The Role of Merchandise Exports To Mexico in the Pattern of Texas Employment

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Texas has been a major beneficiary of Mexico's trade liberalization. Adjusted for inflation, Texas' merchandise exports to Mexico have nearly tripled since the first quarter of 1987. While Mexico's liberalization only partially explains the boom in merchandise exports, it clearly has made Texas products more competitive in Mexico than they would otherwise have been, thereby fueling the expansion.

Under the North American Free Trade Agreement (NAFTA), Mexico has reduced its average tariff on U.S. goods to approximately 11 percent and will reduce it to nothing by 2010.[1] However, these cuts represent only the latest in a series of tariff reductions by the Mexican government. In the latter half of the 1980s, the Mexican government instituted four major tariff reforms that produced two major reductions in tariff rates (Lustig 1992).

Texas has been a major beneficiary of Mexico's trade liberalization. Adjusted for inflation, Texas' merchandise exports to Mexico have nearly tripled since the first quarter of 1987.[2] While Mexico's liberalization only partially explains the boom in merchandise exports, it clearly has made Texas products more competitive in Mexico than they would otherwise have been, thereby fueling the expansion.

In this article, we use an input–output model of the Texas economy to evaluate the employment consequences of the recent expansion in Texas' merchandise exports to Mexico. Because the input–output model describes the interrelationships among industries, it allows us to identify not only the employment gains by industries that export directly but also the employment gains by industries, like transportation services, that interact with the direct exporters. We find that merchandise export growth can explain only a small fraction of Texas' overall employment growth since 1987 but can explain much of the employment growth in specific industries. In particular, we find that all of the recent growth in high-technology manufacturing may be explained by increasing merchandise exports to Mexico.

The link between trade and employment

Nationally, import and export changes have few lasting effects on the level of employment. Over time, workers displaced by increased import competition find jobs in other industries. Similarly, workers hired by growing export firms generally surrender existing jobs. While the composition of employment can change dramatically, the level remains essentially unchanged.[3]

Regionally, however, the situation is very different. As employment patterns shift in response to trade, workers can move geographically, as well as occupationally. After all, the cultural and legal barriers that make it difficult to move across national borders in response to labor market conditions seldom inhibit movement across state lines. Thus, when an increase in exports attracts workers to the petrochemi-

cal industry, it also attracts them to states like Texas that are home to petrochemical firms. Furthermore, because proximity to Mexico can reduce transportation costs, increases in exports to Mexico also encourage firms in those export-oriented industries to locate in Texas rather than in other states.

Measuring the total influence on Texas employment of the state's increasing trade with Mexico requires information on the full range of trade between the two jurisdictions. Thus, we would need data not only on Texas merchandise exports and imports but also on imports and exports of services like tourism and health care. After all, Texas imports services from Mexico whenever Texans vacation in Cancun and exports services to Mexico whenever Mexicans vacation in San Antonio.

Unfortunately, data on Texas' trade in services and merchandise imports from Mexico are not available.[4] Therefore, we focus our analysis on the role that Texas' merchandise exports to Mexico play in the state's economy.[5] Given this narrow focus, our analysis reveals only part of the influence that increasing trade with Mexico has had on the Texas economy. However, because merchandise exports to Mexico represent nearly 5 percent of Texas gross state product (GSP), our analysis describes an important part of the total trade picture.[6]

Input–output analysis

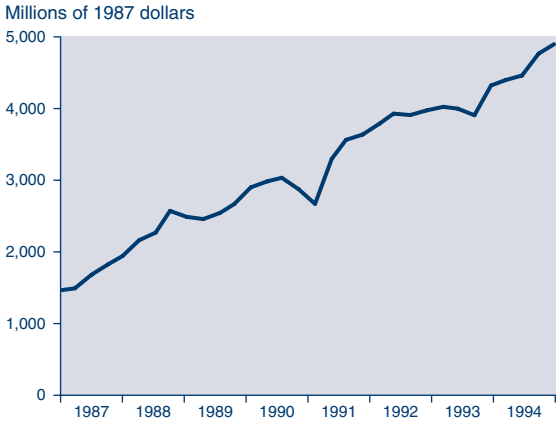
We use an input–output model of the Texas economy to trace the changes in the composition and level of employment that can be attributed to the actual, quarterly changes in merchandise exports since first-quarter 1987. Input–output analysis is an analytic framework that describes the interrelationships between industries and households as a system of simultaneous equations.[7] Each equation represents a sector of the economy. The sectors generally correspond with industries, but some models also include the household sector to reflect the influences that employment changes can have on household demand. Our model of the Texas economy, which we obtained from the Economic Analysis Center of the Texas Comptroller of Public Accounts, incorporates a household sector.

The equation for any given industry describes the total value of that industry's output as the sum of the value of that industry's output that is sold to consumers, the value of that industry's output that is used in the industry's own production process, and the value of that industry's output that is sold as an input to other Texas industries. For example, the 1986 input–output table of the Texas economy indicates that 97 percent of the output of the Texas aircraft industry was consumed locally or exported, 2 percent was used in the production of other aircraft or space vehicles in Texas, and 1 percent was used as an input by firms providing transportation services in Texas. Firms in other states and other countries are consumers from Texas' perspective, so their purchases are included as part of consumption.

Because the inputs of one industry come from the outputs of another, input–output tables also enable users to trace the ways in which each industry uses the products of every other industry. For example, the input–output table described above indicates that to produce $1,000 worth of output, the Texas aircraft and parts industry uses $13 worth of Texas electronics, $4 worth of metals fabricated in Texas, and $36 worth of business services provided by Texas firms.

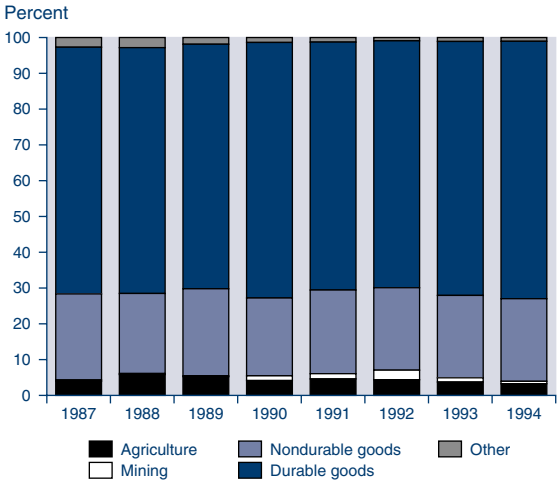
Simultaneously solving the system of 158 equations (representing 157 industries and the household sector) yields the amount of output from each industry that is needed to satisfy consumers' final demands and Texas industry's intermediate-goods demand. By changing final demand, solving the system of equations again, and comparing the industry output across the two cases, one finds the change in each industry's output that would be necessary to satisfy the observed quarterly change in export demand. This change in output reflects not only direct changes in demand but also changes in demand for intermediate goods and changes in household demand induced by changes in worker income.

Figure 1
Texas Exports to Mexico, 1987:1–94:4



SOURCE: Massachusetts Institute for Social and Economic Research.

Figure 2
Average Share of Texas Exports To Mexico by Sector, 1987–94



SOURCE: Massachusetts Institute for Social and Economic Research.

In this modeling framework, industry employment should change at the same rate as industry output. Input–output analysis assumes constant returns to scale and a fixed relationship between factor inputs. For example, if manufacturing $1 worth of apparel requires 50 cents worth of textiles, then manufacturing $2 worth of apparel would require $1 worth of textiles. It also implicitly assumes that labor and capital supplies are perfectly elastic, so that all industries could increase output without changing relative prices for goods or factors. Thus, if the model predicts that a given change in final demand would increase output in the electronics industry by 10 percent, then employment in the electronics industry should also increase by 10 percent.

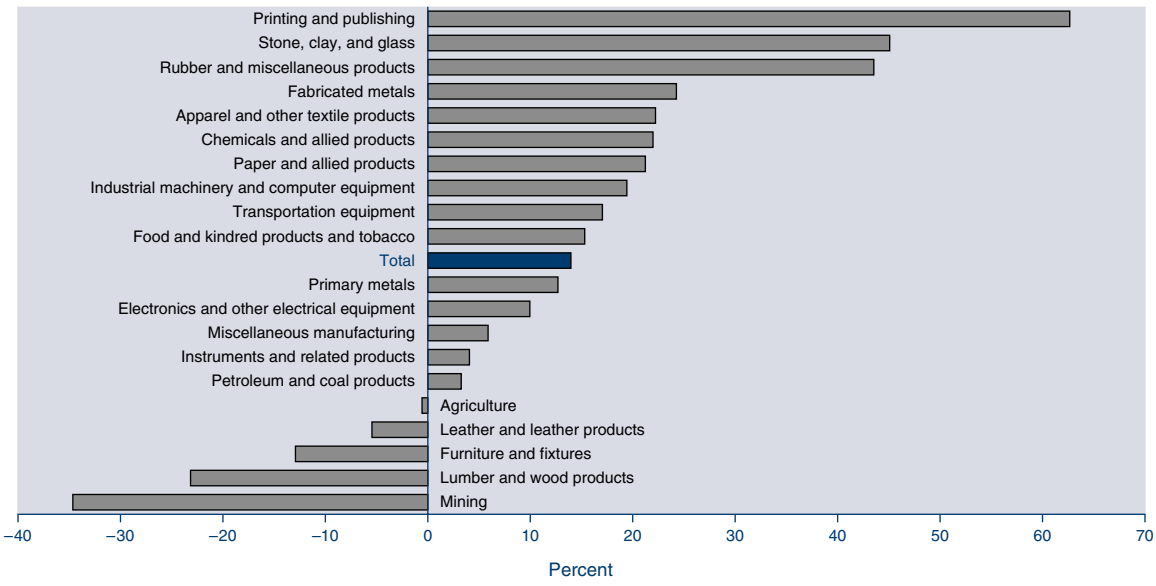
We use data on average industry employment in the model's year (1986) to predict the changes in industry employment attributable to the quarterly changes in merchandise exports.[8] For each industry, the sum of the quarterly changes in employment indicates the total change in employment between first-quarter 1987 and fourth-quarter 1994.

Changes in Texas' merchandise export trade with Mexico

In 1987, Texas exported $25 billion worth of merchandise to foreign countries.[9] Twenty-six percent, or $6.5 billion, of Texas merchandise exports went south to Mexico. By 1994, Texas merchandise exports to Mexico had grown to more than $18.5 billion per year (in 1987 constant dollars). Real Texas merchandise exports to Mexico have grown more than 10 percent a year for six of the past seven years (*Figure 1*).

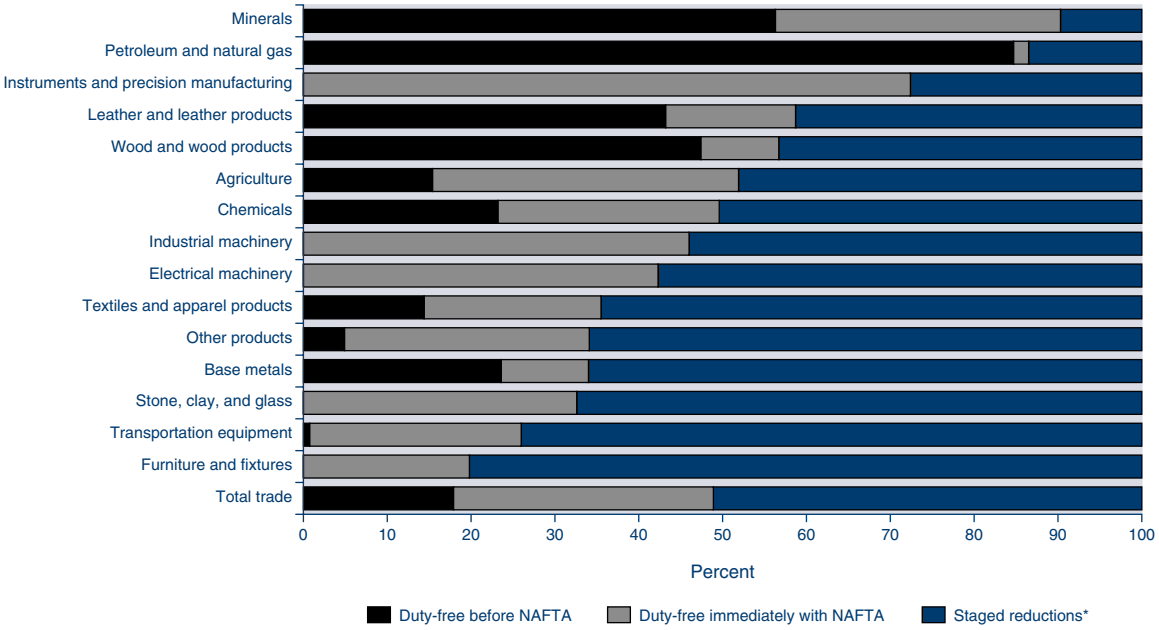
Despite such rapid growth, the general mix of the goods exported to Mexico from Texas has not changed dramatically since 1987 (*Figure 2*). Durable goods consistently account for approximately 70 percent of Texas' merchandise exports.[10] Nondurable goods account for more than

Figure 3
Percentage Change in Real Texas Merchandise Exports to Mexico after NAFTA



SOURCE: Massachusetts Institute for Social and Economic Research.

Figure 4
Percentage of Industry Trade and the Timing of Zero Tariffs



* Includes tariffs that will be reduced in equal annual increments over five to fifteen years. Some staged reductions began January 1, 1994, while others will not be implemented until future years.

SOURCE: United States International Trade Commission (1993).

20 percent of total merchandise exports. Agricultural goods, mining, and other exports (scrap and waste, secondhand merchandise, and special classification goods[11]) make up the remaining 10 percent of merchandise exports.

At a less aggregate level, however, the pattern of merchandise exports shows more variation. The electronics and other electrical equipment category remains Texas' primary merchandise export to Mexico, but the industry's share of total Texas merchandise exports declined from almost one-third in 1987 to almost one-quarter of merchandise exports in 1994. Merchandise export shares have also declined substantially for petroleum and coal products, paper and allied products, chemicals and allied products, and industrial machinery and computer equipment. On the other hand, export shares have more than doubled since 1987 for printing and publishing, transportation equipment, and instruments and related products.

The pattern of exports after NAFTA

Figure 3 details the changes in Texas' merchandise exports since the implementation of NAFTA. Real merchandise exports to Mexico from Texas increased 14 percent between 1993 and 1994. Printing and publishing exports grew 63 percent during that period. Other industries that experienced dramatic growth in exports produce stone, clay, and glass, and rubber and miscellaneous products.

Solid growth in merchandise exports to Mexico following the implementation of NAFTA is particularly striking when one considers the other factors acting to suppress demand. The peso was weaker in 1994 than it had been in 1993, making Texas exports more expensive. Mexico's gross domestic product growth rate was barely positive in 1993 and early 1994 and much weaker than in 1991 and 1992. And finally, political instability in Mexico slowed foreign investment and expansion plans.

Figure 4 details the changes in tariffs with the implementation of NAFTA. For example, the figure indicates that 15 percent of agricultural exports to Mexico were duty-free before January 1, 1994, an additional 37 percent of agricultural exports became duty-free on January 1, 1994, and the tariffs will be reduced in stages for the remaining 48 percent of agricultural exports (U.S. International Trade Commission 1993).

Surprisingly, there is little apparent correlation between the industries that experienced a major boost in exports during 1994 and the industries that experienced a major reduction in tariffs.[12] For example, on January 1, 1994, tariffs dropped to zero for more than 70 percent of instruments exports, yet exports by the instru-

ments industry grew only 4 percent in 1994.

There are a number of possible explanations for this lack of correlation. Price elasticities differ from industry to industry, making some industries more responsive to tariff changes than others. Mexico may have introduced nontariff barriers (like additional inspections or paperwork requirements) that offset the tariff reductions in some industries. Finally, the tariffs are classified according to commodities, while the exports are classified according to industries. At the two-digit level of aggregation, the two series do not correspond exactly, and that lack of correspondence could blur the connection between tariff cuts and export growth.

The employment consequences of increasing merchandise exports to Mexico

Although Texas' merchandise exports to Mexico have nearly tripled since 1987, they still represent less than 5 percent of GSP. Therefore, it would be surprising if merchandise export growth could explain a large percentage of Texas employment growth. Our analysis indicates that 6.1 percent of Texas employment growth between first-quarter 1987 and fourth-quarter 1994 can be attributed to increasing merchandise exports to Mexico.[13] On average, 3 percent of Texas employment growth can be attributed to the direct effects of increases in merchandise exports to Mexico, while another 3.1 percent of Texas employment growth can be attributed to corresponding multiplier effects.

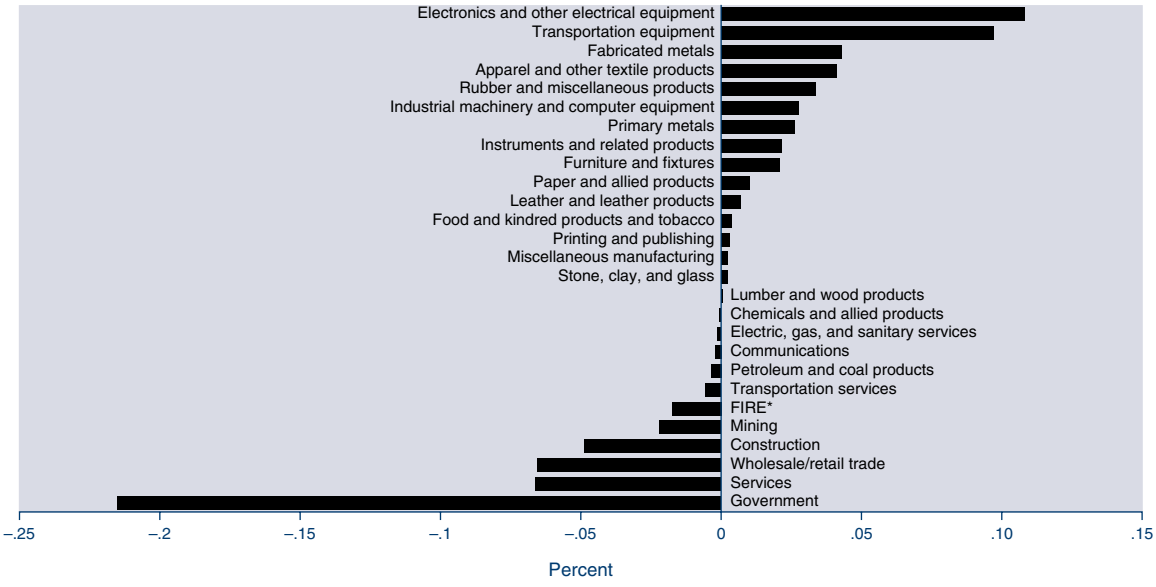
While merchandise export growth cannot explain much of total employment growth, it has had a considerable influence on the composition of the Texas economy. As Figure 5 indicates, increasing merchandise exports to Mexico encouraged workers to shift toward industries that manufacture durable goods like electronics and other electrical equipment and transportation equipment.[14] The electronics and other electrical equipment industry gains the most employment share because exports to Mexico represent a disproportionately large percentage of that industry's production. Especially rapid export growth produced gains in employment share for the transportation equipment industry.

When some industries gain employment share, others must necessarily lose it. Not surprisingly, our analysis indicates that increases in merchandise exports cause employment to shift away from industries that do not produce merchandise exports. Multiplier effects determine the extent of the losses for these industries. Industries that are closely linked to merchandise exporters—such as the transportation-services industry—lose less employment share than industries that are not closely linked.

In Figure 6, we compare the actual employment composition in 1994 with the em-

Figure 5

Changes in Employment Composition Due to Changes in Real Texas Merchandise Exports to Mexico, 1987–94

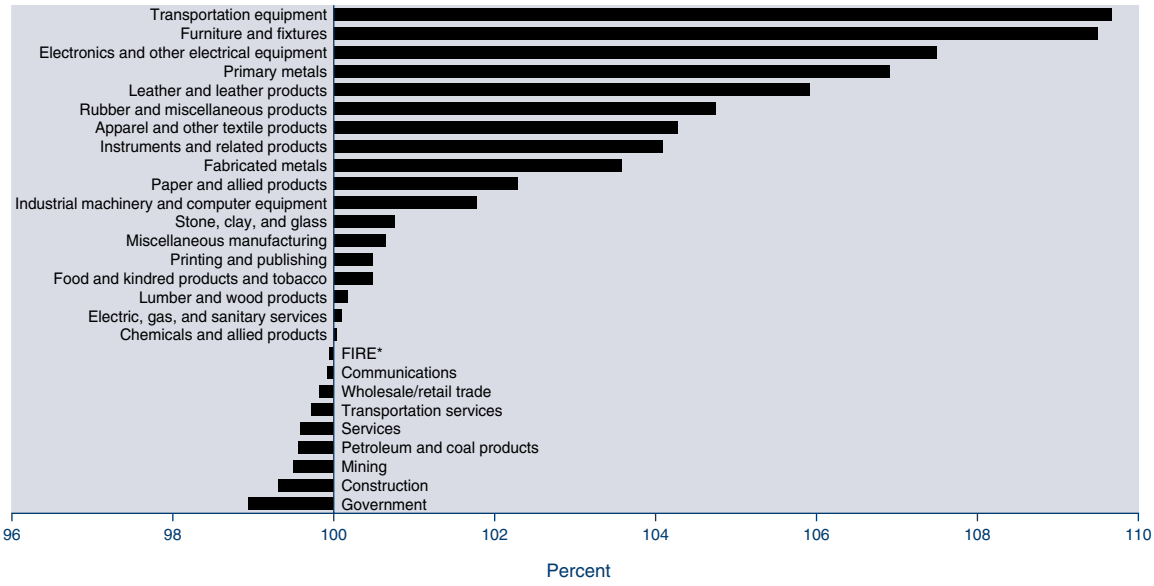


* Finance, insurance, and real estate.

SOURCES OF PRIMARY DATA: Massachusetts Institute for Social and Economic Research; U.S. Department of Labor, Bureau of Labor Statistics.

Figure 6

Ratio of Employment Share to Predicted Employment Share Absent Growth In Merchandise Exports to Mexico, 1994



* Finance, insurance, and real estate.

SOURCES OF PRIMARY DATA: Massachusetts Institute for Social and Economic Research; U.S. Department of Labor, Bureau of Labor Statistics.

ployment composition we predict would have occurred if merchandise exports to Mexico had not changed.[15] This analysis allows us to isolate those industries in which increasing merchandise exports to Mexico have had a significant influence on employment shares. We find that four industries—transportation equipment, furniture and fixtures, electronics and other electrical equipment, and primary metals—would have had much smaller shares of Texas employment had merchandise exports to Mexico remained unchanged. We estimate that since 1987, all the gains in employment in the electronics and other electrical equipment and furniture and fixtures industries, and more than half of the gains in the primary metals industry, can be attributed to increasing merchandise exports to Mexico. Furthermore, we calculate that employment in transportation manufacturing would have fallen much more rapidly over the past few years if increases in merchandise exports to Mexico had not partially offset declines in defense spending by the U.S. government.

A common denominator among three of the four industries that have gained considerable employment share through increasing merchandise exports is that major components of these industries are classified as high-technology manufacturers by the Bureau of the Census. To be classified as a high-technology manufacturing industry, spending on research and development must be more than 50 percent above the U.S. average (Bureau of the Census 1993). We estimate that increasing merchandise exports to Mexico can explain all of Texas' employment growth in high-tech manufacturing since 1987.[16] However, the relationship need not be causal because our analysis does not discriminate between increases in Texas merchandise exports that reflect increasing Mexican demand and increases in Texas merchandise exports that reflect export firms' relocating to Texas from other states.

While the input–output analysis reveals those industries that have been highly influenced by increasing merchandise exports to Mexico, it also reveals those industries that have been essentially unaffected. For example, the analysis indicates that increasing merchandise exports to Mexico have had little influence on the employment shares for energy-related manufacturing (chemicals and petroleum and coal products). This potentially surprising result reflects the fact that while these industries represent 10 percent of Texas merchandise exports to Mexico, exports to Mexico represent less than 1 percent of gross output for these industries.[17]

Sensitivity analysis

The preceding analysis uses data on the "origin of movement to port" to evaluate Texas'

merchandise exports to Mexico. Recently, the Commerce Department has also released data using "state of ZIP code of exporter" to allocate merchandise exports among the states. Because the ZIP-codes series begins in the first quarter of 1993, it was not appropriate for our longer term analysis. However, we wondered if an analysis of the employment effects of merchandise export growth after NAFTA would be sensitive to the export series used.

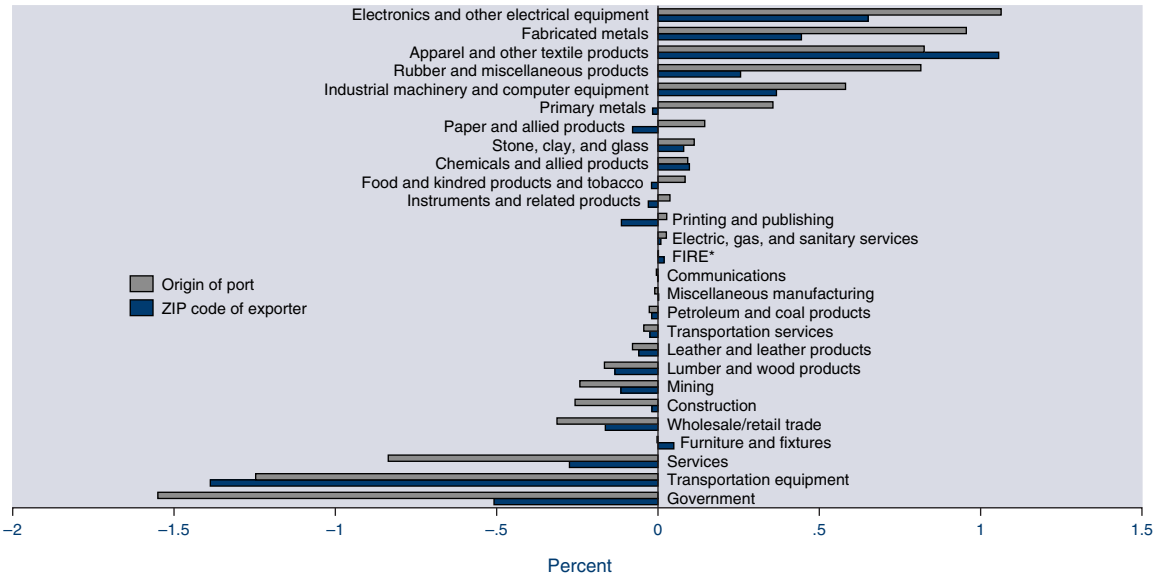
To make the two series comparable for sensitivity analysis, we restrict our evaluation to year-over-year changes in real merchandise exports that have not been seasonally adjusted.[18] For each industry and each series, predicted employment after NAFTA is the sum of actual employment in the fourth quarter of 1993 and the predicted change in employment for 1994.[19]

Figure 7 indicates the difference in employment share between the fourth quarter of 1993 and the predicted employment after NAFTA for each merchandise export series. While the correspondence is not exact, the two merchandise export series generate estimates of employment impact that are qualitatively similar. In either case, the primary beneficiaries of recent increases in merchandise exports to Mexico produce electronics and other electrical equipment, fabricated metals, and apparel and other textile products. The analysis predicts modest growth in employment share for these industries as a result of export growth after NAFTA. Similarly, regardless of the measure of merchandise exports, the analysis predicts a decline in employment share for government, transportation equipment manufacturing, and narrowly defined services such as business services and health care. Thus, our results appear qualitatively insensitive to changes in the definition of merchandise exports.

Conclusion

Our analysis of the employment consequences of increasing merchandise exports to Mexico is more suggestive than definitive for a number of reasons. An input–output model is particularly well-suited to identifying multiplier effects that are not readily apparent, but it cannot incorporate changes in production technology. Therefore, the model will underestimate the employment consequences of export growth for any industry that has become more labor-intensive over time (and vice versa) and will not capture any changes in the interrelationships among industries. Furthermore, data limitations prevent us from describing the employment changes that growth in merchandise imports or bilateral services trade could induce. Because trade is an exchange, it is possible that the compositional

Figure 7
Change in Industry Composition after NAFTA: Two Measures of the Effects of Export Growth



* Finance, insurance, and real estate.

SOURCES OF PRIMARY DATA: Massachusetts Institute for Social and Economic Research; U.S. Department of Labor, Bureau of Labor Statistics.

effects of merchandise exports are fully offset by merchandise imports or by the pattern of trade in services.

Our analysis suggests that growth in Texas' merchandise exports to Mexico can account for only a small fraction of the employment growth in Texas since 1987. However, we find that the growth of merchandise exports to Mexico has had a considerable influence on the composition of the Texas economy. In particular, growth in merchandise exports can explain all of the recent growth in high-tech manufacturing.

Notes

Our thanks to Stephen P. A. Brown, David Gould, Keith Phillips, and Fiona Sigalla for their helpful comments and suggestions and to Carla Miller for her assistance with the export data.

1 Data on Mexican tariff rates were provided by Mexico's Department of Commerce and Industrial Development (SECOFI).

2 Data on merchandise exports to Mexico from Texas are not available for prior years.

3 Changes in trade flows can change real wages, but recent research by Kydland (1995) indicates that changes in real hourly compensation have little long-term influence on hours worked per household.

4 We considered using data on U.S. trade in services with Mexico and U.S. merchandise imports from Mexico as proxies for the corresponding Texas data but rejected that approach because we would not expect Texas' trade to be proportionately similar to U.S. trade. Given its close proximity to Mexico, Texas is likely to be a disproportionately large trading partner in services. Texas is also likely to consume a disproportionately large share of Mexican goods that are expensive to ship. Consumption of imports from Mexico may also be unusually heavy because Texas' large population of Mexican–Americans is more familiar with Mexican products. (For a discussion of the effects that immigrants can have on imports, see Gould 1994.)

5 This analysis does not incorporate any effects that increasing exports to Mexico from other U.S. states may have on Texas.

6 We have extrapolated GSP using data on national productivity trends and Texas employment after 1991.

7 For a more detailed discussion of input–output analysis, see Miller and Blair (1985) and the Texas Comptroller of Public Accounts (1989).

8 For each industry, the input–output table indicates the percentage change in output and employment (ϕ_{it}) that would be required to satisfy the observed change in merchandise exports for period t. Therefore, the change in industry employment in each period that is attributable to changes in merchandise exports would be $L_i \cdot \phi_{it}$, where L_i is the average employment in industry i for 1986.

9 The merchandise export data were provided by the Massachusetts Institute for Social and Economic Research (MISER). The data are based on "origin of movement to port" state-level export codes derived from standard industrial classifications. We use the fixed-weight GDP deflator to adjust the nominal export data for changes in the U.S. price level and use the SAS Institute's X-11 procedure to seasonally adjust the real export data.

10 Mexico's *maquiladora* program undoubtedly contributes to the heavy emphasis on durables in the merchandise export mix.

11 Special classification goods include military equipment, miscellaneous equipment, antiques, donations and charity, and magnetic tape recordings.

12 The Pearson correlation between the percentage of merchandise exports to Mexico becoming duty-free on January 1, 1994, and the percentage growth in merchandise exports between 1993 and 1994 is only 0.3040.

13 While increasing merchandise exports to Mexico can explain only a fraction of total employment growth since 1987, they could explain much of the differential in growth between Texas and the United States. Employment has been growing faster in Texas than in the United States since 1988 (Sigalla 1995).

14 Figure 5 indicates the difference in employment share between first-quarter 1987 and the predicted employment for each industry in fourth-quarter 1994. The predicted employment for each industry is the sum of actual employment in first-quarter 1987 and the total change in employment attributable to increasing merchandise exports to Mexico between first-quarter 1987 and fourth-quarter 1994.

15 We estimate employment shares in the absence of merchandise export growth by subtracting the total predicted change in employment due to merchandise export growth from the observed level of employment in 1994.

16 In Texas, employment in high-tech manufacturing industries represents 100 percent of the chemicals industry, 93 percent of the petroleum refining and coal products industry, 92 percent of the instruments and related products industry, 88 percent of the transportation equipment industry, 86 percent of the electronics and other electrical equipment industry, 28 percent of the industrial machinery industry, and 19 percent of the primary metals industry (Bureau of the Census 1993 and Bureau of Labor Statistics 1993). Our analysis indicates that increasing merchandise exports to Mexico should have generated 17,900 high-tech manufacturing jobs between first-quarter 1987 and fourth-quarter 1994. Texas actually added 13,500 high-tech manufacturing jobs during that period. However, the actual job gains would have been much greater if defense contractors in the transportation

equipment industry had not laid off thousands of workers over the period in question.

[17] We determine export's share of gross output for each industry by comparing the value of exports to Mexico in 1987 with estimates of gross output for 1986 from the input–output table. Assuming that output grew between 1986 and 1987, our estimates represent an upper bound on export's share of gross output.

[18] The full analysis uses seasonally adjusted data, but the ZIP-codes series is too short to seasonally adjust. We use seasonally unadjusted data for both series in the sensitivity analysis to avoid introducing an additional reason for differences between the two series. As before, we adjust both series for inflation, using the U.S. fixed-weight GDP deflator.

[19] The predicted changes in employment for 1994 represent the changes in employment that the input–output table indicates would be necessary to support the total change in industry exports between 1993 and 1994.

References

Bureau of Labor Statistics (1993), *Employment and Wages, Annual Averages, 1991*, Bulletin 2419 (Washington, D.C.: Government Printing Office).

Bureau of the Census (1993), *Statistical Abstract of the United States: 1993*, 113th ed. (Washington, D.C.: Government Printing Office).

Gould, David M. (1994), "Immigrant Links to the Home Country: Empirical Implications for U.S. Bilateral Trade Flows," *Review of Economics and Statistics* 76 (May): 302–42.

Kydland, Finn (1995), "Business Cycles and Aggregate Labor Market Fluctuations," *Frontiers of Business Cycle Research*, ed. T. F. Cooley (Princeton, N.J.: Princeton University Press).

Lustig, Nora (1992), *Mexico: The Remaking of an Economy* (Washington, D.C.: Brookings Institution).

Miller, Ronald E., and Peter D. Blair (1985), *Input–Output Analysis: Foundations and Extensions* (Englewood Cliffs, N.J.: Prentice Hall).

Sigalla, Fiona (1995), "Another Strong Year for the Eleventh District," Federal Reserve Bank of Dallas *Economic Review*, First Quarter, also in this issue.

Texas Comptroller of Public Accounts (1989), "The Texas Input–Output Model, 1986 Update: Technical Documentation" (Austin, Texas, mimeo).

U.S. International Trade Commission (1993), *Potential Impact on the U.S. Economy and Selected Industries of the North American Free-Trade Agreement*, Publication 2596 (Washington, D.C.: Government Printing Office).