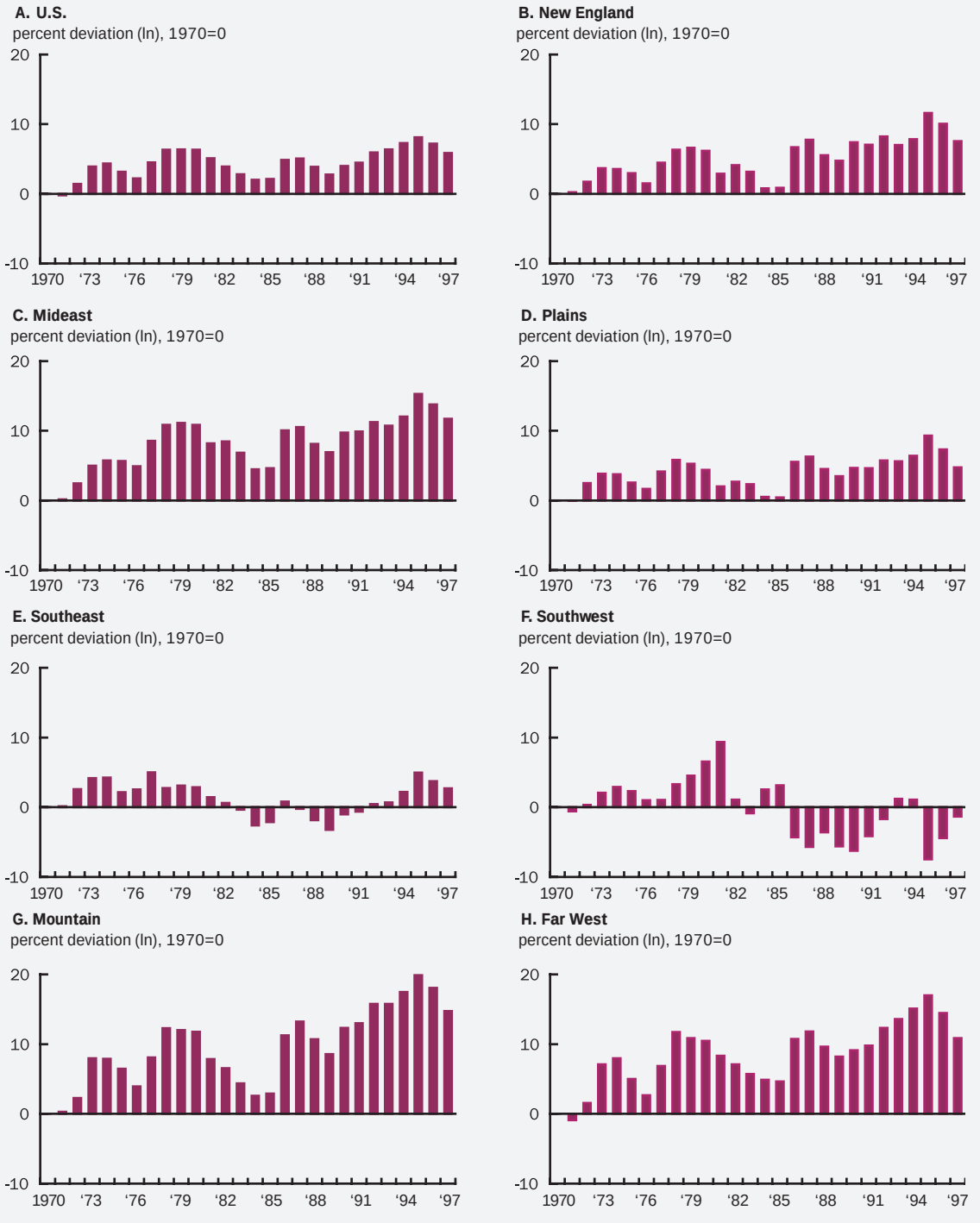
Deviation of regional from U.S. export-weighted exchange rate



nondurables indexes versus the U.S. indexes. For example, in 1995 the Midwest's exchange rate index for durable manufactures was more than 9 percent higher than the comparable U.S. index. However, the Midwest's nondurables index was only 2 percent higher than the comparable U.S. index. Generally, the region-specific nondurables indexes are less volatile and follow the national index more closely than do

FIGURE 4

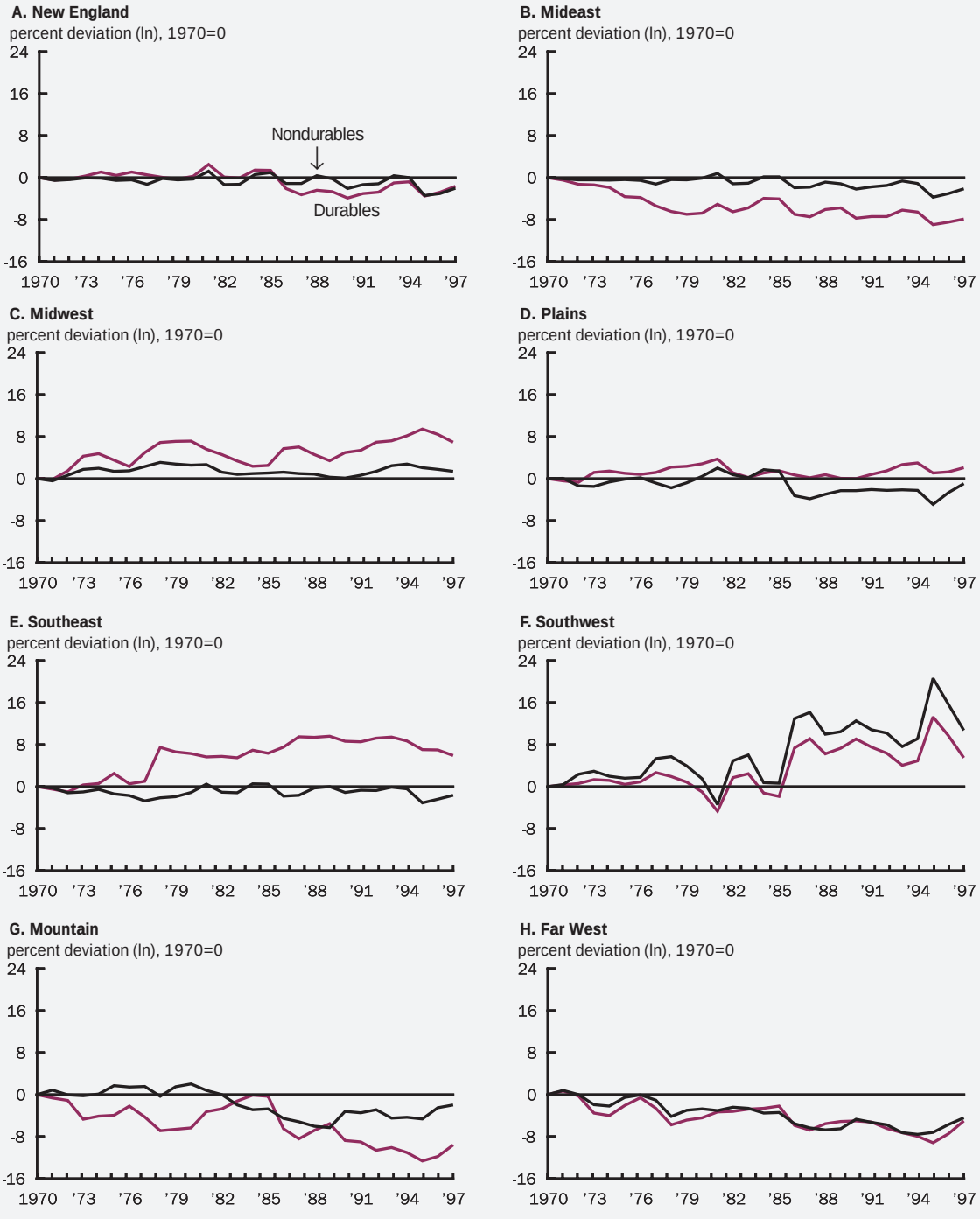
Midwest's deviation from other regions' export-weighted exchange rates



the durable goods indexes. The Southwest is the only region to show a large positive deviation from the U.S. for nondurables (it shows a similar deviation for durables). We suspect that this atypical result for nondurables may be related to the high concentration of *maquiladoras* industries (mostly U.S. industries on the Mexican side of the border that produce for the U.S. market; see box 1) along the U.S./Mexico

FIGURE 5

Deviation of regional industry exchange rate indexes from comparable U.S. indexes



border and the large volume of crossborder trade, especially in the textile and apparel industries.

Foreign demand faced by regional markets

In an open economy, foreign demand contributes to overall demand on the economy's output. We would expect economic expansion or contraction in foreign markets to influence the growth in exports to those markets. Thus, we would expect economic activity in U.S. regions that export to be positively influenced by growth abroad. Furthermore, because economic growth is not uniform across countries and regions do not export uniformly across foreign markets, we would expect economic growth abroad to influence U.S. regional economies differently.

To measure foreign economic growth that is unique to the markets served by individual regions, we use an average foreign gross domestic product (GDP) growth (in real terms) that is exchange rate neutral (measured in terms of an individual country's home currency). Details of our calculations are in technical appendix 2. We construct nine "region-specific" foreign GDP growth rate series—for eight regions and the U.S. Cronovich and Gazel (1998) take a similar approach to measuring export-weighted foreign market growth for individual states.

We weight GDP growth rates for 20 major export markets for each region based on the market share of that region's manufactured goods exports to each country (in 1993–94). Thus, the more important a specific country is for a region's exports, the larger is the weight placed on that country's GDP growth; and the countries included may vary across regions. We use the major markets in the MISER location of exporter series for 1993–94. Individual country GDP growth rates are from the International Monetary Fund, the United Nations, and individual country sources.

Figure 6 presents the region-specific foreign GDP growth rates relative to the U.S.-specific rate. (A positive number indicates that growth in a region's foreign markets is larger than growth in foreign markets for the U.S.) The data suggest that, for the most part, aggregate regional foreign market growth tends to deviate substantially from the U.S. average. Certain regions appear to experience consistently faster or slower growth in their foreign markets than does the U.S. In particular, foreign demand growth in Midwest markets (heavily concentrated in the Americas) was well below the U.S. average throughout the 1970–97 period. On the other hand, the Far West markets, heavily concentrated in the Pacific Rim, recorded consistently higher growth. The Southwest shows a highly variable growth pattern with broad swings in the early and late 1980s and mid-1990s; these are probably largely attributable to the sharp deterioration in economic activity in Latin America and Mexico in the 1980s (credit crisis) and Mexico in the mid-1990s (depreciation of the peso and subsequent austerity measures).

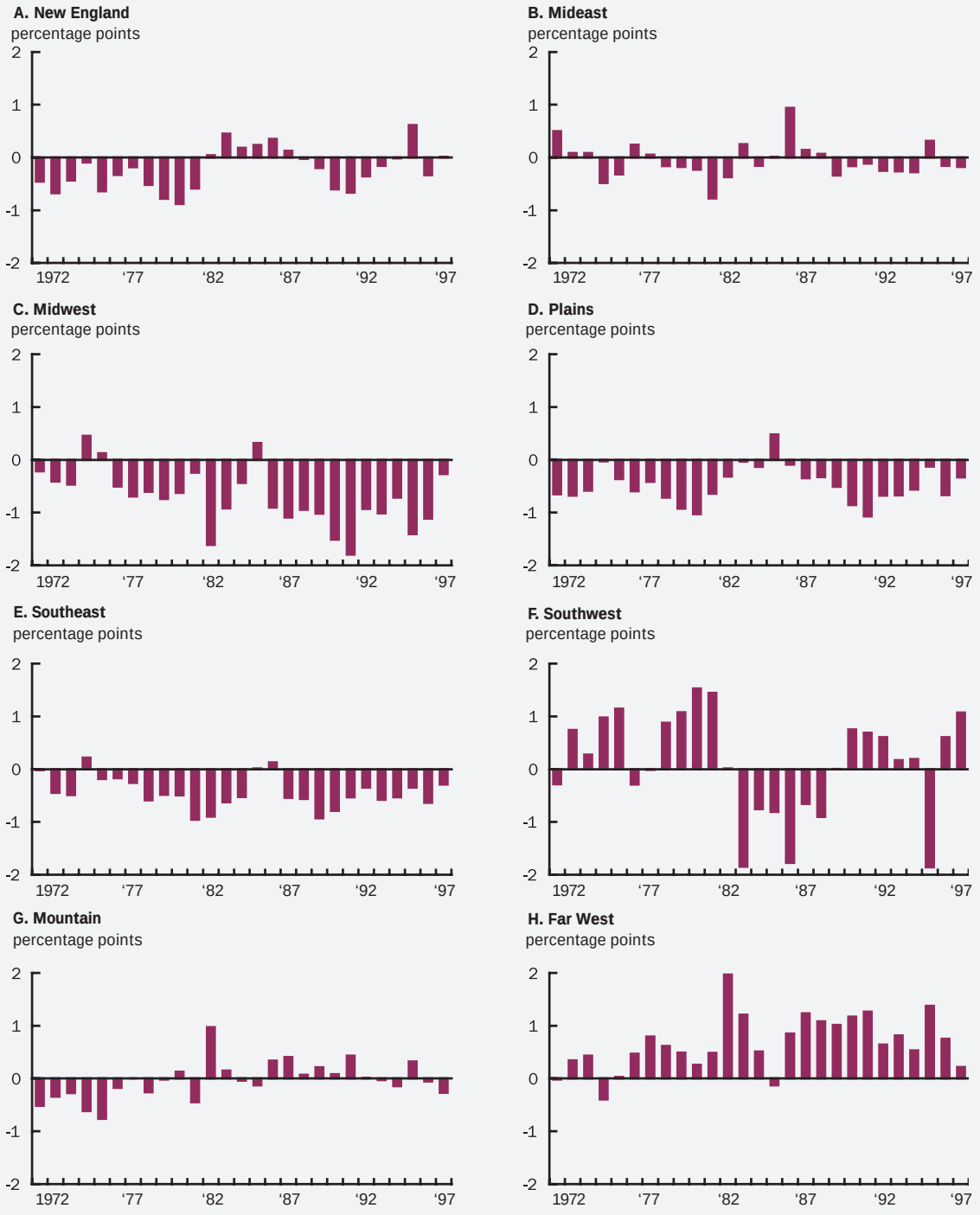
Regional economic activity: Regional exchange rates and foreign economic growth

Our region-specific dollar exchange rates and region-specific foreign economic growth measures suggest that different regions of the country face different mixes of exchange rate and foreign growth change and may be influenced differently by developments in international markets. Do these regional measures of international exposure measurably influence economic growth within these regions? Studies such as Cronovich and Gazel (1998) indicate that region-specific exchange rate and foreign demand growth influence regional export markets. But are the effects large enough to significantly influence overall regional economic growth?

To explore this further, we use four regression models to explain variation in regions' real output or gross regional product (GRP). We use four dependent variables for output—total GRP, GRP attributable to manufacturing industries, GRP attributable to durable manufacturing industries, and GRP attributable to nondurable manufacturing industries (the last three industry designations parallel the definition of the regional exchange rate indexes). The analysis views the two constructed international market variables—region-specific exchange rate indexes and region-specific foreign GDP growth—as externally generated shocks to the regional economies. One may quibble with this assumption, as clearly the relationship between the growth of U.S. and foreign economies is not entirely independent and U.S. foreign exchange rates are not independent of U.S. domestic monetary and economic policy. It is also true that within the U.S., developments in regional growth are not independent of developments in other regions or of the U.S. economy. To isolate these domestic influences on regional growth, we include two measures of recent domestic economic activity—previous period U.S. GDP growth and previous period own-region economic growth. We also include a measure of oil prices as an independent, *external shock* variable. Other researchers, for example, Davis, Loungani, and Mahidhara (1997), have found this to be meaningful in explaining regional economic growth. (One might question the external or supply shock nature of this variable. During the 1970s and early 1980s this nature of oil price determination was reasonably clear, but it has been less clear since them). Technical appendix 3 provides a more detailed discussion of the makeup of the model.

FIGURE 6

Difference in foreign GDP growth (region less U.S.)



What results do we expect from this analysis? We expect the lagged measures of domestic output growth (U.S. and regional) to be positively related to current output growth. We normally expect oil price change to be related negatively to output. If oil prices increase, production that is energy intensive or product that is energy intensive in its use becomes less competitive and output declines, pending a redistribution in resources and output. However, for a region in which energy production is an important

TABLE 1

Regression results for regional output equations

	Total GRP	Manufacturing GRP	Durable GRP	Nondurable GRP
1. United States				
Region-specific foreign GDP	1.3701[c] (0.2318)	2.0616[c] (0.5392)	2.7035[c] (0.7246)	1.2807[b] (0.4734)
Price of crude oil by industry	–0.0271[a] (0.0143)	–0.0668[a] (0.0334)	–0.0610 (0.0453)	–0.0705[b] (0.0283)
Real GDP, U.S. by industry	0.0330 (0.1237)	0.0440 (0.1517)	0.1118 (0.1555)	–0.1926 (0.1658)
Real GRP by industry	NA	NA	NA	NA
Exchange rate index by industry	0.1684[a] (0.0835)	0.2026 (0.1937)	0.2478 (0.2625)	0.1252 (0.1659)
Exchange rate index by industry, one-period lag	0.0838 (0.0771)	0.0461 (0.1855)	–0.0318 (0.2537)	0.1073 (0.1483)
Exchange rate index by industry, two-period lag	0.0859 (0.0768)	0.2316 (0.1813)	0.3796 (0.2421)	0.1321 (0.1541)
Sign / significance of sum of exchange rate variables	+[c]	+[b]	+[b]	+[b]
$\bar{R}^2$	0.69	0.55	0.51	0.49
2. New England				
Region-specific foreign GDP	0.0026 (0.4841)	0.8844 (0.6093)	0.9461 (0.8463)	1.0889[b] (0.4559)
Price of crude oil by industry	–0.3369 (0.2790)	–0.3519 (0.4367)	–0.5662 (0.5155)	–0.2970 (0.5276)
Real GDP, U.S. by industry	0.8534[c] (0.2851)	0.4744[b] (0.1922)	0.4063[a] (0.1984)	0.3549[a] (0.1843)
Real GRP by industry	0.2776[c] (0.1016)	0.2972[b] (0.1152)	0.3769[b] (0.1389)	0.0270 (0.1363)
Exchange rate index by industry	0.0221 (0.0886)	0.1895 (0.1310)	0.1497 (0.1820)	0.2504[b] (0.1191)
Exchange rate index by industry, one-period lag	0.0235 (0.0783)	–0.0255 (0.1198)	–0.0703 (0.1739)	0.1699 (0.1110)
Exchange rate index by industry, two-period lag	0.1083 (0.0784)	0.1655 (0.1342)	0.2199 (0.1920)	0.0982 (0.1220)
Sign / significance of sum of exchange rate variables	+	+[a]	+	+[c]
$\bar{R}^2$	0.82	0.75	0.68	0.69
3. Mideast				
Region-specific foreign GDP	–0.3516 (0.2589)	–0.1828 (0.2899)	–0.4906 (0.4170)	–0.0200 (0.2438)
Price of crude oil by industry	–0.0737 (0.0493)	0.1051 (0.0840)	–0.3048[b] (0.1317)	–0.0410 (0.0728)
Real GDP, U.S. by industry	0.9262[c] (0.1602)	0.9049[c] (0.0972)	1.0667[c] (0.1046)	–0.8095[c] (0.1078)
Real GRP by industry	0.1208 (0.0866)	–0.0267 (0.0691)	–0.0094 (0.0706)	0.0126 (0.0859)
Exchange rate index by industry	–0.0745 (0.0594)	–0.0721 (0.0805)	–0.2360[b] (0.1138)	0.0777 (0.0762)
Exchange rate index by industry, one-period lag	0.0177 (0.0491)	–0.0549 (0.0739)	–0.1842 (0.1095)	0.0905 (0.0653)
Exchange rate index by industry, two-period lag	–0.0012 (0.0491)	0.0810 (0.0759)	0.0764 (0.1093)	0.0517 (0.0734)
Sign / significance of sum of exchange rate variables	–	–	–[b]	+[b]
$\bar{R}^2$	0.87	0.90	0.91	0.89
4. Midwest				
Region-specific foreign GDP	0.1290 (0.3733)	0.1229 (0.4719)	0.2111 (0.5822)	–0.0841 (0.2715)
Price of crude oil by industry	–0.1266 (0.1152)	–0.0130 (0.1205)	–0.0474 (0.1164)	–0.0840 (0.1107)
Real GDP, U.S. by industry	1.1769[c] (0.2583)	1.4066[c] (0.1826)	1.4053[c] (0.1692)	1.0179[c] (0.1412)
Real GRP by industry	0.0460 (0.1073)	0.0003 (0.0829)	–0.0656 (0.0817)	0.0470 (0.0954)
Exchange rate index by industry	0.0134 (0.1164)	0.1411 (0.1649)	0.2538 (0.2110)	0.0330 (0.0959)
Exchange rate index by industry, one-period lag	0.0343 (0.1078)	0.1907 (0.1580)	0.2705 (0.2013)	0.0916 (0.0916)
Exchange rate index by industry, two-period lag	–0.0426 (0.1024)	–0.2000 (0.1589)	–0.3019 (0.2013)	–0.0652 (0.0978)
Sign / significance of sum of exchange rate variables	–	+	+	+
$\bar{R}^2$	0.79	0.87	0.87	0.86
5. Plains states				
Region-specific foreign GDP	0.5244 (0.5027)	0.0779 (0.3307)	–0.0328 (0.6044)	–0.1105 (0.3983)
Price of crude oil by industry	–0.0266 (0.2854)	–0.0803 (0.2368)	0.0743 (0.4214)	–0.1620 (0.3419)
Real GDP, U.S. by industry	0.7803[b] (0.2981)	–0.9214[c] (0.1069)	1.0802[c] (0.1477)	0.8721[c] (0.1811)
Real GRP by industry	–0.0311 (0.1255)	0.0343 (0.0638)	–0.0817 (0.0807)	–0.0305 (0.1437)
Exchange rate index by industry	0.1112 (0.1038)	–0.0276 (0.0795)	–0.1158 (0.1584)	0.0362 (0.1025)
Exchange rate index by industry, one-period lag	–0.0914 (0.0930)	0.0067 (0.0789)	–0.0940 (0.1580)	0.0790 (0.0974)
Exchange rate index by industry, two-period lag	0.0065 (0.0945)	0.0134 (0.0824)	0.1262 (0.1612)	–0.1192 (0.1066)
Sign / significance of sum of exchange rate variables	+	–	–	–
$\bar{R}^2$	0.67	0.92	0.88	0.73

TABLE 1 (CONT.)

Regression results for regional output equations

	Total GRP	Manufacturing GRP	Durable GRP	Nondurable GRP
6. Southeast				
Region-specific foreign GDP	0.3288 (0.2275)	0.4735[b] (0.1853)	0.6775[c] (0.2103)	0.4391 (0.2986)
Price of crude oil by industry	–0.0223 (0.0470)	–0.0839[a] (0.0452)	–0.2474[c] (0.0689)	0.0156 (0.0618)
Real GDP, U.S. by industry	0.7569[c] (0.1349)	0.7792[c] (0.0598)	0.7987[c] (0.0514)	0.8902[c] (0.1217)
Real GRP by industry	0.0253 (0.0720)	–0.1369[c] (0.0433)	–0.1112[c] (0.0364)	–0.0877 (0.0836)
Exchange rate index by industry	–0.0254 (0.0551)	0.0215 (0.0515)	0.1941[c] (0.0571)	–0.1082 (0.0875)
Exchange rate index by industry, one-period lag	0.0052 (0.0454)	0.0578 (0.0463)	0.0336 (0.0497)	0.0643 (0.0854)
Exchange rate index by industry, two-period lag	0.0608 (0.0449)	0.0897[a] (0.0475)	0.2413[c] (0.0523)	0.0046 (0.0845)
Sign / significance of sum of exchange rate variables	+	+[c]	+[c]	–
$\bar{R}^2$	0.90	0.97	0.97	0.88
7. Southwest				
Region-specific foreign GDP	0.1457 (0.3645)	–0.2328 (0.4978)	0.6150 (0.7541)	–1.2066[a] (0.6677)
Price of crude oil by industry	0.5831[c] (0.1953)	0.7880[a] (0.4386)	1.0224 (0.6933)	0.8779 (0.5392)
Real GDP, U.S. by industry	0.7059[c] (0.2299)	1.2613[c] (0.1862)	0.8633[c] (0.2163)	2.0035[c] (0.2900)
Real GRP by industry	0.1856 (0.1681)	–0.0903 (0.1264)	0.0192 (0.1704)	0.0826 (0.1278)
Exchange rate index by industry	–0.0674 (0.1091)	–0.1298 (0.1511)	–0.0999 (0.2479)	–0.3202[a] (0.1847)
Exchange rate index by industry, one-period lag	–0.0696 (0.0778)	–0.3706[b] (0.1368)	–0.5186[b] (0.2365)	–0.1644 (0.1294)
Exchange rate index by industry, two-period lag	0.0458 (0.0810)	–0.0992 (0.1225)	0.1177 (0.2119)	–0.2176 (0.1497)
Sign / significance of sum of exchange rate variables	–	–[b]	–	–[b]
$\bar{R}^2$	0.57	0.77	0.68	0.71
8. Mountain states				
Region-specific foreign GDP	0.2707 (0.5464)	–0.5019 (0.4991)	–1.0768 (0.7794)	0.4088 (0.5240)
Price of crude oil by industry	0.9133 (0.8612)	1.5065 (1.5517)	0.1782 (2.2401)	3.4602[a] (1.8408)
Real GDP, U.S. by industry	0.6981[b] (0.3133)	1.0037[c] (0.1545)	1.0236[c] (0.1855)	0.8708[c] (0.2087)
Real GRP by industry	0.3770[b] (0.1482)	0.0719 (0.1019)	0.0218 (0.1261)	0.0150 (0.1499)
Exchange rate index by industry	0.0634 (0.0973)	–0.0029 (0.1070)	–0.1459 (0.1612)	0.2325 (0.1367)
Exchange rate index by industry, one-period lag	–0.0451 (0.0892)	–0.1803[a] (0.0975)	–0.1398 (0.1536)	–0.2408[a] (0.1175)
Exchange rate index by industry, two-period lag	–0.0205 (0.0937)	0.0431 (0.1049)	–0.0086 (0.1621)	0.1282 (0.1259)
Sign / significance of sum of exchange rate variables	–	–	–	+
$\bar{R}^2$	0.47	0.78	0.71	0.60
9. Far West				
Region-specific foreign GDP	0.0991 (0.3017)	0.6949 (0.5131)	0.6058 (0.6292)	0.2708 (0.4996)
Price of crude oil by industry	–0.0411 (0.0784)	–0.1330 (0.2038)	–0.1037 (0.2124)	0.1416 (0.2751)
Real GDP, U.S. by industry	0.8021[c] (0.1790)	0.6172[c] (0.1636)	0.5373[c] (0.1495)	1.0726[c] (0.2003)
Real GRP by industry	0.3436[c] (0.1117)	0.2524[b] (0.1178)	0.3733[c] (0.1369)	–0.0155 (0.1137)
Exchange rate index by industry	0.0305 (0.0625)	0.2096 (0.1224)	0.1187 (0.1523)	0.2322[a] (0.1304)
Exchange rate index by industry, one-period lag	0.0052 (0.0582)	–0.2211[a] (0.1163)	–0.0823 (0.1540)	–0.4004[c] (0.1124)
Exchange rate index by industry, two-period lag	–0.0965 (0.0632)	0.1091 (0.1267)	0.0543 (0.1632)	0.1728 (0.1182)
Sign / significance of sum of exchange rate variables	–	+	+	+
$\bar{R}^2$	0.77	0.74	0.69	0.76

Notes: Superscript a, b, and c indicate significance at the 10 percent, 5 percent, and 1 percent level, respectively. Numbers in parentheses are standard errors. Price of crude oil is refiner's acquisition price relevant to given industry in given region. Exchange rate indexes are regional export-weighted exchange rate indexes. NA indicates not applicable. GDP is gross domestic product. GRP is gross regional product.

industry, higher energy prices might lead to higher output. In our model, oil prices reflect the importance of a region's GRP (total, manufacturing, durable, and nondurable) relative to the comparable U.S. measure. Thus, the more oil-intensive an industry or region is relative to the U.S., the greater the expected impact of oil prices.

We expect foreign output to relate positively to a U.S. region's output. The greater the importance of manufactured exports to a region's output, the

greater the impact we expect GDP changes in its foreign markets to have on that region.

Regional exchange rate measures in this study are export-weighted. Looking at *export industries only*, we expect exchange rate change to have a negative impact on regional output. That is, an appreciation in the dollar exchange rate increases the foreign currency price of the U.S. region's exports; the higher price to foreign buyers of imports from the U.S. reduces those imports (reduces U.S. exports) and contributes to reduced total purchases of the U.S. region's output. The magnitude of that impact depends upon the elasticity of foreign demand for the goods exported by the region. However, we know that imports also influence domestic output, and they may do so in a positive way. For example, regions/industries that import large quantities of intermediate products will respond positively to an appreciation of the dollar. An appreciating dollar means lower prices to U.S. producers for imported components (the magnitude depending upon the degree of price passthrough). Lower production costs may lead to increased output. Again, the magnitude of this impact depends on price sensitivity at the production and final sales levels. The stronger the import effect, the more likely the exchange rate/output relationship will be positive. Consequently, the sign of the exchange rate variable, as it influences regional output, is ambiguous.

Table 1 (pages 48 and 49) shows the results of our regression analysis. In the U.S. (panel 1), the coefficients for foreign demand are positive as expected and highly significant at standard statistical levels. This provides strong support for the view that economic growth in foreign markets is a positive factor contributing to U.S. economic activity. The relative size of these coefficients by industry also suggests that the U.S. manufacturing sector is more sensitive to changes in foreign demand than is total U.S. GDP. (This is what we would expect given that manufactured goods exports account for a substantially larger share of exports than does manufactured goods output of total GDP.) Within manufacturing, durable goods industries are more sensitive to foreign demand change than nondurable goods industries. The oil price variable is negative, as expected, indicating that an increase in oil prices tends to be a drag on economic activity. The effect is most significant for the nondurable sector, which includes petroleum. The export-weighted exchange rate variable, which enters the regression contemporaneously and with one- and two-period lags, exhibits positive signs in all cases but is significant in only one of the 12 industry/lag relationships. Taken together, however, the exchange rate variables in the four regressions are statistically significant. The positive sign lends some support to the potential positive relationship noted earlier between exchange rates/imports and domestic output.

The results of the regional equations are highly variable. What stands out is the universally positive and significant impact on regional economic activity of the U.S. activity variable (table 1, panels 2 through 9, line 3). This result shows that the national economy is the primary influence on regional economic activity, as pointed out recently in the regional input–output literature (see for example, Hewings, Schindler, and Israilevich, 1998).

At the regional level, the impact of oil prices on output generally shows the expected negative sign. However, the impact of this variable on regional economic activity is only occasionally statistically significant. Manufacturing and durable manufacturing industries in the Southeast (table 1, panel 6) show a significant negative influence of oil price change on output. The two regions that show positive (though generally not statistically significant) oil price/output relationships are, as one might expect, in the energy producing regions—the Southwest (panel 7) and the Mountain states (panel 8).

The variables that we are particularly interested in, that is, region-specific foreign GDP growth and regional export-weighted exchange rates, also give mixed results.

The expected positive sign of region-specific foreign GDP growth on regional economic activity is supported in 21 of the 32 region/industry categories. In most cases, however, even where the expected positive relationship exists, the statistical significance is weak. In the Southeast (panel 6, line 1), the manufacturing and durable classifications record positive and significant relationships. In New England (panel 2, line 1), the foreign demand variable contributes to a positive and statistically significant impact on output in the nondurable manufacturing industry. The magnitude of the coefficients, which may be interpreted as a measure of the sensitivity of the region's economic growth to foreign economic growth (income elasticity) is modest. In the Southeast, for example, a 1 percent increase in foreign GDP growth would have about a 0.7 percent positive impact on GRP.

The regression results reflecting the impact of changes in regional exchange rates on output also show mixed results. Of the 32 region/industry equations (excluding the U.S. equation), half of the sums of the coefficients (table 1, line 8 of each panel) of the exchange rate lag structure (table 1, lines 5, 6, and 7) are negative and half positive. Coefficients on five of

the positive sums (New England, the Mideast, and the Southeast) are significantly different from zero; three of the negative sums (Mideast and Southwest) are significant. As mentioned earlier, a negative impact of an appreciating dollar, for example, indicates that the higher price of a region's exports results in a reduction in foreign purchases (reduced exports from the region), which has a negative impact on the region's output. A positive impact from an appreciating dollar may indicate that the lower dollar cost of a region's imports of production components ultimately leads to an increase in GRP. We suggest that the difference between these two outcomes may be due to variation in the industrial composition across regions, which we are unable to discern with the levels of industry aggregation we use in this study.

As noted at the outset, we are particularly interested in the economic revival of the Midwest during the late 1980s. The importance of international markets and exchange rate change in the post-1985 period have been widely touted as influential in the region's recovery. Our results suggest that the Midwest economy is critically dependent on the U.S. economy (table 1, panel 4, line 3). Indeed, based on the magnitude of the coefficients, the Midwest economy is significantly more sensitive to conditions in the U.S. economy than are the other seven regions. This holds true for manufacturing industries overall and for durable manufacturing. The international sector variables we identify, region-specific foreign economic growth and region-specific exchange rates, do not appear to provide a significant additional explanation for Midwest economic activity, although the signs of the coefficients are plausible.

Conclusion

Although regional economies are part of the U.S. economy, regions differ substantially in their industrial makeup and the extent of their involvement in international markets. While they face a common external border and a common set of national exchange rates, different regions and their industries may face a different set of exchange rates and foreign demand conditions. We have examined these differences through the construction of region-specific exchange rate and foreign GDP growth indexes.

Our export-based exchange rate indexes indicate that Midwest manufactured goods exporters, for example, faced an appreciating dollar from the late 1980s until the mid-1990s related to the composition of their foreign markets and their heavy concentration in durable goods industries. This contradicts the common perception, based on exchange rate trends for major currencies, that the dollar was depreciating during that period.

Our foreign GDP growth indexes also suggest some variation in the rate of foreign economic growth/demand faced by various U.S. regions. Because the Midwest's primary foreign markets are at the low end of the growth spectrum, its region-specific foreign growth has been the lowest of the eight BEA economic regions since 1980. With exports going mainly to high-growth Asian economies during the 1970s to mid-1990s, the Far West is at the high end of the spectrum.

These region-specific measures of foreign market influence do not appear to *consistently* contribute to a statistically significant, measurable impact on total regional economic activity. For the U.S., foreign GDP growth does show a strong positive and significant impact on economic activity. However, in only one region, the Southeast, is the impact of foreign demand growth strong enough to impose a positive and significant impact on GDP growth in manufacturing and durable manufacturing. The exchange rate measures show a significant impact on U.S. GDP, but this is apparently through the terms of trade effect on imports, which promotes domestic output through the lower relative cost of component imports. This pattern holds for several of the regions (New England, the Mideast, and the Southeast) for selected manufacturing classifications. In only one region, the Southwest, does the exchange rate variable appear to negatively and significantly influence the region's overall economic activity.

The Midwest economy does not respond significantly to the foreign GDP or exchange rate variables, given the statistical formulation we use here. However, our results indicate that the impact of the domestic economy variable (the home market) is significantly more important for the Midwest on an industry by industry basis than for the other regions (though the variable is significant for all regions). The only region/industry equations with larger sensitivity measures on an industry by industry basis are nondurables, most likely petroleum-related, in the Southwest and Far West.

Finally, the main implication of this study reinforces recent work in regional input–output research. While international markets are certainly important to the U.S. economy, from a regional perspective the U.S. economy is still the primary factor influencing economic growth. A healthy U.S. economy is first and foremost in its influence on regional output; our results indicate that this is especially true for the Midwest.

TECHNICAL APPENDIX 1

Regional export-weighted dollar

Calculation of the regional export-weighted dollar takes the following form:

$$RGTWD_{k,i,t} = 100\left[\prod_{j=1}^{44}\left[\frac{XR_{j,t}}{XR_{j,0}} \div \frac{PPI_{j,t}}{PPI_{US,t}}\right]^{Wgt_{k,i,j}}\right],$$

where

RGTWD = regional export-weighted dollar,

k = U.S. region with *n* states,

j = country (1 to 44),

i = U.S. manufacturing industry category (SIC 20–39),

t = time period; observations are monthly January 1970 through December 1997. (The indexes are available through July 1998, reflecting the widespread appreciation of the U.S. dollar that began in 1996; however, the focus of this article ends with 1997.),

XR = exchange rate of country *j* with respect to the U.S. dollar (foreign currency/U.S. dollar),

PPI = Producer (wholesale) Price Index for country *j* or the U.S., 1990 = 100, and

Wgt = share of U.S. exports of industry *i*, from region *k*, to country *j*. (Weights are an average of 1993 and 1994 U.S. good exports.)

Note: The indexes are constructed with the base year 1990 = 100. For expository purposes the indexes are rescaled to 1970 = 100.

TECHNICAL APPENDIX 2

Region-specific foreign GDP growth

Calculation of the region-specific foreign real GDP growth rates takes the following form:

$$GDPfrs_{k,t} = \sum_{j=1}^{20}(X_{k,j} / X_{T20,k}) \times (GDPf_{j,t}),$$

where

GDPfrs = export-weighted average of annual GDP growth rate (ln) of region *k*'s 20 major foreign export markets for time *t* (region-specific GDP),

GDPf = annual real GDP growth rates (ln) for country *j* for time *t*,

$X_{T20,k}$ = sum value of exports of manufactured goods (annual) from region *k* to country *j;* 20 major foreign markets (average for 1993–94),

X = value of region *k*'s manufacturing goods exports (annual) to country *j* (average for 1993–94),

k = U.S. regions one to eight, plus U.S. total, and

j = country one to 20 major export markets for region *k*.

Note: Period covered is 1970 through 1997. China is not included in the 20 major foreign markets (GDP growth rates are not available prior to 1978).

TECHNICAL APPENDIX 3

Impact of exchange rates and foreign demand growth, OLS model

The central question of this study is whether the interaction between U.S. regional economies and their respective international markets shows differences across regions with regard to the exchange rates they face and economic growth in their foreign markets. There appear to be differences across regions in both the exchange rate aggregates and the foreign market growth aggregates.

Do these region-specific measures of exchange rates and foreign economic growth have a measurable impact on the regions' economic activity? We address this question using an ordinary least squares model that identifies three "shock" variables' (region-specific foreign GDP, region-specific exchange rates, and oil prices) impact on the gross regional product (GRP) of the eight U.S. Bureau of Economic Analysis (BEA) regions, plus the U.S.

We base GRP for a region on data from the BEA "Gross state product by industry" series for 1977–96. These data are available in nominal and real values for total, all manufacturing industries, durable manufacturing industries, and nondurable manufacturing industries. We extended the nominal GRP series to 1970–76 and 1997 using BEA earnings data in the appropriate industry class. We then deflated the estimated nominal GRPs using one of several standard price indexes, based on the strength of the correlation between the standard indexes and the implicit deflator between nominal and real GRP by region and industry for 1977–96.

Oil price (*OIL*) is defined as average refiners' acquisition cost (domestic and foreign sources). Nominal prices are deflated using CPI less energy. Real oil prices enter the region and industry equations in the following form: Where total *GRP* for the region is the dependent variable, *OIL* enters the equation as the year-to-year percent change (ln) in its full price adjusted value. Where *GRP* for a region is defined by an industry category, for example, durable manufacturing, *OIL* enters the equation as the year-to-year percent change in the full price adjusted value multiplied by the region's GRP in durable manufacturing share of U.S. durable manufacturing GRP. In this form, the more important a region's durable manufacturing is in U.S. durable output, for example, the heavier the oil price weight will be.

The regional export-weighted exchange rate is defined in technical appendix 1. Region-specific foreign GDP growth is defined in technical appendix 2. In addition, to account for the influence of the domestic economy, we include one-period lags of U.S. GDP and the GRP of the region in question.

The regression equation takes the following form (all observations are annual)

$$\begin{aligned} GRP_{k,i} = {} & a + b_1(GRP_{k=US_{t-1},i_{t-1}}) + b_2(GRP_{k_{t-1},i_{t-1}}) \\ & + b_3(GDPfrs_k) + b_4(OIL_{k_{t-1},i_{t-1}}) \\ & + b_5(RGTWD_{k_{t-1},i_{t=0}}) + b_6(RGTWD_{k_{t-1},i_{t-1}}) \\ & + b_7(RGTWD_{k_{t-1},i_{t-2}}), \end{aligned}$$

where

GRP = gross regional product (real) as defined above, percent change (ln),
GDPfrs = region-specific foreign GDP (real) as defined in technical appendix 2—enters equation in the contemporaneous period, percent change (ln),
RGTWD = region-specific export-weighted dollar (real) as defined in technical appendix 1—enters equation contemporaneously and with one-period and two-period lags, percent change (ln),
OIL = refiners' acquisition price for oil (real) defined above—enters equation with a one-period lag,
k = regions one through nine (U.S. total and eight BEA regions), and
i = industry classification (all SICs, aggregated all manufacturing SICs, aggregated durable manufacturing SICs, and aggregated nondurable manufacturing SICs).

Variables are in log changes, except as defined above for oil.

NOTES

[1]This article grew out a research project conducted as part of the Federal Reserve Bank of Chicago's year-long study of the Midwest economy. Summaries of the six Midwest Assessment conferences and a project report are available on the Internet at www.frbchi.org. Research papers are also available from the Bank's Public Information Department on request.

[2]Some would question the assertion that exchange rates and foreign economic growth are externally determined variables relative to the U.S. economy, given the interdependence of the world's economies. Certainly international interdependence has increased during the past 20 to 30 years. However, we would argue that the advent of floating exchange rates in the early 1970s unlinked many foreign economies from the U.S. economy and the dollar, in the sense that U.S. monetary policy no longer determined world monetary policy.

[3]The broad-based appreciation of the U.S. dollar relative to nearly all other currencies in 1997 through mid-1998 further accentuates the apparent strength of the Midwest dollar, relative to the earlier periods. It also dramatically affects the exchange rates of those regions heavily influenced by the Asian markets.

[4]These figures are based on U.S.D.C. National Income and Product Account data, *Survey of Current Business,* tables 1.4 and 4.1 (selected issues). A more complete discussion of export shares of output is in Hervey (1995).

[5]Estimated from data in U.S. Department of Commerce, Bureau of the Census, "Exports from manufacturing establishments," Analytical Report Series, *Annual Survey of Manufactures*, selected issues 1983–91, and *Origin of Exports from Manufacturing Establishments*, selected issues 1969–81.

[6]Clark, Sawyer, and Sprinkle (1997 and 1999) have found "nontrivial differences" between a "Southern" export-weighted dollar index and an index constructed for the rest of the U.S. They have also found differences in similarly constructed indexes of U.S. census regions versus a total U.S. index.

[7]The seven foreign markets defined in figure 1 account for 100 percent of U.S. goods exports during 1993 and 1994. They include the 44 countries used in this study, which accounted for 91.5 percent of U.S.goods exports and "all other" markets. The groups are defined as: North America—Canada and Mexico; Latin America—Argentina, Brazil, Chile, Colombia, Ecuador, Peru, and Venezuela; Europe—Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom; Japan; Southeast Asia—Australia, Hong Kong, India, Indonesia, the Republic of Korea, Malaysia, New Zealand, Pakistan, Philippines, Singapore, Taiwan, and Thailand; Africa—Morocco, Nigeria, and South Africa; Other—Kuwait, Turkey, Saudi Arabia, and all other.

[8]New England—Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont; Mideast—Delaware, District of Columbia, Maryland, New Jersey, New York, and Pennsylvania; Great Lakes—Illinois, Indiana, Michigan, Ohio, and Wisconsin; Plains—Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota; Southeast—Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia; Southwest—Arizona, New Mexico, Oklahoma, and Texas; Mountain—Colorado, Idaho, Montana, Utah, and Wyoming; Far West—Alaska, California, Hawaii, Nevada, Oregon, and Washington.

[9]U.S. Department of Commerce, Bureau of the Census, *FT-900 Supplement*, "Location of exporter" series.

[10]The "Location of exporter" series was first made available (on a continuous basis) by the U.S. Department of Commerce for 1993. We consider this data series to be superior to the Department's "Origin of exporter" series, available from 1987, which biases the valuation of exports by individual states toward those states where the port of export is situated.

[11]The state export data as reported by the Bureau of the Census contain a substantial category of "unallocated" exports. The Massachusetts Institute for Social and Economic Research, "MISER state of exporter location data (series II)," adjusts these data to account for the unallocated portion. The adjusted data series are made available on a by-state-by-country of destination at the two-digit SIC classification. In 1994, these adjustments accounted for nearly 7 percent of total manufactured exports.

[12]Durable goods: SIC-24, lumber and wood products; 25, furniture and fixtures; 32, stone, clay, and glass products; 33, primary metal industries; 34, fabricated metal industries; 35, industrial machinery and equipment; 36, electronic and other electric equipment; 37, transportation equipment; 38, instruments and related products; and 39, miscellaneous manufacturing industries. Nondurable goods: SIC-20, food and kindred products; 21, tobacco manufactures; 22, textile mill products; 23, apparel and other textile products; 26, paper and allied products; 27, printing and publishing; 28, chemicals and allied products; 29, petroleum and coal; 30, rubber and miscellaneous plastics; and 31, leather and leather products.

[13]In sum, the third-country issue boils down to this: The dollar may experience a real depreciation or appreciation relative to a bilateral trading partner. That exchange rate change affects the relative competitiveness not only of U.S. goods versus the bilateral partner, but also of U.S. goods versus third-country trading partners. The aggregate exchange rate construction we use here does not allow us to address this issue.

[14]A scheme utilized by Hayward and Erickson (1995), who in a somewhat different context sought to measure the size of import competing industries by state by SIC, appears potentially useful in getting to the import competitiveness issue. This work is being extended to include an aggregate bilateral index that uses a modification of the Hayward–Erickson measure for imports by region.

[15]These price indexes were provided by the Economic Research Group of J. P. Morgan through December 1997. Based on availability of data, some countries' price indexes are versions of their consumer price index.

[16]The monthly regional index series for the three industry categories for each of the regions (currently January 1970 through July 1998) are available from the authors on request.

[17]Percentage changes in the indexes are reported on a logarithmic basis.

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