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# In This Issue . . .

The disparity across states in the growth of manufactured exports suggests that the internationalization of the U.S. economy has spread unevenly. In the first article in this *Review*, "Accounting for Changes in Manufactured Exports at the State Level: 1976-86," Cletus C. Coughlin and Thomas B. Mandelbaum explore several factors that may have produced these differences in states' export growth.

Using a technique called shift-share analysis, the authors determine that, in most cases, the industrial composition of a state's exports is not a major influence on its export growth. Rather, the relationship between export growth in a state's individual industries and national export growth in these industries causes state export growth to differ from the national average. Since previous research has established that capital abundance—especially human capital abundance—is the United States' primary source of international comparative advantage, the link between a state's 1976-86 export growth and its growth in physical and human capital is also examined. When differences in the industrial mix of exports are eliminated, Coughlin and Mandelbaum find a positive relationship between a state's export growth and the growth of its human capital.

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In the second article of this issue, "The Pitfalls of Exchange Rate Targeting: A Case Study from the United Kingdom," Michael T. Belongia and K. Alec Chrystal discuss the arguments, pro and con, surrounding the use of the exchange rate as a target objective for monetary policy. Many of the world's central banks considered this strategy in the 1980s, primarily because of breakdowns in the historical relationships between monetary aggregates and economic activity and because of perceived misalignments in exchange rates and trade balances. Using a well-defined episode of monetary policy in the United Kingdom as a case study, Belongia and Chrystal argue that exchange rate targeting can have severe adverse consequences if a central bank uses monetary policy to offset a real exchange rate change. Specifically, resisting a real exchange rate change while trying to maintain a nominal exchange rate target can exacerbate recession or inflation. Examining the United Kingdom in the late 1980s, they argue that the rapid acceleration of its inflation rate is linked directly to the Bank of England's attempt to keep the exchange rate at a level of three DM per pound rather than let it appreciate to a higher value.

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In the third article in this issue, Daniel L. Thornton considers the question: "Do Government Deficits Matter?" Thornton discusses alternative views of the effects of deficits on the economy, interest rates, the

trade deficit and the like, pointing out the rationale behind the conventional views, for example, that government deficits cause real interest rates to be high or the trade deficit to be large. He then discusses the alternative view, called Ricardian Equivalence, that deficits don't matter. Finally, he presents some evidence on the relationship between government deficits and various economic variables using annual data for 16 OECD countries for the period 1975-86. By and large, his results, consistent with most U.S. time-series studies, support the Ricardian view.

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Studies of the historic U.S.-Canada Free Trade Agreement have produced conflicting estimates of its economic effects. In the fourth article in this *Review*, "What Do Economic Models Tell Us About the Effects of the U.S.-Canada Free Trade Agreement?" Cletus C. Coughlin examines five studies to better understand their estimates and determine why they contradict each other. The conflicting results emerge both from different assumptions about how certain markets operate and the values of some parameters and from differences in the level of detail with respect to commodities and countries.

As Coughlin stresses, several key aspects of the agreement are not included in these models because they are difficult to quantify. These unmeasured aspects, the author says, may be more important than the measured ones in terms of the economic effects of the agreement. Thus, the message of this article, which is applicable to all economic models of trade policy changes, is "let the user beware."

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In the last article of this issue, Michael T. Belongia summarizes the proceedings of a conference held at the Federal Reserve Bank of St. Louis in honor of the Federal Reserve System's 75th anniversary. The papers at this conference reviewed the historical performance of monetary policy in the United States, why the Federal Reserve might choose the federal funds rate as its operating target, whether the Federal Reserve should be constrained by a monetary rule with a target of price stability, how the money stock should be measured and whether monetary actions have significant effects on real output. A complete conference program and instructions on how to obtain the proceedings also are included.

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# Accounting for Changes in Manufactured Exports at the State Level: 1976-86

THE RAPID INTERNATIONALIZATION of the U.S. economy in recent years has spread unevenly across regions and states. For example, while the real value of direct manufactured exports rose 25 percent in the nation between 1976 and 1986, it actually declined slightly in the Middle Atlantic and Upper Midwest regions of the United States.[1] Coughlin and Fabel (1988) have demonstrated that some of the variation in state export levels can be explained by differences in their endowments of productive resources. According to these authors, states with relatively more capital, both human and physical, have higher export levels and, thus, higher shares of U.S. exports.

This paper extends the research in Coughlin and Fabel by examining the change in export levels across states between 1976 and 1986. We explore the factors that potentially caused the varied growth in states' export sectors. Using a technique called shift-share analysis, we isolate two influences on state export growth—industrial composition and relative export growth of the same industry at the state and national levels—and compare their relative importance. Next, we examine the relationship between export growth and resource endowments at the state level to see if we find results consistent with those of Coughlin and Fabel.

## FACTORS INFLUENCING THE SHIFT OF EXPORTS AMONG STATES

Table 1 contains the basic export and resource endowment data used in this study for the 48 states in the continental United States.[2] A look at the export data columns shows the tremen-

[1]This comparision uses U.S. Census regions. The Middle Atlantic Census Region consists of New York, New Jersey and Pennsylvania; the Upper Midwest is actually the East North Central Census Region, which consists of Ohio, Indiana, Illinois, Michigan and Wisconsin. The value of direct manufactured exports is the plant value of manufactured exports (U.S. Department of Commerce, 1981 and 1989). In 1986, the port value of U.S. manufactured exports was $182 billion; the plant value of exports, $159.4 billion, is obtained by removing transportation and insurance costs.

[2]Our analysis excludes the District of Columbia, Alaska and Hawaii because their export values are small and their exports are not disaggregated by industry, a deficiency that precludes meaningful interpretation of the shift-share analysis that we present later.

Table 1

## Direct Manufactured Exports, Human Capital and Physical Capital

| | Direct Exports | | Human Capital | | Physical Capital | |
|---|---|---|---|---|---|---|
| | 1986 level ($ millions) | Percent change 1976-86 | 1986 level ($1000/worker) | Percent change 1976-86 | 1986 level ($1000/worker) | Percent change 1976-86 |
| Alabama | $ 1684.9 | 102.5% | $ 91.4 | 140.4% | $ 56.3 | 130.2% |
| Arizona | 1755.8 | 174.7 | 97.5 | 114.2 | 40.0 | 95.4 |
| Arkansas | 1065.4 | 63.6 | 63.7 | 380.2 | 41.1 | 148.2 |
| California | 17216.4 | 113.3 | 135.5 | 173.2 | 36.3 | 129.6 |
| Colorado | 1477.7 | 139.8 | 117.6 | 128.4 | 43.2 | 118.2 |
| Connecticut | 3996.4 | 104.1 | 122.0 | 138.9 | 30.3 | 113.5 |
| Delaware | 429.5 | 128.0 | 195.1 | 133.2 | 48.4 | 78.1 |
| Florida | 3372.6 | 147.5 | 98.5 | 124.1 | 38.6 | 100.5 |
| Georgia | 2826.7 | 107.2 | 74.5 | 177.5 | 40.2 | 136.4 |
| Idaho | 502.6 | 197.6 | 82.0 | 118.9 | 50.3 | 136.3 |
| Illinois | 7209.2 | 8.3 | 123.8 | 158.6 | 44.3 | 125.6 |
| Indiana | 4787.4 | 69.3 | 131.2 | 134.2 | 57.9 | 119.8 |
| Iowa | 1932.4 | 28.8 | 100.1 | 206.9 | 54.8 | 159.4 |
| Kansas | 1835.0 | 188.9 | 88.7 | 137.2 | 41.8 | 136.7 |
| Kentucky | 1939.8 | 70.6 | 102.1 | 423.8 | 51.3 | 150.6 |
| Louisiana | 3020.3 | 118.3 | 125.3 | 164.5 | 167.4 | 204.5 |
| Maine | 800.6 | 214.1 | 88.0 | 138.7 | 60.1 | 188.5 |
| Maryland | 1740.5 | 171.7 | 128.6 | 143.8 | 45.7 | 102.1 |
| Massachusetts | 5513.8 | 120.3 | 115.7 | 131.4 | 30.4 | 146.7 |
| Michigan | 10878.0 | 57.9 | 164.7 | 200.5 | 47.4 | 122.7 |
| Minnesota | 3691.9 | 135.6 | 116.2 | 175.3 | 35.6 | 152.2 |
| Mississippi | 1337.1 | 91.6 | 69.2 | 197.1 | 46.5 | 191.0 |
| Missouri | 4267.9 | 163.1 | 107.3 | 112.7 | 35.7 | 146.5 |
| Montana | 101.2 | 132.1 | 31.0 | −30.9 | 71.4 | 67.9 |
| Nebraska | 753.3 | 143.6 | 82.0 | 146.0 | 35.9 | 108.0 |
| Nevada | 167.1 | 514.3 | 100.4 | 275.6 | 43.9 | 94.7 |
| New Hampshire | 892.6 | 206.6 | 86.2 | 98.1 | 31.6 | 136.6 |
| New Jersey | 3548.1 | 33.4 | 127.9 | 101.9 | 34.5 | 89.8 |
| New Mexico | 177.7 | 156.8 | 88.2 | 704.9 | 57.0 | 158.3 |
| New York | 9412.4 | 76.9 | 134.8 | 162.4 | 33.7 | 131.3 |
| North Carolina | 5260.8 | 138.9 | 66.9 | 175.1 | 37.6 | 127.9 |
| North Dakota | 214.7 | 154.1 | 68.6 | 234.2 | 55.7 | 170.1 |
| Ohio | 10653.0 | 83.9 | 131.1 | 147.9 | 45.6 | 108.9 |
| Oklahoma | 1084.6 | 87.4 | 111.4 | 166.7 | 52.1 | 181.3 |
| Oregon | 1862.7 | 126.0 | 90.8 | 182.8 | 43.7 | 102.9 |
| Pennsylvania | 6026.6 | 28.1 | 107.3 | 130.0 | 42.1 | 113.1 |
| Rhode Island | 481.9 | 79.3 | 89.8 | 109.6 | 22.6 | 106.6 |
| South Carolina | 2398.0 | 156.4 | 80.5 | 464.6 | 53.6 | 159.5 |
| South Dakota | 212.7 | 211.4 | 73.2 | 261.0 | 30.0 | 142.3 |
| Tennessee | 2910.4 | 132.3 | 87.9 | 154.9 | 40.5 | 121.1 |
| Texas | 10981.5 | 111.2 | 121.5 | 193.6 | 81.5 | 150.6 |
| Utah | 668.5 | 199.0 | 102.1 | 240.1 | 39.1 | 110.8 |
| Vermont | 384.0 | 92.2 | 90.5 | 72.8 | 55.7 | 259.6 |
| Virginia | 2704.0 | 75.1 | 80.9 | 166.6 | 43.7 | 133.6 |
| Washington | 9862.8 | 204.9 | 141.6 | 166.7 | 55.0 | 99.9 |
| West Virginia | 983.2 | 119.9 | 155.2 | 215.1 | 68.1 | 85.2 |
| Wisconsin | 3313.5 | 50.0 | 100.1 | 231.8 | 39.9 | 143.0 |
| Wyoming | 19.1 | 85.4 | 56.9 | 45.9 | 102.1 | 114.4 |

dous diversity across these states in both the level of exports and their growth over the decade. In 1986, for example, the value of direct manufactured exports ranged from $19.1 million in Wyoming to $17.2 billion in California. While direct exports rose 91.2 percent in the continental United States between 1976 and 1986, state growth rates ranged from 8.3 percent in Illinois to 514.3 percent in Nevada. States with relatively high growth rates captured larger shares of U.S. exports over time, while those with lower growth rates saw their export shares diminish.

These changes in export shares can be examined by a technique called shift-share analysis. This method, an accounting technique, is described in detail in the appendix. Basically, the technique calculates each state's net relative change over the period; states in which exports grew more rapidly than the national average between 1976 and 1986 have a positive net relative change and vice versa. The figures in the first column in table 2 show these net relative changes in exports across states. These changes and their individual components (also in table 2) are expressed as percentages of the export levels that would have been achieved in 1986 had their exports grown from 1976 to 1986 at the national rate. Thus, for example, Arizona's exports in 1986 were 36 percent higher than if its exports had grown at the national rate from 1976 to 1986.

The shift-share method divides a state's net relative change (NRC) in exports among three components: the industrial mix effect (IME), the competitive effect (CE) and the allocative effect (AE). Each state's IME, CE and AE sum to its NRC.

## The Industry Mix Effect

During any period, exports of some of the nation's goods will grow faster than others. Those states whose exports are more heavily concentrated in these faster-growing export sectors will find their share of the nation's total exports rising, other things the same. The opposite relationship holds true as well: states whose exports are more heavily concentrated in goods whose export sales are growing relatively slowly at the national level will find their share of the nation's export sales declining. Discussions of regional export growth frequently focus on the region's industrial mix as a key determinant of its export performance. For example, Hervey (1986) attributed the Midwest's slow export growth throughout most of the 1970s and early 1980s to its "traditional" industry composition.[3]

Table 3 shows 1976-86 annual growth rates of U.S. exports from the 20 major industry groups. The industries are listed in declining order of their export growth rates over the 10-year period. The last column in table 3 shows the composition of U.S exports in 1976. If the composition of a state's exports was identical to that of the nation's exports, its IME would equal zero. If a state had a favorable (unfavorable) mix of exports, that is, if it had high (low) concentrations of its 1976 exports in industries experiencing rapid national export growth over the 1976-86 decade, its IME would be greater (less) than zero. The magnitude of IME indicates how much higher or lower the state's exports were in 1986 than they would have been if the state's export composition were identical to the nation's. This value is expressed as a percentage of the level of 1986 total state exports that would have resulted if they had grown at the national rate in the 1976-86 period.

The IME values listed in table 2 range from 99 percent for North Dakota to −29 percent for Nevada. Thus, the industrial mix effect, *ceteris paribus*, contributed to a 99 percent increase in North Dakota's exports relative to what they would have been otherwise, while contributing to a 29 percent reduction in exports in Nevada.

## The Competitive Effect

The CE figures listed in table 2 indicate the influence of the relative export growth of a state's industries, assuming its industry mix of exports is identical to the nation's. A positive (negative) CE indicates how much higher (lower) a state's exports were in percentage terms in 1986 solely because exports from individual state industries grew at a faster (slower) rate than the corresponding national industries over the 1976-86 period. This value is expressed as a percentage of total state exports that would have been achieved in 1986 had they grown at the national rate over the 1976-86 period.

[3]More recently, Smith (1990) concluded that a region's industrial mix was an important factor in distinguishing its relative export performance during 1987 and 1988.

Table 2

## Shift-Share Components for State Export Growth, 1976-86

| | Net Relative Change | Industry Mix Effect | Competitive Effect | Allocative Effect |
|---|---|---|---|---|
| Alabama | 20.7% | 15.8% | 30.0% | -25.1% |
| Arizona | 36.1 | 3.8 | 36.3 | -4.0 |
| Arkansas | -10.6 | 0.2 | 92.6 | -103.4 |
| California | 14.0 | 6.0 | 11.2 | -3.3 |
| Colorado | 23.4 | 5.1 | 50.0 | -31.7 |
| Connecticut | 7.7 | 7.0 | 18.2 | -17.4 |
| Delaware | -7.2 | 13.3 | 249.2 | -269.7 |
| Florida | 31.5 | 4.2 | 61.3 | -34.0 |
| Georgia | 4.6 | 0.5 | 16.1 | -12.0 |
| Idaho | 57.3 | 13.8 | 83.0 | -39.4 |
| Illinois | -42.4 | -2.6 | -27.6 | -12.1 |
| Indiana | -9.7 | 3.8 | 5.0 | -18.5 |
| Iowa | -30.4 | -2.7 | -12.8 | -15.0 |
| Kansas | 56.9 | 10.9 | 53.4 | -7.4 |
| Kentucky | -10.0 | 3.3 | -11.4 | -1.9 |
| Louisiana | 19.1 | 13.6 | 8.8 | -3.3 |
| Maine | 86.0 | 38.0 | 181.0 | -133.0 |
| Maryland | 34.7 | -3.8 | 206.3 | -167.7 |
| Massachusetts | 18.7 | 4.3 | 24.8 | -10.4 |
| Michigan | -15.9 | 3.8 | -9.3 | -10.3 |
| Minnesota | 27.5 | -2.0 | 11.4 | 18.1 |
| Mississippi | -1.4 | 0.5 | 7.4 | -9.3 |
| Missouri | 40.6 | 7.1 | 20.0 | 13.5 |
| Montana | 50.2 | 76.5 | -7.8 | -18.5 |
| Nebraska | 29.6 | 0.5 | 46.0 | -16.9 |
| Nevada | 209.0 | -29.0 | 1902.7 | -1664.7 |
| New Hampshire | 64.8 | 0.3 | 45.8 | 18.8 |
| New Jersey | -28.6 | 8.9 | -34.4 | -3.1 |
| New Mexico | 36.9 | -15.9 | 800.7 | -747.9 |
| New York | -5.4 | 0.4 | 0.2 | -6.0 |
| North Carolina | 26.8 | -3.2 | 80.8 | -50.8 |
| North Dakota | 161.5 | 99.0 | 104.6 | -42.1 |
| Ohio | -2.7 | 0.6 | 4.4 | -7.6 |
| Oklahoma | 0.6 | -3.9 | 17.0 | -12.5 |
| Oregon | 21.9 | -6.9 | 131.3 | -102.5 |
| Pennsylvania | -33.3 | -4.5 | -22.2 | -6.6 |
| Rhode Island | -2.3 | -12.5 | -6.5 | 16.7 |
| South Carolina | 37.6 | -2.4 | 59.7 | -19.7 |
| South Dakota | 64.2 | 31.6 | 287.4 | -254.7 |
| Tennessee | 20.9 | -1.5 | 46.3 | -23.9 |
| Texas | 12.5 | 6.6 | 6.9 | -1.0 |
| Utah | 52.5 | -8.7 | 433.0 | -371.8 |
| Vermont | 37.7 | 21.8 | 270.7 | -254.8 |
| Virginia | -6.7 | 3.1 | 24.2 | -34.0 |
| Washington | 61.4 | 0.9 | 305.6 | -245.0 |
| West Virginia | 23.6 | 5.5 | -1.0 | 19.0 |
| Wisconsin | -20.2 | -2.8 | -9.8 | -7.5 |
| Wyoming | 7.8 | 7.6 | 67.5 | -67.3 |

NOTE: See appendix for definitions of components.

Table 3
**Growth and Composition of U.S. Exports**

| SIC | Industry Group | Compounded annual growth rate, 1976-86 | Percent of total 1976 exports |
|---|---|---|---|
| 29 | Petroleum and coal products | 10.5% | 1.4% |
| 25 | Furniture and fixtures | 10.3 | 0.2 |
| 30 | Rubber and miscellaneous plastics | 8.8 | 1.5 |
| 38 | Instruments and related products | 8.5 | 4.5 |
| 28 | Chemicals and allied products | 8.5 | 11.2 |
| 37 | Transportation equipment | 8.1 | 20.0 |
| 27 | Printing and publishing | 7.4 | 0.7 |
| 31 | Leather and leather products | 7.3 | 0.3 |
| 21 | Tobacco products | 7.1 | 1.2 |
| 36 | Electrical equipment | 7.1 | 11.1 |
| 23 | Apparel and textile products | 6.7 | 0.9 |
| 20 | Food and kindred products | 6.4 | 6.9 |
| 26 | Paper and allied products | 6.0 | 2.7 |
| 32 | Stone, clay and glass products | 5.6 | 1.1 |
| 35 | Machinery, except electrical | 5.5 | 23.0 |
| 22 | Textile mill products | 3.8 | 1.5 |
| 24 | Lumber and wood products | 3.4 | 2.2 |
| 34 | Fabricated metal products | 3.4 | 4.5 |
| 39 | Miscellaneous manufacturing | 2.1 | 1.6 |
| 33 | Primary metal industries | 1.5 | 3.6 |
| | Total Exports | 6.7 | 100.0 |

Regardless of its export composition, a state's overall exports could grow more rapidly than the national average if its individual sectors sufficiently outpaced the national industry average. In other words, a state can experience rapid export growth not only by exporting those goods that grew rapidly at the national level, but also by relatively rapid growth of exports from industries displaying little national export growth.

South Carolina's pattern of export growth exemplifies this possibility. The state, as reflected in its negative IME, has an unfavorable mix of exports. This mix is characterized by a relatively large export share in the textile mill products sector, whose exports had grown slowly nationally, and low concentrations in the chemicals and transportation equipment sectors, among the more rapidly growing export sectors nationally. Despite this industrial mix, exports from South Carolina grew faster than the national average because, as the positive CE shows, it had relatively rapid export growth in individual sectors. Exports of South Carolina's textile mill products, for example, grew at a 6.2 percent annual rate between 1976 and 1986; at the national level, in contrast, they grew at a relatively slow 3.8 percent rate.

## *The Allocation Effect*

The allocation effect reflects differences between a state and the nation in both industrial mix and relative industry export growth. Unfortunately, unlike the IME and CE terms, there is no clear-cut interpretation of the AE.[4] In 43 of the states, the AE component was negative. For most states, then, those sectors for which 1976 exports accounted for a small share of total state exports relative to the national export composition tended to grow more rapidly than at the national level between 1976 and 1986. In addition, those sectors that were relatively large in 1976 grew more slowly.

Returning to the South Carolina example, one reason that the state's AE was negative stems

[4]According to Esteban-Marquillas (1972), p. 252, the allocative effect "will show us if the region is specialized in those sectors in which it enjoys better competitive advantages" as evidenced by faster-than-national growth. Since our analysis is restricted to exports rather than production, this terminology is inappropriate.

from its transportation sector. Exports of transportation equipment accounted for less than 1 percent of the state's exports in 1976 compared with 20 percent nationally, while the state's 1976-86 annual growth rate of transportation equipment exports was approximately double the national rate. This combination of small relative size and rapid growth contributed to the state's negative AE.

## *The Relative Influence of IME, CE and AE*

To evaluate the contribution of industry mix, industry growth and allocation effect for each state, each component was ranked by its importance in influencing the state's net relative change. Using the figures from table 2, the component with the smallest absolute value for each state—and thus the state's least important factor—was ranked 1, while the state's largest component in absolute value—its most influential component—was ranked 3. The results of this exercise, shown in table 4, clearly indicate that the IME was least important for most states, while the CE was most important.[5] The IME was ranked as the least important component in 37 states, while the CE was ranked as most important in 34 states.

The relative influence of each of the three components also can be evaluated by comparing each component's percent share of the sum of the absolute values of the three components. In California, for example, the IME value of 6.0 represents 29.3 percent of the total effect [{6.0/(6.0 + 11.2 + 3.3)}x100= 29.3]. As table 4 shows, on average, IME, CE and AE account for 12.6 percent, 49.7 percent and 37.7 percent, respectively, of the total influence on NRC.

Correlations between NRC and each of the three components reinforce the notion that a state's CE is the primary influence on NRC. The simple correlations across states between NRC and the IME, CE and AE components were .32, .68 and −.62, respectively. While all three coefficients are significantly different than zero at the 0.5 percent level, the NRC-CE correlation is substantially larger than the NRC-IME relationship, and, unlike the NRC-AE correlation, indicates a positive relationship.

Table 4

**Relative Importance of Shift-Share Components**

| | Number of states in which component was ranked | | | Average percentage share of total effect |
|---|---|---|---|---|
| | 1 | 2 | 3 | |
| Industry mix effect | 37 | 9 | 2 | 12.6% |
| Competitive effect | 4 | 10 | 34 | 49.7 |
| Allocative effect | 7 | 29 | 12 | 37.7 |

NOTE: A rank of 1 indicates a component was the smallest in absolute value of the three components for a state, while a 3 rank indicates it had the largest absolute value.

The strongly negative NRC-AE relationship suggests that, in general, those states with faster-than-national export growth managed this growth despite having relatively small shares of their 1976 exports in industries in which the state's exports subsequently outgrew the national industry average. Rather, their rapid export growth was the result of faster-than-national growth of individual industries, even though the rapid growth from these industries tended to account for a relatively small share of their 1976 exports. While states with rapid export growth tended to have favorable industry mixes, this factor is less important than the relatively fast growth of state exports from these industries.

In summary, across all states, the IME appears to be relatively unimportant in determining whether a state's exports grew faster than the national average. For the most part, it is the relative export growth of a state's individual industries that determines whether the state's export performance is superior to the nation's.

## WHAT ARE THE SOURCES OF A STATE'S COMPARATIVE EXPORT ADVANTAGE?

To explain the relative export performance of states, Coughlin and Fabel applied the Heckscher-

[5]This result corroborates Bauer and Eberts' (1990) finding that a state's growth rate of exports between 1980 and 1986 cannot be explained by the mix of industries in the state.

Ohlin theory of international trade. The Heckscher-Ohlin approach highlights the importance of a country's productive resources in determining its pattern of trade. One reason for international trade is differences in production costs across countries. These differences depend on what proportions various factors of production exist in different countries (that is, the relative factor endowments) and how the factors are combined in producing different goods (that is, the relative factor intensities).

Assuming a world consisting of two factors of production, two goods and two countries, the essence of the Heckscher-Ohlin theory can be explained simply. In a two-factor world, a country is relatively capital-abundant (labor-abundant) if it has a higher (lower) ratio of capital to labor than the other country. In a two-good world, a product is capital-intensive if its production requires a higher ratio of capital to labor than the other good. The Heckscher-Ohlin theory predicts that a country will export the good that uses its abundant factor intensively, while importing the other good. For example, if the United States is relatively capital-abundant and Mexico is relatively labor-abundant, the United States will export capital-intensive products and import labor-intensive goods, while Mexico would do just the opposite. The reason for this trade pattern hinges on the relative production costs. A country should be the lower-cost producer of goods that use relatively larger amounts of its more abundant resource.

The Heckscher-Ohlin approach allows for predictions about trade patterns based on a knowledge of countries' factor supplies. Since the services of factors of production are embodied in exports and imports, international trade may be viewed as the export of the services of the country's relatively abundant factor in exchange for the services associated with its scarce factor.

The preceding idea can be applied to states within a country.[6] Relative state export performance depends on state advantages; however, the specific advantages must also be defined in the context of the world economy. For example, if a state is relatively well-endowed with a resource that is scarce in the United States relative to other countries, then its resource advantage will not necessarily translate into superior export performance. Rather, the resource may simply allow increased production of an import-competing good. States that are better endowed with the characteristics that are associated with comparative advantage at the national level, however, should display relatively better export performance.

Numerous empirical studies suggest that the United States' primary source of international comparative advantage is its abundance of human capital.[7] In addition, as Coughlin and Fabel found, physical capital is a significant determinant of relative state export performance. To further explain the interstate differences in export growth rates, we examine the link between states' export growth and their changing endowments of physical and human capital.

## *The Relationship between Changes in State Exports and Endowments*

The connection between state export growth and endowment changes is explored by testing whether there is a statistically significant relationship across states between measures of export growth for the 1976-86 period and the percent change in human and physical capital per manufacturing worker for the same period.

Two measures of export growth are used in the statistical analysis: a state's NRC and its CE. Over any given period, a state's export growth relative to the nation (expressed by its NRC) is influenced by both the export growth of its individual industries (measured by CE) and the state's industrial mix at the beginning of the period. While a state's human or physical capital growth might be expected to stimulate the export growth of its individual industries (and, thus, increase its CE), there is no reason to think that the state's capital growth would be linked to the industry mix of its exports at the beginning of any period. Thus, a state's capital growth should be more closely linked to its CE

[6]Neither Coughlin and Fabel (1988) nor the present study are tests of the Heckscher-Ohlin theory of trade. See Bowen et al. (1987) for a rigorous examination. In the present case, the Heckscher-Ohlin theory provides a well-known framework in which to analyze the factors that contribute to a state's relative export performance.

[7]Keesing (1966), Balassa (1979), Branson and Monoyios (1977) and Stern and Maskus (1981) are a few of the studies that have emphasized the impact of human capital on U.S. international trade.

than to its NRC; by definition, the former measure is purged of the irrelevant and possibly confounding effects of a state's industrial mix that is included in the latter measure.

For our analysis, a state's human capital per manufacturing worker is measured using the difference between the state's average wage for manufacturing workers and the average wage of unskilled manufacturing workers in the state.[8] This difference, which is assumed to persist indefinitely, is viewed entirely as a return to human capital. This flow of returns is converted to a stock of human capital by dividing by an interest (discount) rate. Physical capital per manufacturing worker is measured by depreciable assets per manufacturing employee in the state.[9]

Table 1 shows the 1986 levels of the capital measures and their percent change since 1976. Montana has the dubious distinction of having the slowest growth in both human and physical capital. The change in human capital ranges from −30.9 percent in that state to 464.6 percent in South Carolina with a mean of 182.7 percent. The change in physical capital ranges from 67.9 percent in Montana to 259.6 percent in Vermont with a mean of 132.3 percent.

The relationships between state-level changes in exports and endowments were explored by first regressing NRC, and then CE, against the percent change in human and physical capital in a cross-sectional framework. The regression analysis shows whether variations across states in human or physical capital are closely linked to variations in CE or NRC among states.

The results of this analysis are shown in table 5.[10] Overall, neither the changes in human capital nor those in physical capital explain, in a statistical sense, differences in net relative change across states. We do, however, find that changes in human capital endowments explain differences in the competitive effect across states. Specifically, we find that, *ceteris paribus*, states with larger increases in human capital endowments per manufacturing employee had larger values for their competitive effect. Changes in physical capital endowments, however, do not explain differences in the competitive effect.

The difference in explanatory power of human capital between the two regressions is not surprising. A state's relative export growth is affected by a variety of factors besides changes in resource endowments. A list of reasonable determinants includes resource changes in the rest of the world, demand changes in both the United States and the rest of the world and promotional expenditures by state governments.[11]

By focusing on the competitive effect, some of the potentially confounding effects associated with a state's industry mix are eliminated. For example, foreign demand shifts toward certain industries would result in rapid export growth (and large positive NRCs) in states that happened to have relatively large export concentrations in those industries. Conversely, in states that had relatively small shares in the rapidly growing industries, we might find NRCs that are negative even though many of their industries may have experienced faster-than-national export growth.

## CONCLUSION

A shift-share analysis reveals that the differing growth of state exports relative to the national average was due primarily to the "competitive effect," that is, faster-than-national or slower-than-national export growth in individual indus-

[8]Following Hufbauer (1970), this method of calculating human capital has been used frequently in international trade studies. Average manufacturing wages for 1976 and 1986 are from the U.S. Department of Commerce (1981 and 1988). Unskilled manufacturing wages were from the Current Population Survey-BLS Microdata File. A 10 percent discount rate was used for all states. This value affects the levels of human capital per worker, but does not affect the statistical results.

[9]Data for depreciable assets are from the *Annual Survey of Manufactures*. Data represent the gross book value of depreciable assets at year's end, 1975 and 1985.

[10]Nevada was excluded from the reported regressions because an examination of the residuals indicated that it was an outlier.

[11]Evidence is presented in Coughlin and Cartwright (1987) and Coughlin (1988) that export promotion expenditures by state governments alter the export performance of states. We also recognize that the rest of the world does not consist of identical countries, a fact that creates numerous empirical issues. States export their products to different mixes of foreign countries. Thus, each state's exports are affected by specific foreign supply and demand changes to varying degrees. Primarily because of the volatility of exchange rates in the 1980s, the different regional effects of exchange rate changes is a topic that has received increasing attention. See Cox and Hill (1988) and Carlino et al. (1990) for attempts to identify the differential output effects across states of exchange rate changes.

Table 5

**State Export Growth and Change in Endowments[1]**

| Dependent Variable | Constant | Independent Variables: Human Capital | Independent Variables: Physical Capital | $\bar{R}^2$ |
|---|---|---|---|---|
| Net Relative Change | −1.41 | −0.01 | 0.18 | −0.02 |
| | (−0.07) | (−0.22) | (1.14) | |
| Competitive Effect | −36.29 | 0.69* | −0.06 | 0.25 |
| | (−0.49) | (4.07) | (−0.11) | |

NOTE: The value of the t-statistics are in parentheses. An asterisk denotes significance at the 5 percent significance level using a two sided hypothesis test. $\bar{R}^2$ is the adjusted coefficient of determination.

[1]Human capital is the percent change of a state's human capital per worker between 1976 and 1986, while physical capital is the percent change of a state's physical capital per worker between 1976 and 1986. The dependent variables are measures of export growth. See the appendix for additional details.

tries in the state. The industrial composition of exports in a state and the concentration of a state's exports in industries that grew relatively rapidly in the state were both found to be less influential in determining why a state's export growth diverged from that of the nation. Thus, our analysis suggests that a state's industrial structure does not always provide useful information in accounting for its export growth.

Since previous research has established that capital abundance—in particular, human capital—is the United States' primary source of international comparative advantage, the link between a state's 1976-86 export growth and its change in physical and human capital abundance was examined. No link was found between a state's export growth relative to the nation (that is, its net relative change) and the growth of either its human or physical capital. When differences in industrial mix among states were eliminated, however, a positive association was found between a state's export growth and the growth of its human capital. In other words, a state's competitive effect was related to its human capital growth.

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# Appendix
# Using Shift-Share Analysis To Analyze State Export Growth

Two important factors that determine whether a state's foreign exports grew at a different rate than the national average over a given period are the state's industrial mix of exports compared with the national mix (the industrial mix effect) and the differential growth rate of exports from individual state industries relative to their national counterparts (the competitive effect). Shift-share analysis enables these two factors to be separated and evaluated. The Esteban-Marquillas (1972) shift-share model makes the competitive effect completely independent of industry mix by calculating a third factor, called the allocative effect, which accounts separately for the covariance between the industry mix and the competitive effect (Kochanowski, et al. 1989).[1]

Let $S_{is}$ and $S_{in}$ denote proportions of total direct exports represented by the ith industry in state s and the nation, n, respectively; $G_s$ and $G_n$ are the 1976-86 growth rates of total exports in s and n, respectively; $G_{is}$ and $G_{in}$ the 1976-86 growth rates of exports in the ith industry in s and n, respectively; and $E_s$ the 1976 level of direct exports in state s.[2]

For the 1976-86 study period, the difference between the state's actual 1986 exports and what its 1986 exports would have been if state exports had grown at the national rate between 1976 and 1986 is called the Net Relative Change (NRC). In symbols,

$$(1)\quad NRC_s = E_sG_s - E_sG_n.$$

This is equivalent to:

$$(1')\quad NRC_s = \Sigma\,(E_sS_{is}G_{is} - E_sS_{in}G_{in}),$$

where the summation in this equation, as well as those in the following equations, are over all manufacturing industries. Exports were not reported for some industries for one of the required years, so the two equations yielded different values of NRC for some states. Equation 1' was used for our calculations.

A state's export growth relative to the nation, as reflected in its NRC, is due to its industrial mix effect (IME) and its competitive effect (CE)—which identifies the extent that exports of individual state industries grew at rates different from their national counterparts. There is an additional factor, called the allocative effect (AE), which can be interpreted as a measure of the degree to which a state's exports were concentrated in industries at the beginning of the study period that grew faster than the national industry average. Thus, for a given state,

$$(2)\quad NRC = \Sigma\,IME_i + \Sigma\,CE_i + \Sigma\,AE_i.$$

The industry mix effect is measured by first calculating what the state's 1986 exports would have been if, given its actual 1976 industrial mix of exports, a state's exports for each industry grew at the national industry rate. The IME is the difference between this hypothetical level and the level of 1986 exports the state would have had if (1) it had the same export

[1]Esteban-Marquillas (1972) and Kochanowski, et al. (1989) show that the traditional shift-share model fails to isolate the competitive and industry mix effects.

[2]Direct export data for some industries in some states were not disclosed by the U.S. Department of Commerce to ensure confidentiality. To impute this data, which accounted for less than 3 percent of the 1976 or 1986 continental U.S. direct exports totals, other available indicators of state export activity, such as total export-related shipments and export-related employment, were used.

## Values Used in Shift-Share Example (dollar amounts in millions)

| | State S | | | | | Nation N | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1976 Exports | 1986 Exports | $G_S$ | $S_{iS}$ | $G_{iS}$ | 1976 Exports | 1986 Exports | $G_N$ | $S_{iN}$ | $G_{iN}$ |
| Total | $10 | $17.6 | 1.76 | | | $100 | $158 | 1.58 | | |
| Industry 1 | 4 | 5.6 | | 0.4 | 1.4 | 20 | 30 | | 0.2 | 1.5 |
| Industry 2 | 6 | 12.0 | | 0.6 | 2.0 | 80 | 128 | | 0.8 | 1.6 |

mix as the nation and (2) its exports had all grown at the corresponding national rate. A state's IME is calculated by the following:

$$(3)\ \text{IME} = \Sigma\, E_s(S_{is} - S_{in})G_{in}.$$

The competitive effect, which examines the differential industry growth rates of state vs. national exports, is calculated by first calculating the level of exports that the state would have achieved in 1986 if each of its industry's exports had grown at its actual rate, but assuming that the state had an industrial structure identical to the nation. The CE is simply the difference between this level and the state export level that would have existed in 1986 if the state's industrial mix of exports and export growth had been identical to the nation's. Thus, the competitive effect is calculated as:

$$(4)\ \text{CE} = \Sigma\, E_s S_{in}(G_{is} - G_{in}).$$

Finally, the allocative effect is calculated as follows:

$$(5)\ \text{AE} = \Sigma\, E_s(S_{is} - S_{in})(G_{is} - G_{in}).$$

The allocative effect indicates the degree to which a state's exports are concentrated in industries whose exports have grown more rapidly than at the national level.

To facilitate meaningful comparisons among states, each state's shift-share components reported in table 2 were divided by the level of state exports that would have resulted in 1986 if such exports had grown at the national rate between 1976 and 1986. That is, each state's components are divided by actual 1986 exports minus the state's net relative change. Thus, these "normalized" results indicate the percentage deviation of actual 1986 state exports from the level that would have resulted from export growth at the national 1976-86 rate.

### *A Numerical Example*

An example may clarify the application of the shift-share technique. Suppose 1976 and 1986 exports in state S and nation N are as shown in the table. $E_S$, the 1976 base period export level in S is $10 million. For each of the two industries, growth rates are simply the ratio of 1986 to 1976 exports. For example, $G_{1S} = 1.4$ (5.6/4). Export shares are each industry's share of total 1976 exports. For example, $S_{1S} = 0.4$ (4/10). S's net relative change can be calculated using equation 1:

$$(1)\ \text{NRC} = E_S G_S - E_S G_N.$$

Substituting data for S and N yields:

$$10(1.76) - 10(1.58) = \$1.8 \text{ million}.$$

Alternatively, NRC can be calculated using equation 1':

$$(1')\ \text{NRC} = \Sigma\, (E_S S_{iS} G_{iS} - E_S S_{iN} G_{iN}).$$

Substituting data for S and N yields:

for i=1: $10(0.4)(1.4) - 10(0.2)(1.5) = \$2.6$ million
for i=2: $10(0.6)(2.0) - 10(0.8)(1.6) = -0.8$
Total NRC = $1.8 million

The industrial mix effect for S is found using equation 3:

$$(3)\ \text{IME} = \Sigma\, E_S(S_{iS} - S_{iN})G_{iN}.$$

Substituting data for S and N yields:

for i=1: $10(0.4 - 0.2)1.5 = \$3.0$ million
for i=2: $10(0.6 - 0.8)1.6 = -3.2$
Total IME = −$0.2 million

S's competitive effect is calculated using equation 4:

$$(4)\ CE = \Sigma\ E_S S_{iN}(G_{iS} - G_{iN}).$$

Substituting data for S and N yields:

$$\begin{aligned} \text{for } i=1:\ & 10(0.2)(1.4-1.5) = -\$0.2 \text{ million} \\ \text{for } i=2:\ & 10(0.8)(2.0-1.6) = \quad 3.2 \\ & \text{Total CE} = \$3.0 \text{ million} \end{aligned}$$

Finally, S's allocative effect is computed using equation 5:

$$(5)\ AE = \Sigma\ E_S(S_{iS} - S_{iN})(G_{iS} - G_{iN}).$$

Substituting data for S and N yields:

$$\begin{aligned} \text{for } i=1:\ & 10(0.4-0.2)(1.4-1.5) = -\$0.2 \text{ million} \\ \text{for } i=2:\ & 10(0.6-0.8)(2.0-1.6) = \quad -0.8 \\ & \text{Total AE} = -\$1.0 \text{ million} \end{aligned}$$

As equation 2 shows, a region's NRC is the sum of its IME, CE and AE [$1.8 million = (−$0.2 million) + $3.0 million + (−$1.0 million)]. These results indicate that S's 1986 exports were $1.8 million higher than if they had grown at the national rate between 1976 and 1986. S's 1976 exports were relatively more concentrated than were the nation's exports in industry 1, a comparatively slow-growing industry at the national level. As indicated by IME, this unfavorable industry mix caused S's 1986 exports to be $0.2 million below the level it would have achieved if its 1976 export mix had been identical to that of the nation.

S's CE indicates that its 1986 exports were $3.0 million higher because exports of its industries grew faster than the corresponding industries at the national level. Although export growth of S's industry 1 was slightly slower than the national rate, this influence was more than offset by industry 2's substantially faster-than-national growth; since industry 2 accounted for an 80 percent share of national exports and, therefore, was weighted more heavily than industry 1 in computing total CE, S's CE was positive.

The AE value, which reflects differences between S and N in both industry mix and relative industry growth, was negative. This result reflects S's relatively higher- (lower-)than-national export concentration in 1976 in industry 1 (industry 2), in which its exports grew slower (faster) than the national average in the 1976-86 period. To summarize, this example shows that S's exports grew faster than the nation's exports, despite S's unfavorable mix of export sectors; this occurred because its industries' exports grew faster than exports of the corresponding industries at the national level.

To ease comparison among states, each of S's shift-share components is expressed as a percentage of S's 1986 level of exports that would have resulted if S's 1976 exports had expanded at the national rate between 1976 and 1986. This normalizing factor is S's actual 1986 export level minus its NRC or, in the current example, 17.6 − 1.8 or 15.8. In percentage terms, the normalized components are NRC, 11.4 percent; IME, −1.3 percent; CE, 19.0 percent and AE, −6.3 percent. S's 1986 exports were 11.4 percent greater than if they had grown at the national rate from 1976 to 1986. Although the state industry mix depressed 1988 exports by 1.3 percent from the level that would have existed had other things been equal, its relatively fast growth of individual industries, expressed in CE, allowed S's exports to grow more rapidly than did exports at the national level.

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# The Pitfalls of Exchange Rate Targeting: A Case Study from the United Kingdom

"My advice has been for Britain to retain its system of flexible exchange rates and to stay out of the present arrangements of the ERM.... It would not be in Britain's or, I believe, Europe's interest to join the present half-baked system."

Alan A. Walters

SINCE THE BREAKDOWN of the Bretton Woods System of fixed exchange rates in the early 1970s, the search for a new monetary order has continued. In theory, the system that was adopted nearly 20 years ago seems ideal: it allowed exchange rates to float freely and each country to pursue an independent domestic monetary policy while the exchange rate compensated for differences in economic conditions across countries. The actual behavior of nominal exchange rates during this floating period, however, has been extremely volatile in the short run; moreover, over longer periods, prolonged swings in real exchange rates have occurred, which appear hard to explain in terms of economic fundamentals.[1]

Although, in one sense, this volatility is *prima facie* evidence that the major currencies *have* floated freely, the desirable characteristics of floating exchange rates have been offset, in the minds of many observers, by substantial disruptions in trade flows that such currency fluctuations are thought to have caused. In the United States, for example, the strong appreciation of the dollar in the early 1980s and the large, per-

[1]Typically, factors such as relative rates of economic performance, foreign-domestic interest rate differentials, relative inflation rates and changes in a nation's trade deficit or surplus come under the umbrella of economic "fundamentals," linked by economic theory to exchange rate movements. See Coughlin and Koedijk (1990) for a review of movements in the real exchange rates of the major currencies and tests of alternative approaches to explain them.

sistent U.S. current account deficit that developed during the same period are often cited as the adverse consequences of unbridled free-floating exchange rates.[2] At less aggregated levels, the loss of jobs and market share by firms in the automobile and steel industries are viewed by some observers as a consequence of freely floating exchange rates.

In this article, we discuss the benefits of using monetary policy to peg the value of the exchange rate at some desired level and analyze the mechanics and likely effects of resorting to exchange rate targeting as an approach to conducting monetary policy. We first outline a simple model of exchange rate determination and use this framework to argue that exchange rate pegging could produce desirable monetary policy actions only when the real economy is stable. This proposition is illustrated with a case study of exchange rate pegging in the United Kingdom and the economic consequences associated with this policy.

## SOME FUNDAMENTAL EXCHANGE RATE DISTINCTIONS

Before discussing the mechanics of exchange rate determination, one must understand the difference between real and nominal exchange rates. Such an understanding will explain why pegging the value of the exchange rate is attractive to some policymakers.

The nominal exchange rate is the relative price of one currency in terms of another. For example, if it takes two dollars to buy one British pound, the exchange rate could be quoted as \$2.0/£; alternatively, it could be quoted as 0.5£/\$. Many newspapers quote the exchange rate both ways.

The nominal exchange rate tells us nothing, however, about the "purchasing power" of one currency vis-a-vis another. The real exchange rate is useful for this purpose; it is obtained by multiplying the nominal exchange rate by the ratio of the domestic and foreign price levels. The real exchange rate (RER) can be written as $RER = E\left(\frac{P}{P^*}\right)$, where E is the nominal exchange rate expressed as units of foreign currency per domestic currency unit, P is the domestic price level and P* is the foreign price level. Unlike the nominal exchange rate, the real exchange rate is not observed in financial markets; instead, it must be approximated by a calculation similar to this.[3]

Distinguishing between real and nominal exchange rates would be pointless if the nominal exchange rate and the prices of goods and services in different countries all responded to a common influence at the same rate and by the correct magnitudes so that no relative prices were changed, even in the short run. As a general rule, however, nominal exchange rates adjust more quickly than prices to actual or expected changes in economic variables.[4] Because E adjusts more quickly than does $\left(\frac{P}{P^*}\right)$ to economic factors, the real exchange rate will mimic, at least temporarily, movements in the nominal exchange rate. These differences in the speed of price adjustments are important because, until both the nominal exchange rate and prices adjust fully to a change in another variable, a nation's pattern of trade and trade balance may be disrupted.

Consider, for example, some good news about the U.S. economy that leads to a 10 percent appreciation of the dollar but no immediate response in either U.S. or foreign prices. This event causes a 10 percent appreciation of the real exchange rate. This change immediately makes foreign goods 10 percent less expensive to U.S. citizens and U.S. goods 10 percent more expensive to foreigners. Eventually, the increased demand for foreign goods and reduced demand for U.S. goods (through a variety of mechanisms) will result in higher prices of foreign goods and lower prices of U.S. goods; in the interim, however, foreign exports to the United States will rise and U.S. exports to the rest of the world will decline. Thus, while U.S. consumers will enjoy a temporary boost in their purchasing power, some U.S. firms will be harmed tem-

[2]See, for example, Destler and Henning (1989).

[3]Among the problems in making this calculation are the choice of a conceptual measure for P and the potential measurement errors associated with this choice. The CPI, PPI and indexes of unit labor costs have been used to calculate real exchange rates, sometimes with significantly different results. See Batten and Belongia (1987) for a discussion of factors that may affect the measurement of the real exchange rate.

[4]Contracts, both for goods prices and wages, often are cited as a reason for sluggish price level adjustments.

porarily by a decline in their domestic and export sales. After domestic and foreign goods prices adjust fully to the news that caused the dollar appreciation, the real exchange rate will have returned to its original level and neither U.S. consumers nor U.S. exporters will be better or worse off.

### *The Exchange Rate as a Policy Target*

Typically, policymakers have made the nominal exchange rate a primary target for policy actions when real exchange rate changes were judged to have had significantly adverse effects on their country's domestic and export sales. Economists have investigated the exchange rate-export relationship from two perspectives: (1) How much does a change in the *level* of the real exchange rate affect trade and (2) How much does exchange rate *variability* affect trade? The responsiveness of export sales to changes in the level of the real exchange rate has been estimated for a variety of commodities; in general, economists have found significant effects.

From the policy standpoint, however, moving the real exchange rate to a new level has not been a frequent topic of policy discussions.[5] Instead, the issue has been one of stabilizing the nominal value of the exchange rate and, specifically of reducing the adverse trade effects of exchange rate variability associated with a free-floating exchange rate system. Indeed, the European Monetary System (EMS), a cooperative agreement among members of the European Community, was created in 1978 to reduce exchange rate volatility because it was widely felt that intra-European Community trade was being impeded by the costs of this volatility. It has never been clear, however, what those costs are.[6] Moreover, arguments that volatile exchange rates impede trade because of the "increased uncertainty" they generate have found weak or no empirical support.[7] Finally, even economic theory does not demonstrate that reducing exchange rate variability will contribute to improved economic performance.[8] Whether a real exchange rate that is too high or too volatile really produces short-run damage to the export sector, the presumption that such damage does occur is the main reason behind efforts to peg the value of the nominal exchange rate.

## A SIMPLE MODEL OF THE EXCHANGE RATE

Any discussion of the implications of attempting to peg the value of exchange rate must begin with a simple notion of why exchange rates change in the first place—that is, with a model of the factors that influence the exchange rate. Suppose that there are two countries: the home country and the rest of the world, whose economic variables are denoted by an *. The nominal exchange rate between these two currencies can be written as (all variables, except interest rates, are in logarithms):[9]

$$(1)\quad e = (m^* - m) - h(i^* - i) - k(y^* - y) + s$$

where:

- e = the nominal exchange rate in units of foreign currency per unit of domestic currency;
- m = nominal money supply;
- i = nominal interest rate;
- y = real GNP;
- k = the income elasticity of real money demand;
- h = the interest semi-elasticity of real money balances;[10]
- s = a "shift" factor that reflects the impact on the exchange rate of all factors other than those shown.

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[5]While the September 1985 Plaza Accord may seem to be one exception to this discussion, subsequent meetings to that agreement have tended to focus on *stabilizing* the exchange rate around some target value.

[6]See Ungerer, et al. (1986), pp. 17-18, for a discussion of the ambiguity associated with arguments of how exchange rate variability might affect trade.

[7]For a review of the evidence, see Farrell et al. (1983) who conclude that, generally, the relationship is not supported by the empirical evidence. DeGrauwe (1988), however, finds some evidence suggesting a negative association.

[8]See Meltzer (1990) for a review of the alternative arguments.

[9]This exchange rate model, based on the standard monetary approach to the balance of payments, is taken from Dornbusch (1980). The model assumes that "uncovered interest parity" holds, which means that, at every point in time, the interest rate differential (i*-i) is equal to the expected change in the exchange rate. Thus, any shock that affects the expected path of the exchange rate will be reflected in the interest differential.

[10]An elasticity, such as k or h, represents the percentage change in one variable (e) in response to a 1 percent change in some other variable [(i*-i) or (y*-y)]; h is a semi-elasticity because the interest rate terms are not expressed in logarithms.

The equation states that a country's currency will depreciate (e will decline) if domestic money growth accelerates, domestic nominal interest rates decline, or domestic real economic growth slows relative to changes in the same variables in the foreign country; moreover, there also are exogenous shocks that can adversely affect the exchange rate independent of the three influences just described. In this model, policymakers can affect the nominal exchange rate either through monetary policy, which affects m, or through policies that affect domestic interest rates or output; their influence on e, of course, depends on relative changes in these variables. The shift factor, s, presumably is beyond the ability of policymakers to control.

Equation 1 can be modified to express the real exchange rate as follows:

$$(2)\quad rer = (m^* - m) - h(i^* - i) - k(y^* - y) - (p^* - p) + s,$$

where $p^*$ and p are the logarithms of the foreign and domestic price levels, respectively. Thus, equations 1 and 2 show that the nominal and real exchange rates are affected by essentially the same variables. And, empirical work shows that the nominal and real exchange rates typically move together in the short run, suggesting that aggregate price levels and their differential adjust more slowly than the other factors discussed above.[11]

## *Policy Levers and the Exchange Rate*

A comparison between equations 1 and 2 highlights a key conclusion for any policymaker concerned with exchange rate targets. While changes in domestic monetary policy that affect m relative to $m^*$ could move the nominal exchange rate in equation 1 permanently to a new level, monetary policy can change the *real* exchange rate only if the nominal exchange rate and aggregate price level differential adjust at different speeds. Even in this case, the change in the *real* exchange rate will be only temporary. In equation 2, for example, an increase in the domestic money supply (m) reduces rer while an increase in the domestic price level (p) increases it. If one believes that changes in the domestic price level ultimately are proportional to changes in the domestic money supply—a standard interpretation of the quantity theory of money—equation 2 shows that these effects will offset each other, at least in the long run; thus, the real exchange rate, but not the nominal rate, will return to its former level. Indeed, this "netting out" effect could occur even in the short run if people anticipated the monetary policy change and responded to it by quickly raising prices. The conclusion from equation 2, then, is that monetary policy actions have no permanent effects on the real exchange rate; any effect is strictly temporary.

Given equations 1 and 2, we can now consider two possible "sources" of exchange rate changes. Broadly speaking, the two sources are nominal factors that originate from a change in the money supply and real factors that originate outside of the monetary sector of the economy. What difference does the source of the change in the exchange rate make?

Suppose that the source of the exchange rate movement is a nominal one—that the domestic money stock is growing rapidly relative to that in the foreign country. By itself, this would produce some domestic inflation and a continuing fall in the currency's nominal value. If the monetary authority were pegging the nominal value of the exchange rate, however, it would be forced to buy back the "excess" money with foreign reserves or otherwise tighten monetary policy. As long as the foreign money supply growth were unchanged, pegging the exchange rate would have had the beneficial effect of forcing the monetary authority to slow money growth and domestic inflation.

In contrast, suppose some supply-side improvement boosts domestic real GNP, causing the nominal exchange rate to rise. The effect on the real exchange rate depends on how much the effect of a lower domestic price level (or slower inflation rate) offsets the effect of the higher real income level (or growth rate). If the monetary authority resists this rise in the nominal exchange rate, however, the result will be faster money growth and a higher unnecessary inflation.

The problem for policymakers is that only the nominal exchange rate can be observed in world financial markets and, as such, exchange rate targets also are expressed in nominal terms. For

[11]See, for example, Mussa (1986).

a variety of reasons, however, policymakers have trouble distinguishing whether changes in the nominal exchange rate are due to nominal or real sources. Moreover, they are generally ignorant as well as to whether these changes are permanent or temporary.

An early example of the problem associated with this confusion was experienced by the United Kingdom in 1977. The United Kingdom had recently started producing oil and was beginning the transition from net importer to substantial exporter of oil. Both a nominal and real appreciation of the currency would be expected under the circumstances. The monetary authorities, however, initially resisted the nominal appreciation by selling pounds and buying massive amounts of foreign currencies.[12] This strategy was later abandoned because of its unacceptable implications for domestic inflation.[13] We now turn to a more recent episode of attempted exchange rate pegging, which followed the same pattern as the earlier episode.

## A CASE STUDY OF THE UNITED KINGDOM SINCE 1987

In figure 1, the daily DM/£ exchange rate is plotted over the most recent three-year period. Overall, there are four striking aspects of these data: a large appreciation of pound against DM in February 1987, an extremely stable rate at close to DM 3.0/£ between February 1987 and March 1988, another large appreciation of the pound in March 1988 and a general and sharp depreciation of the pound throughout 1989. Each of these episodes is discussed briefly below.

The appreciation of the pound from DM 2.747/£ on February 3, 1987, to DM 2.95/£ by March 18 is associated with the Louvre Accord. This agreement pledged cooperative monetary policies among the G-7 countries to strengthen what was then a weakening value of the dollar. This agreement presumably implied relatively restrictive monetary policy in the United States and relatively expansionary monetary policies among the other G-7 members. In theory, there is no reason for the pound to appreciate against the DM if both the United Kingdom and West Germany are intervening similarly to support the value of a third currency (the dollar). Pepper (1990) has argued, however, that Nigel Lawson, then Chancellor of the Exchequer, used the Louvre Accord as an opportunity to introduce a nominal exchange rate target of DM 3.0/£.[14]

Although data on intervention in specific currencies are not available, the actual pattern of net foreign exchange reserves at the Bank of England, shown in table 1, is broadly consistent with Pepper's view. The one-year interval of a nearly stable DM 3.0/£ exchange rate is associated with frequent, and often massive, foreign exchange interventions. Instead of steady interventions in one direction, as one would expect from an effort to support the value of the dollar, the amount of intervention varies widely across months; it even switches direction, with reductions in foreign exchange reserves in some months.

The data in figure 1 confirm this view as well. They show that, while the DM/£ exchange rate was flat over the period, the pound appreciated steadily and substantially against the dollar—rising from $1.52 on February 3, 1987, to $1.90 by January 1988. Thus, the evidence in both the table and figure is consistent with the view that the Bank of England varied the amount of intervention to keep the DM/£ rate near a rate of DM 3.0/£ while paying less attention to the movement in the $/£ rate.

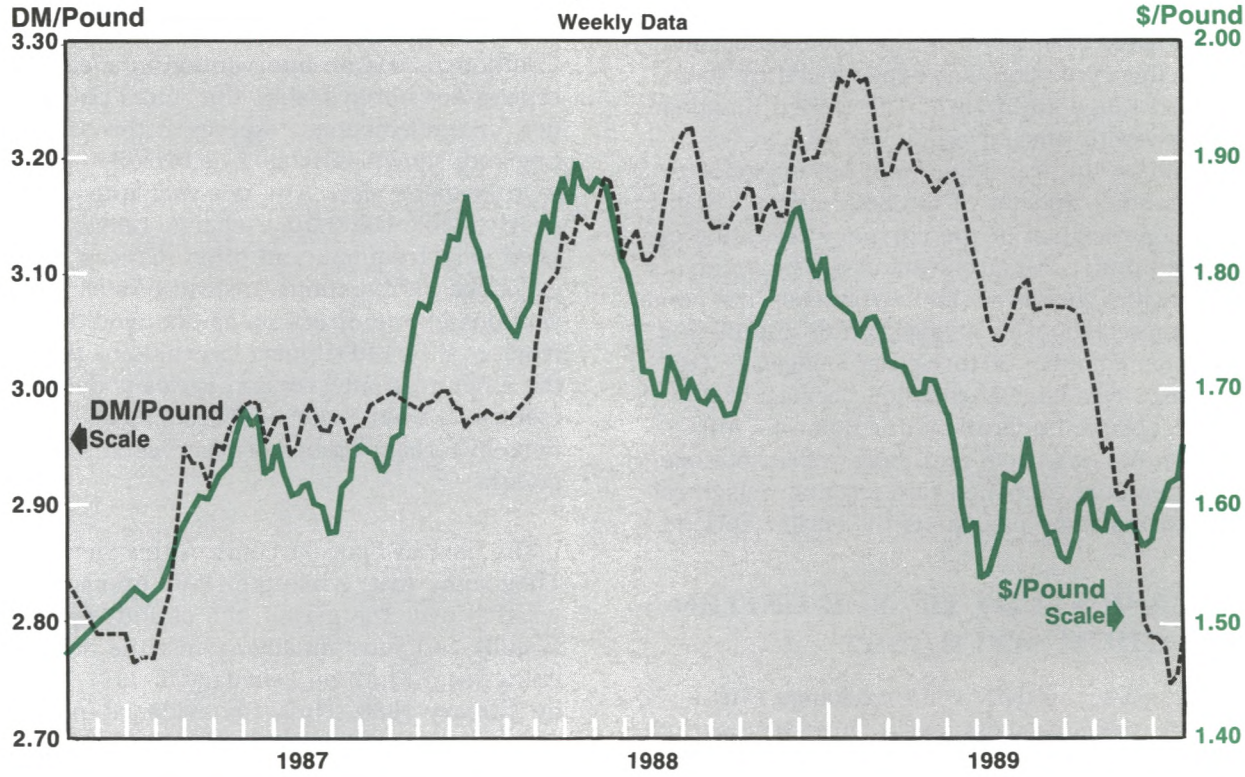
Although the United Kingdom apparently directed its monetary policy to achieve an exchange rate target of 3.0DM per pound throughout most of 1987, it is unclear why this objective was chosen. In view of the earlier discussion, countries direct monetary policy to exchange rate objectives when exports are weak and unemployment in export industries is rising. In the United Kingdom, however, exports were strong at the time this policy strategy was adopted and, overall, the United Kingdom economy was performing quite well: inflation had declined substantially, real growth was strong and the government was running an increasing budget surplus.

[12]U.K. foreign exchange reserves rose from SDR2.3 billion in 1976 to SDR16.1 billion in 1977, a seven-fold increase.

[13]See Chrystal (1984) for a thorough discussion of this episode.

[14]In the United Kingdom, the Chancellor of the Exchequer has ultimate responsibility for monetary policy. The Bank of England is under the Chancellor's direct control.

## Figure 1
## The DM/Pound and $/Pound Exchange Rate




### Table 1
### Changes in U.K. Foreign Exchange Reserves (millions of dollars)

| | |
|---|---|
| February 1987 | $ 287 |
| March | 1,785 |
| April | 2,912 |
| May | 4,760 |
| June | −230 |
| July | 499 |
| August | −457 |
| September | 380 |
| October | 6,699 |
| November | 31 |
| December | 3,737 |
| January 1988 | 38 |
| February | −25 |
| March | 2,225 |
| April | 514 |
| May | 814 |

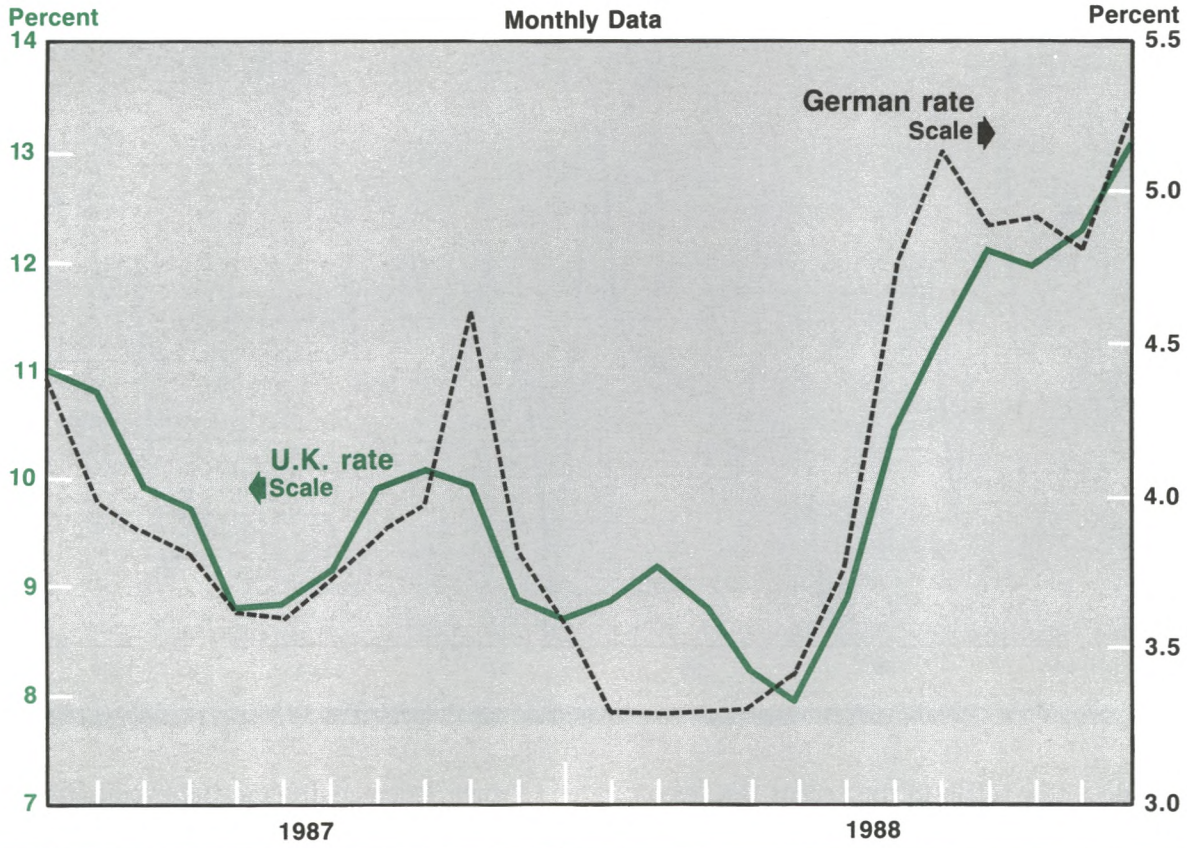
SOURCE: Datastream

Why, then, peg the pound to the DM? To condense a long and complicated series of events leading up to this decision, the monetary aggregates in the United Kingdom—as in other industrialized countries—began to behave in the 1980s in ways that were perceived to be erratic.[15] In particular, the traditional linkages between monetary actions and changes in either output or inflation appeared to weaken or evaporate. Thus, if the monetary aggregates could not be relied upon for guidance in conducting monetary policy, becoming a "shadow" member of the EMS's Exchange Rate Mechanism (ERM) and pegging the pound to the DM might have been viewed as a plausible alternative for monetary targeting.[16] Indeed, one advantage of

[15]This shift in the behavior of the U.K. monetary aggregates was exacerbated by the abolition, in June 1980, of a quantitative control on bank liabilities (known as the corset) and other regulatory changes.

[16]Much of this discussion is drawn from Pepper (1990). Although circumstantial evidence seems to support this view, to our knowledge, no official statements exist that explicitly establish a DM 3.0/£ exchange rate target.

Figure 2
## Three-Month Eurocurrency Rates for Germany and the United Kingdom

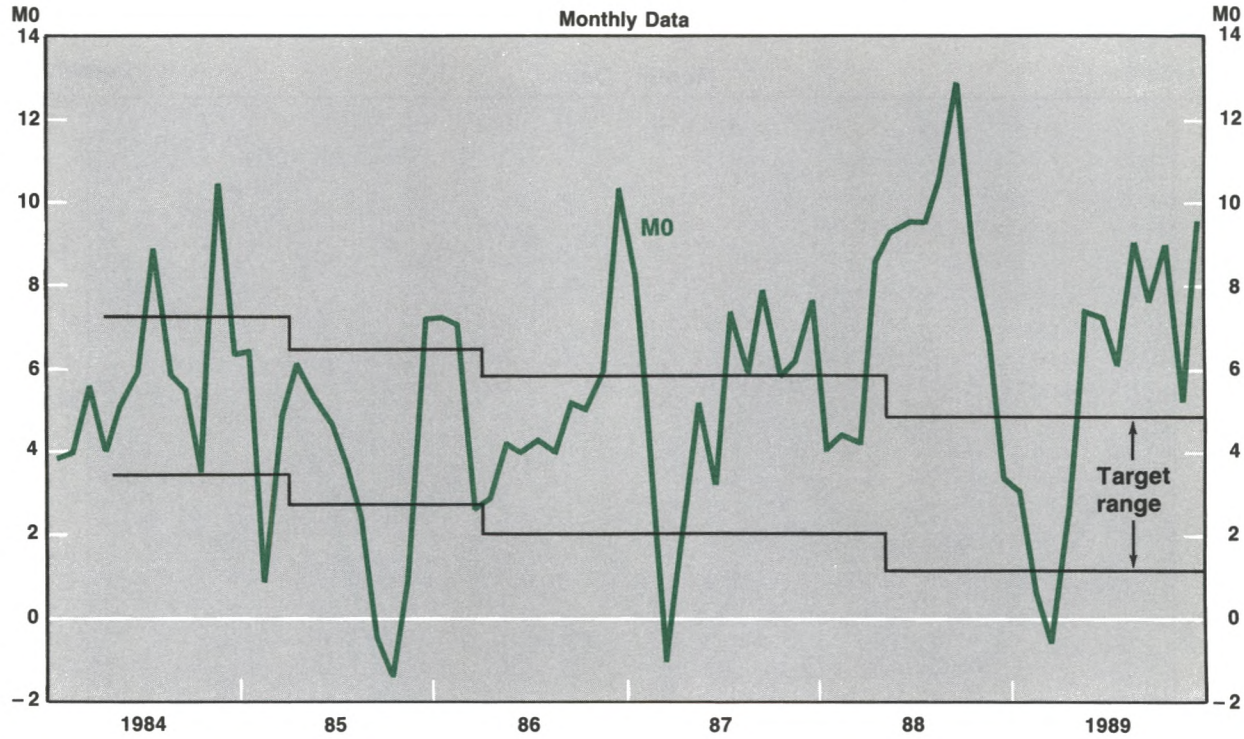



the EMS from the perspective of its high inflation members is that low and stable inflation in Germany will discipline their internal policies—especially monetary policy—if their currencies are tied to the DM. As we shall see, however, it is not enough just to peg your currency to the DM; you must peg it at the correct rate as well.

Early in 1988, the pound again began to appreciate strongly, both in real and nominal terms, because of a widening U.K.-German interest rate differential on one hand and several well-publicized events that presaged stronger U.K. real growth on the other hand. As figure 2 shows, the U.K.-German interest differential widened considerably between December 1987 and February 1988. On the real side, the end of a ban on overtime work by miners on March 7, the announcement of a large oil discovery on March 8 and a large tax-reducing budget on March 16 are consistent with reductions in the values of either the $(i^* - i)$ and $(y^* - y)$ terms in equation 1 and, therefore, appreciations of the pound. Each of these events would tend to raise both the real rate of return on physical assets and real output for the United Kingdom in equation 1 so that (if there were no immediate change in U.K. price levels) the real interest rate and real output differentials would decline and the pound would appreciate.

What could be done about this rise in the exchange rate? From a theoretical standpoint, the term $(m^* - m)$ is an obvious policy lever in equation 1. And, because the money stock can be controlled by the central bank, this is an effective lever with which to achieve a reduction in its currency's nominal value, should that be the desired policy result. What is required is a faster growth rate of its money stock relative to the money growth in the nation against which the exchange rate has appreciated.

## Figure 3
## Three-Month Moving Average of U.K. M0 Growth



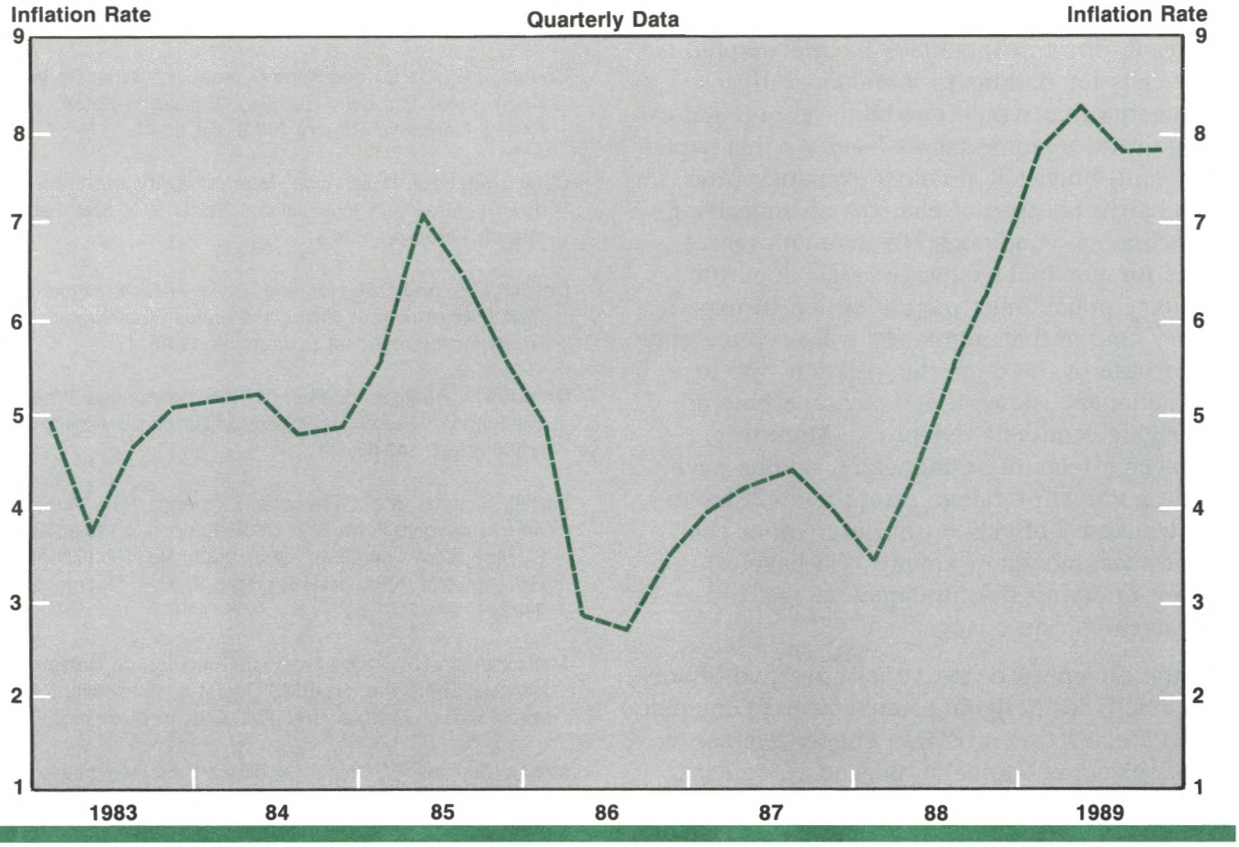

How does this relate to the recent U.K. experience? Figure 3 plots the growth rate of M0 (the U.K. monetary base), the monetary variable targeted by the Bank of England in the late 1980s, and the target ranges that the Bank had established for its policy objective. As the figure shows, while the target range for M0 was being adjusted downward, actual M0 growth was increasing on average.[17] Moreover, a sharp increase in M0 growth occurred early in 1988, when the pound appreciated substantially above the level of 3.0 DM that had prevailed for about a year.

Figure 4 depicts the inevitable consequences of this action. As growth in M0 expanded, the U.K. inflation rate, with a lag, also accelerated. Recalling from equation 2 that faster money growth in the United Kingdom will be associated with a decline in the (nominal) DM/£ exchange rate, the data in figures 1-3 show that the point at which the pound began to decline in value coincides closely with the time at which U.K. money growth began to increase and U.K. interest rates fell. Thus, while expansionary monetary actions by the Bank of England resulted in a reduction in the DM/£ nominal ex-

[17]The effects of this monetary expansion were reinforced by four incremental reductions of 0.5 percentage points each in the U.K. base lending rate between March 9 and May 11. Thus, while expansionary U.K. monetary policy was helping to reduce the pound's value by decreasing the value of the (m*-m) term in equation 2, further downward pressure on the pound was coming from a widening of the (i*-i) term in equation 2. This sharp decline in U.K. interest rates and its impact on the German-U.K. interest differential during the March-May interval also are shown clearly in figure 2. The base rate, set by the Bank of England, was reduced from 11 percent to 9 percent. See Pepper (1990).

Another factor in these U.K. interest rate movements is the "excess credibility" problem. The idea is that, under normal circumstances, an investment abroad carries the risk of an adverse exchange rate movement in addition to all of the usual risks. When a country is believed to be pegging its exchange rate, however, the exchange rate risk is reduced and, for a given foreign-domestic interest differential, additional capital will flow into the country that is pegging. Thus, once investors perceived and believed in a continuation of the U.K.'s attempt to peg the pound, financial capital flowed into the United Kingdom and tended to reduce U.K. interest rates.

Figure 4
**Four-Quarter Moving Average of U.K. Inflation Rate**




change rate, that effort also increased the U.K. inflation rate from 4.1 percent in 1987 to 7.8 percent in 1989 and 9.7 percent as of May 1990.[18]

The final episode, the sharp decline in the pound during 1989, reflects the increase in the U.K. inflation rate, relative to the German inflation rate, that was produced by the excessive U.K. monetary expansion. U.K. inflation, as measured by the CPI, had averaged near 4 percent between 1985-87. With the monetary expansion of 1987-88 the inflation rate accelerated to a peak of 12 percent in January 1989 and stood at 9.7 percent as of May 1990. German inflation, on the other hand, has remained relatively constant, near an average of 4 percent. As equations 1 and 2 indicate, domestic monetary expansion and the associated inflation will reduce a currency's nominal value with no long-run effect on its real value.

This result has led some observers to note the irony of how an attempt to peg the exchange rate to a low-inflation country (Germany) can result in higher domestic inflation. The problem with this reasoning, of course, is not the act of pegging itself but, rather, selecting the wrong value for the exchange rate target. If, for example, the United Kingdom had chosen to pursue an exchange rate objective of, say, DM 3.3/£, the real appreciation of the pound might have been accommodated without resorting to an offsetting domestic monetary expansion. But, by establishing the target at a level too low for the fundamental economic differences that then prevailed between the United Kingdom and Germany, the monetary expansion and subsequent inflation were necessary results of maintaining a DM 3.0 objective. Unfortunately, this type of error is clear only in hindsight. The fundamental problem for policymakers is how to deter-

[18]See Pepper (1990) for more detail on this episode.

mine the "correct" value for the exchange rate target in advance.

## CONCLUSIONS

Volatile movements in both exchange rates and trade flows in the 1980s have prompted many calls for nations to join cooperative agreements that would peg bilateral nominal exchange rates at some target level. As this paper points out, however, nominal exchange rates may change because of changes in underlying real economic conditions. To maintain target values for nominal exchange rates, domestic monetary policy must pursue either an expansionary course that ultimately will produce only an increase in the domestic inflation rate or a contractionary stance that will exacerbate an underlying economic downturn. Moreover, whatever effects these monetary actions have on the nominal exchange rate, they will have only transitory effects on trade or other real magnitudes; monetary actions will have no permanent effect on the fundamental real causes of the exchange rate change.

In the European context there are two important lessons for designing steps toward Economic and Monetary Union (EMU). The first lesson is that a system of mutuallly pegged currencies, such as the current ERM, has obvious dangers. Structural changes in one or another of the member countries may cause unnecessary inflation or deflation if real exchange rate adjustments are resisted. The second lesson is that, if a common currency were to be established, obstacles to real market adjustments must be eliminated.

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# Do Government Deficits Matter?

THERE HAS BEEN considerable concern about the size of the federal deficit and the rather modest success of the Gramm-Rudman-Hollings Act to reduce it. The traditional, that is, Keynesian, view of deficit spending in macroeconomics was that it could smooth out fluctuations in economic activity due to gaps between saving and investment that were primarily the result of exogenous shifts in investment. From this perspective, deficit spending was seen as both desirable and necessary to offset cyclical fluctuations in economic activity that were characteristic of capitalist, free-market economies.

Recent discussions of government deficits, however, have focused on their alleged adverse effects. It is now common to blame deficit spending for high real rates of interest and the large and persistent trade deficit. Moreover, there is widespread concern that large and persistent federal deficits will produce stagnant economic growth and result in renewed inflationary pressures.

An alternative view, called Ricardian equivalence, however, sees deficit spending as a harbinger of neither good nor ill. According to this view, deficit spending cannot offset fluctuations in economic activity due to exogenous shifts in either private saving or investment; nor, can it be blamed for high real interest rates or the large trade deficit. Moreover, it has no influence on the outlook for economic growth or inflation. Macroeconomic tests of the effects of deficits on the economy using U.S. time-series data have generally favored the Ricardian view.[1]

The purpose of this article is to review both views of deficit spending to determine which view of the relationships between deficit spending and various associated macroeconomic variables is supported by evidence from 16 OECD countries over the period 1975-86.[2]

[1]Recently, there have been three excellent surveys of the empirical investigations of Ricardian equivalence. See Barro (1987), Bernheim (1987) and Aschauer (1988). Also, see Evans (1988), Koray and Hill (1988) and Leiderman and Razin (1988) for more recent work that is not summarized in the three surveys. For some very recent work on this issue, see Feldstein and Elmendorf (1990), Modigliani and Sterling (1990) and Kormendi and Meguire (1990). Most of the empirical evidence against the Ricardian view is at the microeconomic level using cross-sectional or panel data.

[2]The reader is cautioned that the evidence presented here can be considered suggestive for only a couple of reasons. First, strictly speaking, Ricardian equivalence is a proposition about what happens when deficit spending is substituted for taxes at an unchanged expenditure level. Second, in a rational expectations framework, only unanticipated changes in deficits should affect macroeconomic variables, and there is no plausible way to isolate the unanticipated component of deficits from these annual data. Third, the deficit measures used here are not cyclically adjusted. Hence, they are endogenous, at least in part.

## THE CONVENTIONAL VIEW OF DEFICIT SPENDING

Total saving has two components: public and private saving. Public saving measures the government's surplus or deficit position: surpluses represent positive public saving, while deficits represent public dissaving. In the Keynesian view, deficits can be used to offset gaps between saving and investment, thereby stabilizing output around its potential (full-employment) level. For example, if private saving is too high relative to investment to achieve potential output, a government deficit will reduce the amount of total saving and close the gap between saving and investment. Conversely, if private saving is too low relative to investment, a government surplus can increase total saving. Hence, cyclical swings in economic activity arising from movements in the saving/investment gap can be shortened by changing public saving appropriately to maintain total saving at a level consistent with potential output.

### *Deficits and Private Saving*

The above analysis is based on the assumption that public and private saving are separate and distinct activities.[3] In the extreme, they are viewed as totally independent: changes in public saving have no direct effect on private saving and vice versa.[4] In this case, total saving will change one-for-one with changes in public saving. In the less extreme case, total saving is simply positively correlated with public saving.[5]

### *Deficits and Interest Rates*

In the conventional view, increases in the deficit cause the interest rate to rise.[6] Since the interest rate is the price of credit, it is determined by the supply and demand for credit. According to the traditional view, an increase in the deficit increases the demand for credit relative to the supply and, consequently, increases the interest rate.[7]

### *Deficits and the Trade Deficit*

The effect of deficits on credit demand can also affect the relationship between government deficits and the trade deficit. The effect of deficit changes on interest rates depends on the slope of the credit supply curve—the steeper the slope, the larger the effect on interest rates. Among other things, the slope of the credit supply curve depends on the degree of openness of the nation's money and capital markets to the rest of the world. In general, the more open these markets are, the flatter is the supply of credit.

To see this more easily, let's recast the discussion in terms of the demand for securities. In this framework, the price of bonds and, hence, the interest rate are determined by the supply and demand for bonds. The bond and credit markets are related inversely: those who supply credit are demanding bonds while those who demand credit are supplying bonds. If financial markets are open and competitive, the demand curve for bonds seen by individual bond suppliers, including the government, is flat at the market price of securities. In other words, no matter how many bonds that individuals, firms or the government may supply, individually, they see no effect on the market price of bonds and, hence, on the interest rate. All market participants, including the federal government, are

[3]The following discussion is based on the standard IS/LM aggregate demand-aggregate supply model of the macroeconomy, where deficit spending is treated as exogenous.

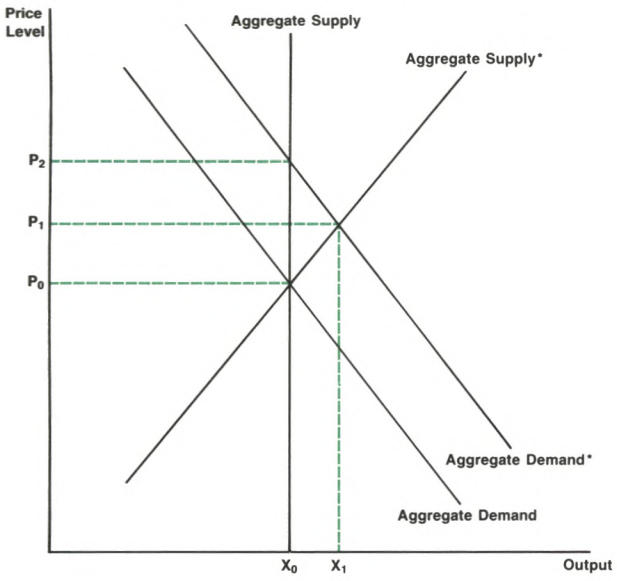
[4]Also, deficits can have an indirect effect on saving if the increase in the deficit spending raises real income and, hence, saving. Likewise, if a shift in the saving or investment functions cause a change in income, the deficit will respond endogenously because both expenditures and taxes are related to the level of income. Hence, the assumption that the series are independent applies to their autonomous components.

[5]Strictly speaking, the above conclusion holds as long as public and private savings are not perfect substitutes. Note, however, fiscal policy is used to offset changes in private savings, there may be a negative correlation between public and private savings even, if at a more abstract level, the series are unrelated. That is, there may be a policy reaction function where deficits respond, presumably with a lag, to changes in private savings.

[6]The discussion here abstracts from the possible effects of deficits on the rate of inflation, so the hypothesized effect in this section is on the *real* interest rate.

[7]Most standard IS/LM aggregate demand-aggregate supply models assume that there is no direct effect of the increase in the deficit on private savings; however, this assumption is not necessary to obtain the usual implications. All that is required is that the direct effect on private savings (if the effect is to increase it) be less than the increase in the deficit. Also, the effect on the interest rate would be small if the monetary authority monetized debt to keep real interest rates low. While this is a controversial issue, the evidence for the U.S. suggests that the Federal Reserve has not monetized the debt. See Thornton (1984). This discussion abstracts from the effect of the deficit on interest rates via a deficit-induced increase in the rate of inflation.

Figure 1
**Price Level and Output Determination**




"small" relative to the total market, that is, each is a "price-taker."[8] Thus, if the economy is sufficiently open, the money and capital markets are competitive and the government is a price-taker, changes in deficit spending will have no effect on the interest rate. Increases or decreases in the supply of bonds will be fully absorbed at the current market price.

This does not mean, however, that deficit spending has no effect on the economy. In the above case, the deficit will be matched by foreign claims on U.S. assets. That is, there will be a capital inflow which, given the balance-of-payments identity, must be matched by a trade deficit. Hence, if the economy is "sufficiently" open, there may be no (zero) correlation between government deficits and interest rates, but there may be a positive correlation between the government and trade deficits.

The strength of this correlation depends on the degree of openness of financial markets. If financial markets are only partially open or approximated by the competitive model, the government deficit will be positively correlated with both the interest rate and the trade deficit.

## *Deficits and Economic Activity*

The effect of deficits on economic activity can be illustrated in terms of the aggregate demand/aggregate supply model. The traditional view asserts that increases in the deficit will increase the demand for goods and services, as illustrated in figure 1. The extent to which the increase in aggregate demand affects output or prices is determined (among other things) by the slope of the aggregate supply curve. The steeper the slope of the aggregate supply curve, the larger the effect on the price level and the smaller the effect on output. If the aggregate supply curve were vertical, the deficit would affect only the price level.

Economic theory and empirical evidence suggest that the aggregate supply curve is upward-sloping in the short run.[9] If this is true, there should be a positive correlation between deficits and both prices and output.

## *Adverse Effects of Deficits on Output*

In addition to the positive effects of deficits on output, it is often suggested that deficits can affect output adversely because of their impact on interest rates. In a closed economy, some argue, the deficits raise the real interest rate and, thereby, "crowd out" private investment.[10]

[8]This argument also applies to the Federal Reserve's control over real interest rates in an open economy, and may have implications for the Fed's control over interest rates in a "closed" economy as well.

[9]The "long run" tends to mean different things in macroeconomics depending on the context in which it is used. In the present IS/LM aggregate demand-aggregate supply framework, it means the period of time for all wages and prices to adjust to exogenous shocks. If all wages and prices adjust instantaneously, the aggregate supply curve would be vertical for all time periods. Hence, the positively sloped aggregate supply curve in this model results from some "imperfections" which keep wages and prices from adjusting instantaneously to shocks.

[10]Bernheim (1989) and others call this the neoclassical view. In the neoclassical framework, crowding out necessarily results from a full-employment assumption. The only way that the government can spend more is for the private sector to spend less. That is, interest rates must rise to increase private savings by the amount of the decrease in public savings. The much-hypothesized adverse effects of government deficits in the neoclassical view come either through current government consumption replacing private investment or the assumed lower marginal productivity of public capital (see footnote 11). In any event, no explicit distinction between the conventional and neoclassical views is made in the text because they are comparable in their implications (though certainly not with the full-employment assumptions).

Other things the same, the degree of crowding out will be larger, the more responsive interest rates are to deficit spending and the more responsive investment spending is to changes in the interest rate. Thus, the larger the effect of deficits on interest rates, the smaller should be the effect on current output. Even with this crowding out effect, however, deficits and output are still expected to be positively correlated—at least in the short run.[11]

### *Deficits and Inflation*

To be confused about the effect of deficits on inflation and the price level is easy; therefore, it is important to understand and recognize the distinction between these effects. The fundamental distinction can best be seen by noting that the price level is measured at a specific point in time, while inflation is measured over an interval. According to the conventional view, an increase in the deficit increases aggregate demand and, hence, the price level. Because adjustments in the price level take place over time, such changes are reflected in the measured rate of inflation during the period of price adjustment. Other things the same, however, prices eventually will adjust to their new higher level after which no further price changes will be forthcoming. Consequently, while deficit spending may affect the price level permanently, it has only a temporary affect on the rate of inflation.

For deficits to really be considered inflationary, they must generate continuing increases in the price level. In terms of the aggregate demand and supply curves, deficits would have to cause the aggregate demand curve to keep shifting to the right at a faster rate than the aggregate supply curve. This could happen only if deficits become persistently larger over time, or if they are being monetized (producing increases in the rate of money growth). The dynamic aspect of inflation, however, requires a permanent rise in the rate of money growth in response to the larger deficit.[12]

## THE EFFECTS OF DEFICIT SPENDING: RICARDIAN EQUIVALENCE

An alternative view of the effects of deficit spending is called Ricardian equivalence. Unlike the Keynesian view, which sees public and private saving as essentially unrelated, the Ricardian view sees them as perfect substitutes.[13] According to this view, changes in public saving are matched by an equal but opposite change in private saving. This fundamental difference manifests itself in the answer to the question: Is government debt part of society's net wealth?

In the Keynesian view, the answer is "Yes," while the Ricardian alternative would answer "No." According to the Keynesian view, when

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[11]Some people fear that deficits could have some longer-term adverse effects due to crowding out. They argue that, if deficits lead to higher interest rates and lower investment, society will be left with a smaller capital stock, which, in turn, means that future output will be smaller than it would have been in the absence of deficit-financed expenditures. Consequently, in the short run, deficits and output are expected to be positively correlated. In the long run, however, they may be negatively correlated, or at least negatively correlated with output growth. There is an implicit assumption in this argument about the nature of public expenditures or the relative productivity of "public" and "private" capital. To see this, note that the supply of output, $Y_t$, is a function of labor, $L_t$, and the capital stock, $K_t$, i.e., $Y_t = f(L_t, K_t)$.

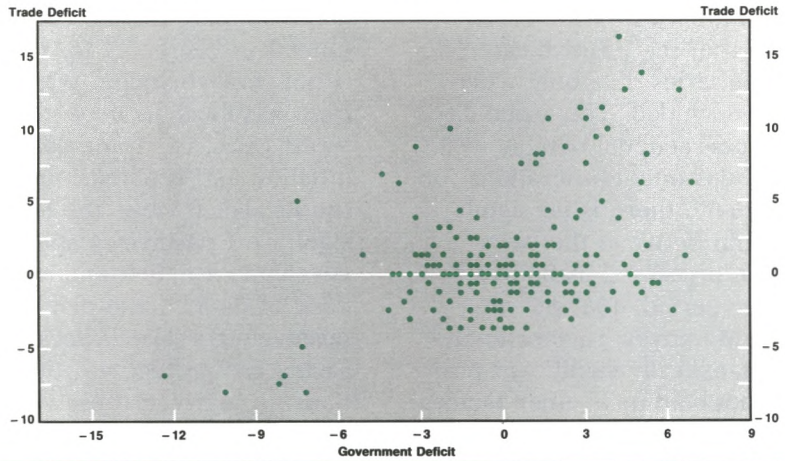
Output rises with both labor and the stock of capital. Consequently, if a deficit-induced rise in interest rates causes investment to fall in this period, the next period's capital stock will be smaller, as will the next period's output. This assumes that all of the rise in the deficit was used for current consumption. Alternatively, aggregate output could be expressed as a function of labor and the public and private capital stocks, $K^{pu}_t$ and $K^{pr}_t$, respectively, i.e., $Y_t = h(L_t, K^{pu}_t, K^{pr}_t)$. If the rise in the deficit is used to acquire public capital, the immediate effect on output is indeterminant even in the case of complete crowding out, i.e., the decline in private capital from what it would have otherwise been is equal to the increase in public capital. See Aschauer (1989a, 1989b).

[12]Deficits can sustain inflation if the monetary authority attempts to peg the nominal interest rate [see Friedman (1968)] or if deficits become explosive. In the latter case, the ratio of interest-bearing government debt to output increases without limit forcing the monetary authority to monetize the debt. See Sargent and Wallace (1981) and Miller and Sargent (1984) for a discussion of these points and McCallum (1984) for a qualification.

[13]This is merely a convenient, equivalent characterization. Ricardian equivalence stems directly from an intertemporal resource constraint. That is, for a given path of expenditures, a cut in present taxes necessarily implies an increase in future taxes of equal present value. If an individual's demand for goods and services depends on his "after tax" net worth—the present value of assets, the present value of liabilities and the present value of taxes—a fall in current taxes would necessarily be matched by an increase in the present value of future taxes. Since a budget deficit merely rearranges the timing of the tax liability, it cannot affect aggregate demand. The decrease in public saving (the deficit) must be matched by an increase in private saving.

Strictly speaking, however, Ricardian equivalence holds only for a given path of government expenditures. There can be real effects associated with changing the level or timing of real government expenditures.

Figure 2
**The Trade Deficit and the Government Deficit**




the government issues debt, the holder of the debt views it as an asset; but taxpayers do not view it as their liability. That is, they do not believe that they will have to pay current or future taxes to service or retire the debt. Consequently, their saving behavior is unaffected by the debt issuance.

The Ricardian view, on the other hand, asserts that individuals believe that they, or their heirs, will have to pay taxes to service and retire the increased debt. Because they perceive an increase in the present value of their taxes that just offsets deficit-financed expenditures, the stock of government debt is not part of society's net wealth. Hence, a rise in the deficit (a fall in public saving) will be matched by a rise in private saving in anticipation of future taxes.

If public and private saving are perfect substitutes, a decline in public saving—the increase in the deficit—is offset by an increase in private saving, with no effect on the gap between saving and investment. According to this view, then, deficit spending cannot be used to smooth out cyclical variations in economic activity due to exogenous swings in the gap between saving and investment. Moreover, the increased demand for credit due to deficit spending will be matched by an increase in the supply of credit due to an increase in private saving. Also, the increase in aggregate demand that results from a rise in deficit spending will be offset by a decrease in aggregate demand due to the fall in private spending—that is, there is no net change in aggregate demand.

Because the Ricardian view holds that changes in deficit have no net effect on the excess demand for credit or aggregate demand, deficits should be uncorrelated with interest rates, the trade deficit, the price level, output or total saving. Deficits and private saving, however, should be perfectly, positively correlated.

## EMPIRICAL EVIDENCE

The evidence presented here consists of simple scatter plots between the government deficit and the trade deficit, personal saving, real output growth, the price level, the inflation rate and the nominal interest rate for 16 OECD countries.[14] (A more detailed statistical analysis consistent with these scatter plots is presented in the appendix). The currency-denominated variables are expressed as a percent of the country's gross domestic product, GDP, to put them in common units, and all variables are adjusted for their mean values.[15]

Figure 2 shows the relationship between the so-called twin deficits: the trade and the government deficits. The scatter plots show that there

[14]The countries are: Australia, Austria, Belgium, Canada, Finland, France, Greece, Great Britain, West Germany, Ireland, Japan, Norway, Netherlands, Sweden, Switzerland and the United States. The interest rate was not available for Austria, Canada, Finland or Greece.

[15]These are pooled time-series cross-sectional data, where the average level is allowed to vary each year. See the appendix for details.

is a weak (but statistically significant) positive association between the two deficits. This association is consistent with both the conventional view and U.S. time-series data.[16] Barro (1987), however, finds that the positive association exists for U.S. time-series data only when data for the 1980s are included. This instability is evident for these cross-sectional data as well. When the sample includes only observations for the earlier period, 1975-80, there is no significant positive relationship between the twin deficits. These data are presented in figures 3, while data for the later period, 1981-86, are presented in figure 4. Moreover, further analysis suggests that the statistically significant positive relationship does not hold up if other factors are considered (see the appendix).

Figure 5 shows the relationship between personal saving and the government deficit. The strictest form of the conventional view argues that these series should be unrelated, while the Ricardian alternative argues that they should be perfectly, positively correlated. Neither view is supported by these cross-sectional data. Instead, there is a statistically significant negative relationship between these variables. This anomalous result may stem from the response of both the deficit and personal saving relative to GDP to cyclical movements in output. For example, it is well-known that deficits typically rise relative to GDP as output falls and vice versa. If consumers attempt to maintain their living standard in the face of a temporary decline in output, personal saving would fall relative to output. Consequently, personal saving and government deficits relative to GDP should be negatively correlated over the business cycle. In any event, the statistically significant negative relationship supports neither hypothesis.[17]

Figures 6-9 show the relationship between the government deficits and inflation, output growth, the price level and interest rates. In all cases, there is no statistically significant relationship between the deficit and these variables.[18] Consequently, the cross-sectional data provides little or no support for the conventional view. On the other hand, support for the Ricardian alternative is not overwhelming. While the lack of significant relationships between the deficit and interest rates, the trade deficit, output, prices, inflation and economic growth is consistent with the Ricardian view, the lack of a statistically significant positive relationship between the government deficit and private saving is not. Indeed, if deficits and private saving are perfectly, positively correlated because public and private saving are perfect substitutes, a positive relationship between these variables should have been apparent. Thus, at best, the evidence presented here should be interpreted as cautiously favoring the Ricardian view.

## *Implications of the Results*

Whether the evidence presented here is taken to support, however cautiously, the Ricardian alternative, the most interesting result is the lack of evidence to support the conventional view. In particular, the evidence suggests that countries with large government deficits do not have higher interest rates or larger trade deficits despite the widespread opinion to the contrary. Of course, these puzzling results could be an artifact of the simple measures of deficit spending used here. If the relationships between government deficits and either interest rates or the trade deficit were as strong as many commentators suggest, however, it is odd that they do not emerge in these annual data across countries. These results, coupled with the fact that more sophisticated empirical studies using U.S. time-series data have also failed to uncover the conventional relationships, should perhaps lead advocates of the conventional view either to rethink their position or present some evidence to support their claims.

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[16]See Barro (1987) and Dewald and Ulan (1990). Dewald and Ulan argue that the observed positive association between the twin deficits in U.S. time-series data results from failing to account for inflation or changes in the market value of the U.S. federal debt or other major elements of the U.S. net external wealth position. This argument, however, requires a different definition of the deficit than the one used in the conventional stories of the effects of deficits on economic variables.

[17]Recently, Swamy, Kolluri and Singamsetti (1990) have suggested that finding any statistically significant relationship between the deficit and interest rates—although the sign of the coefficient is opposite that hypothesized by the conventional view—contradicts the Ricardian equivalence paradigm. Such an extreme view is unwarranted.

[18]There are two exceptions when first-differences are used. The one of some importance for the conventional wisdom is the positive and statistically significant relationship between the deficit and output growth, suggesting that larger government deficits have at least some initial positive effect on real output. Of course, if the rise in the deficit is due to an increase in government spending, there is a positive relationship between the deficit and GDP by definition. See the appendix for details.

Figure 3
**The Trade Deficit and the Government Deficit: 1975-1980**

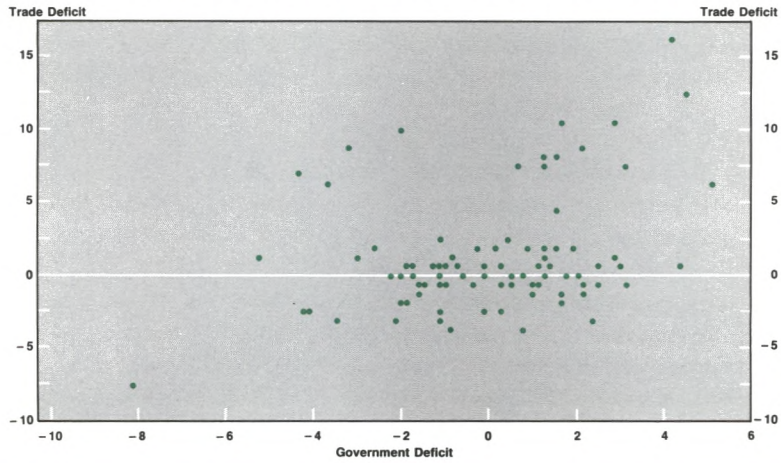



Figure 4
**The Trade Deficit and the Government Deficit: 1981-1986**

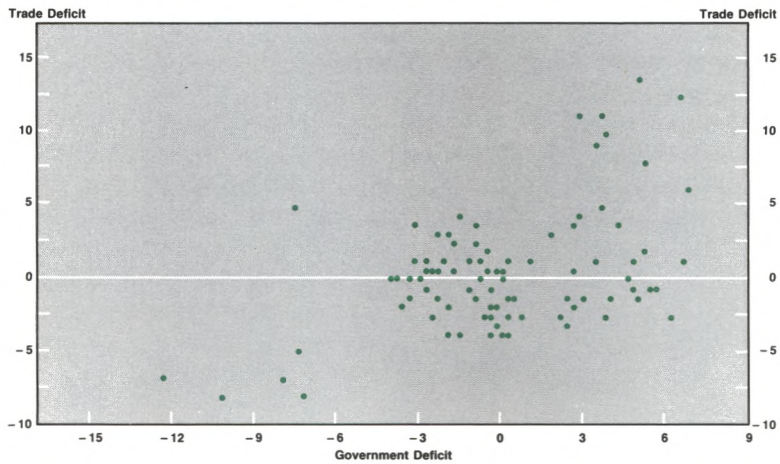



Figure 5
**Personal Saving and the Government Deficit**

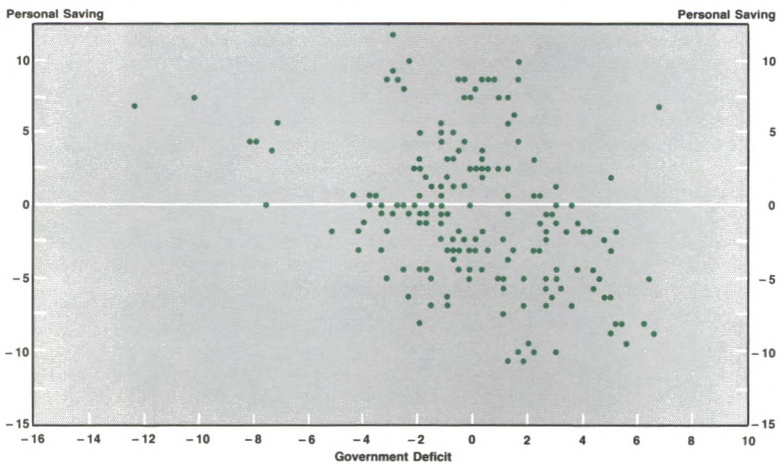


Figure 6
**The Rate of Inflation and the Government Deficit**

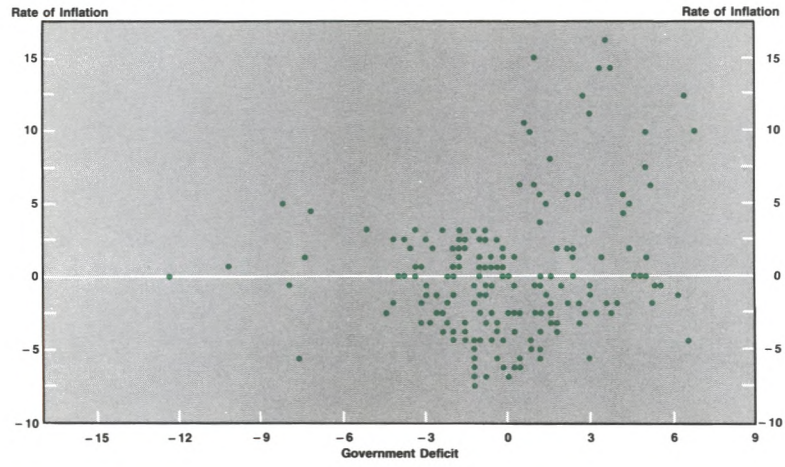



Figure 7
**The Growth Rate of Real GDP and the Government Deficit**

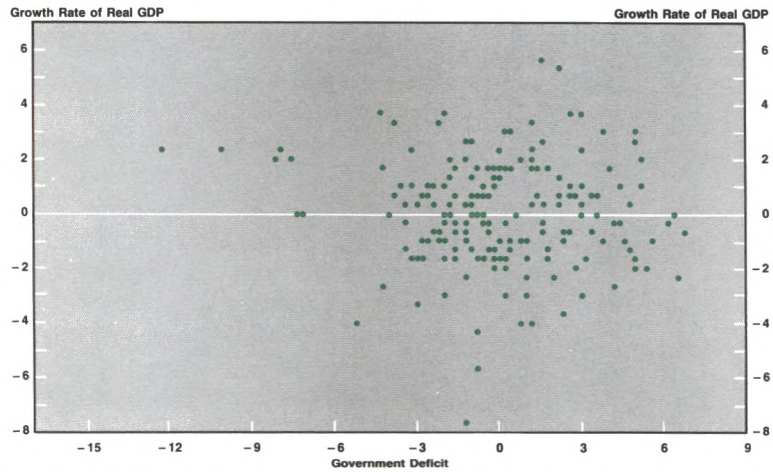



Figure 8
**The Price Level and the Government Deficit**

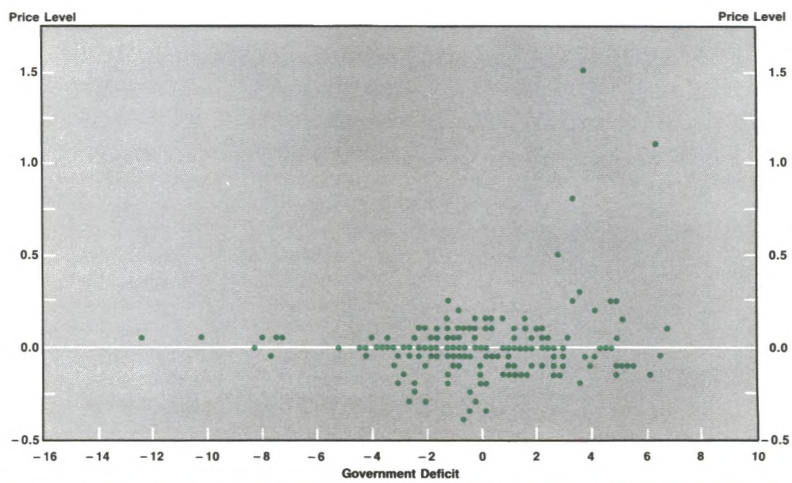
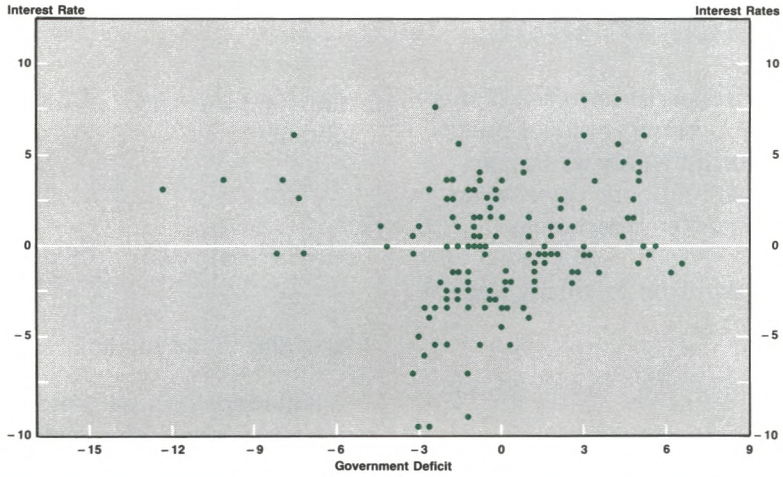


Figure 9
**The Interest Rate and the Government Deficit**

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# Appendix
# An Econometric Analysis of the Effect of Government Deficits

The purpose of this appendix is to see if there is a statistical association between government deficits and some important macroeconomic variables as hypothesized by both the conventional view and the Ricardian alternative.

The analysis begins with the following general equation:

(A.1) $DV_{it} = \alpha_{it} + \beta_{it}DEF_{it} + \varepsilon_{it}$, i=1,..., K, and

t=1,..., T,

where $DV_{it}$ and $DEF_{it}$ denote the $t^{th}$ observation for the $i^{th}$ country of the dependent variable and the deficit measure, respectively, $\alpha_{it}$, and $\beta_{it}$ denote fixed parameters and $\varepsilon_{it}$ denotes a random error.

Equation A.1 cannot be estimated because the number of parameters exceeds the number of observations. This problem can be circumvented by obtaining time-series and/or cross-section representations of equation A.1. The time-series representation is obtained by imposing the restrictions $\alpha_{it} = \alpha_i$ and $\beta_{it} = \beta_i$ for all t. The cross-sectional representation is obtained by imposing the restrictions $\alpha_{it} = \alpha_t$ and $\beta_{it} = \beta_t$ for all i. These specifications are:

(A.2) $DV_{it} = \alpha_i + \beta_i DEF_{it} + \varepsilon_{it}$

and

(A.3) $DV_{it} = \alpha_t + \beta_t DEF_{it} + \varepsilon_{it}$.

A pooled time-series/cross-section representation can be obtained by imposing the restrictions $\alpha_{it} = \alpha$ and $\beta_{it} = \beta$ for all i and t, to obtain

(A.4) $DV_{it} = \alpha + \beta DEF_{it} + \varepsilon_{it}$.

(This is equivalent to imposing the restrictions $\alpha_i = \alpha$ and $\beta_i = \beta$ for all i on the time-series model or $\alpha_t = \alpha$ and $\beta_t = \beta$ for all t on the cross-sectional model).

Equations A.2-A.4 were estimated with annual observations on the government deficits, nominal interest rate, the trade deficit, the price level (1980=100), the inflation rate, real output growth and private saving for 16 OECD countries (K=16) for which the relevant annual data are available.[1] The period is from 1975 to 1986 (T=12). Because the currency-denominated variables are expressed in the respective country's currency, it is necessary to put these data in common units. This was done by measuring these variables as a percent of gross domestic product, GDP.[2]

The equations were estimated both in levels and first-differences. The latter form was estimated because some of the data showed a tendency to trend with time. The sample was too small, however, to perform the usual tests for stationarity. Estimates of first-order autocorrelation from equation A.2 suggest that first-differencing may result in over-differencing in many cases. Because some of these data appeared to have trends, the pooled time-series/cross-section equation, A.4, was estimated by allowing the intercept term to vary with time.[3] Because the estimates of equations A.2 and A.3

[1]The interest rate is the three-month money market rate.

[2]This was also done by measuring these variables relative to their mean value for the period and indexing them to 1975. When the variables were normalized in this way, a measure of the level of GDP was also used as a dependent variable. In nearly all cases, estimates of equations A.2 and A.3 resulted in insignificant coefficients on the deficit measure, so the results are not reported here.

Also, the OECD data are based on the system of national accounts which differs in a number of respects from our system of national income and product accounts. One of these is that capital expenditures by government are not treated as current expenditures, so that the deficit is current expenditures plus consumption of fixed capital less revenue.

[3]The reported intercepts in tables A.1 and A.2 are for 1986. The equations were also estimated using a time trend. The results with this variable were not qualitatively different from those that allowed for a time-varying intercept. Consequently, they are not reported here. Also, the equations were estimated using the alternative dependent variables as regressors. Except for the interest rate, however, the qualitative results were unaffected, so these results are not presented here.

are qualitatively the same as those of equation A.4, only estimates of equation A.4 are presented.

## The Results

Estimates of equation A.4 for both levels and first-differences are reported in table A.1.[4] The only coefficients that are statistically significant in both the level and first-difference specifications occur when the trade deficit or private saving is the dependent variable. In the latter case, however, the coefficient was negative, which suggests that increases in deficit spending are associated with decreases in personal saving: when public saving decreases, so does private saving. This result is not consistent with the Ricardian view that public and private saving are substitutes; however, it might reflect an endogenous response of both government deficits and personal saving to cyclical variations in output. It is well-known that deficits tend to rise relative to GDP when output falls. Likewise it might be that personal saving also rises when output falls, as individuals try to maintain their level of consumption in the wake of declining income levels. In this case, personal saving would decline relative to GDP. The simultaneous response of both government deficits and personal saving to cyclical variation in income could account for the statistically significant negative coefficient on the deficit when personal saving is the dependent variable.

Barro (1987) also found a positive and statistically significant relationship between the two deficits using U.S. data, but stated that this relationship emerges only when data for the 1980s were included. When the sample was partitioned into 1975-80 and 1981-86 periods, a positive relationship emerged between the twin deficits during both periods; however, consistent with the findings of Barro, the relationship was not statistically significant during the first period.[5]

Dewald and Ulan (1990) argue that the positive relationship between the twin deficits in the U.S. results from failing to account for inflation or changes in the market value of the net U.S. federal debt or other major elements of the U.S. external wealth position. When adjustments for these factors are made, they find no statistically significant relationship between the two deficits. Because this argument might apply to cross-sectional data as well, caution should be used in interpreting these results as evidence of the conventional wisdom on the twin deficits. This is especially true because the estimated coefficient on the deficit is not large: a 1 percentage-point rise in the government deficit relative to GDP would result in only about a .20 percentage point rise in the trade deficit relative to GDP. Moreover, as shown later, the result is not robust.

The statistical significance of the coefficient on the deficit when inflation or the price level is the dependent variable depends on whether the equation is estimated in levels or first-differences, being insignificant in the former case and significant in the latter. In either case, however, the coefficient has a sign opposite that of the conventional story. Consequently, these results are not evidence for or against either of these views.

The same result occurs when the growth rate of GDP is the dependent variable. In this case, however, the conventional wisdom does not state the direction of the expected change. From a short-run perspective, output growth should be positively related to deficits. From a long-run perspective, they should be negatively related. The results in table A.1 suggest a positive relationship if first differences are used, with a 1 percentage-point increase in the deficit being associated with a quarter of a percent increase in the rate of growth of GDP. Of course, if the increase in the deficit is due to an increase in government spending, there is a positive relationship between deficits and GDP by definition, if crowding out is not complete.

Estimates of the effect of the deficit on interest rates also are sensitive to the specification of the equation. When levels are used, there is a negative, but statistically insignificant, relationship between interest rates and the deficit. When first-differences are used, however, there is a positive and statistically significant (a one-

[4]It was assumed that variance was constant over time, but differed over cross-sections, that is, $E(\varepsilon_{it}\varepsilon_{js}) = \sigma^2_i$ for $i = j$ and $t = s$ and 0 otherwise. Estimates of equation A.2 indicated considerable cross-sectional heteroskedasticity.

[5]The estimated coefficient on the deficit variable during the first period for the level specification was .181, with a t-statistic of 1.42. The comparable statistics for the second period are .307 and 3.52, respectively. The same statistics for the two periods for the first-difference specification are .094 and 1.37 and .226 and 3.01, respectively.

Table A.1

**Pooled Time-Series, Cross-Sectional Estimates of Equation A.4**

| Dependent variable | Levels | | First difference | |
|---|---|---|---|---|
| | Constant | Deficit measure | Constant | Deficit measure |
| Trade deficit | −1.396* | 0.195* | −0.453 | 0.127* |
| | (2.43) | (2.42) | (1.43) | (2.26) |
| Personal saving | 9.163* | −0.447* | 0.197 | −0.170* |
| | (14.25) | (6.59) | (0.77) | (3.43) |
| Output growth | 2.349* | −0.060 | −1.206* | 0.244* |
| | (5.67) | (1.34) | (2.87) | (3.73) |
| Inflation | 4.444* | −0.061 | 0.327 | −0.154* |
| | (5.76) | (0.77) | (1.70) | (4.40) |
| Price level | 1.517* | −0.002 | 0.07* | −0.004* |
| | (75.44) | (1.17) | (12.11) | (3.58) |
| Interest rate | 8.120* | −0.020 | −0.886 | 0.248* |
| | (10.89) | (0.28) | (1.96) | (1.95) |

*Indicates statistical significance at the 5 percent level.

tailed test at the 5 percent significance level) relationship between the two variables. Even if one takes the results that are most supportive of the conventional wisdom, however, the effect of deficits on interest rates is fairly weak: a 1 percentage-point rise in the deficit relative to GDP is estimated to produce about a 25 basis-point rise in nominal interest rates.

## *The First-Difference Results*

While the results for the first-difference specification appear to indicate statistically significant relationships between the government deficit and all of the dependent variables, these relationships are not as strong as the results in table A.1 would suggest. Scatter plots of the first-differenced data, mean-adjusted, are presented in figures A.1-A.6. These data suggest that much of the reported statistically significant relationship could be due to a relatively few outliers. In most cases, these are attributable to two countries, Greece and Norway. Also, the reported results could be due to the failure to account for other factors that affect the relevant dependent variable. Both issues are investigated in table A.2, which reports the results of estimates of the first-difference specification when Greece and Norway are deleted and, alternatively, when all other variables are included as regressors.[6] As the table shows, the results are sensitive to both of these changes. Deficits are not significantly related to the price level or interest rates when the two countries are deleted and no longer have a statistically significant effect on the trade deficit, the price level or the interest rate when the other variables are included. The only significant effects that are robust to these changes are those for the effect of the deficit on private saving, output growth and inflation. In the first and last case, however, the sign of the coefficient is opposite that suggested by the conventional view.

[6]All other variables save the interest rate, since the interest rate was unavailable for Austria, Canada, Finland and Greece.

Figure A1
**Change in The Trade Deficit and the Government Deficit**

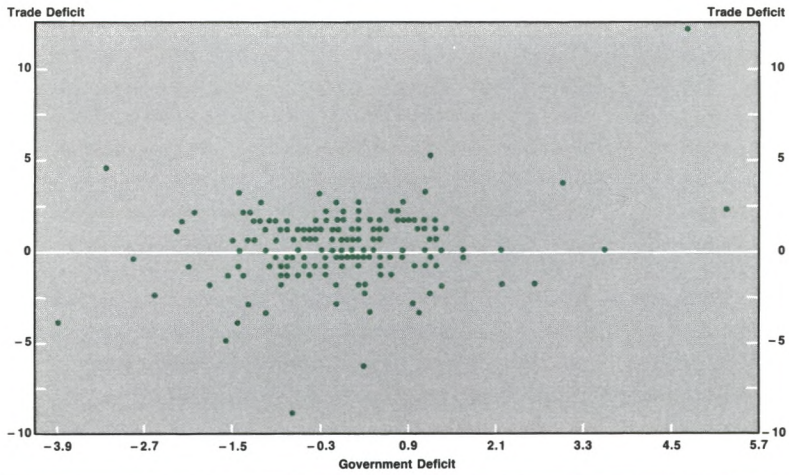


Figure A2
**Change in Personal Saving and the Government Deficit**

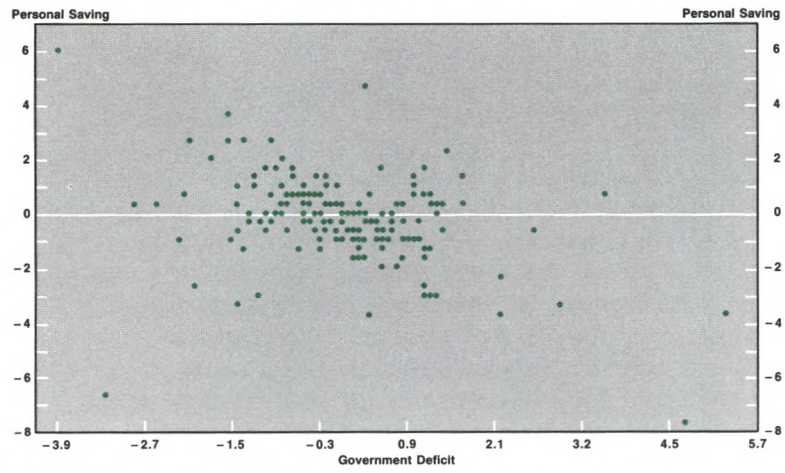


Figure A3
**Change in the Inflation Rate and the Government Deficit**

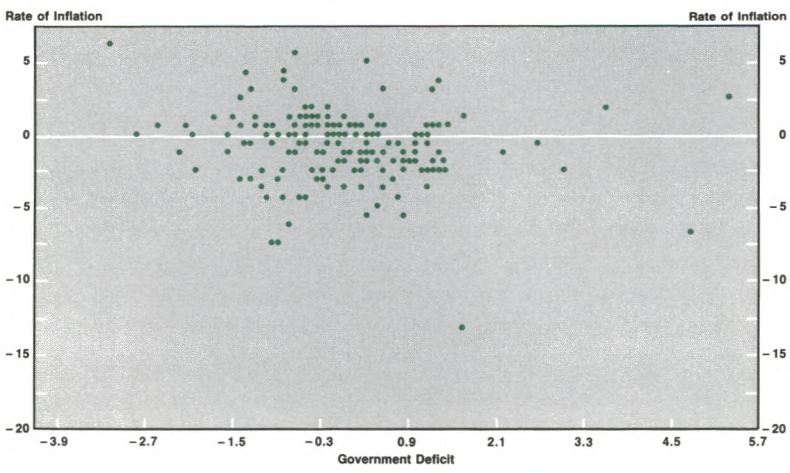

Figure A4
**Change in the Growth Rate of Real GDP and the Government Deficit**

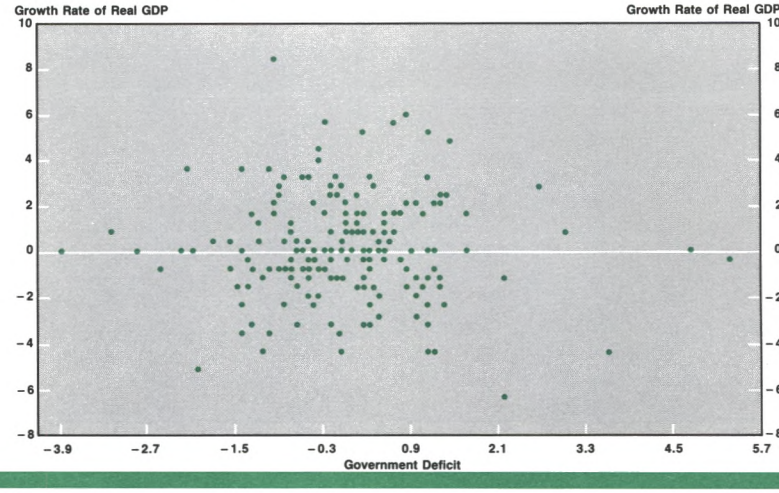


Figure A5
**Change in the Price Level and the Government Deficit**

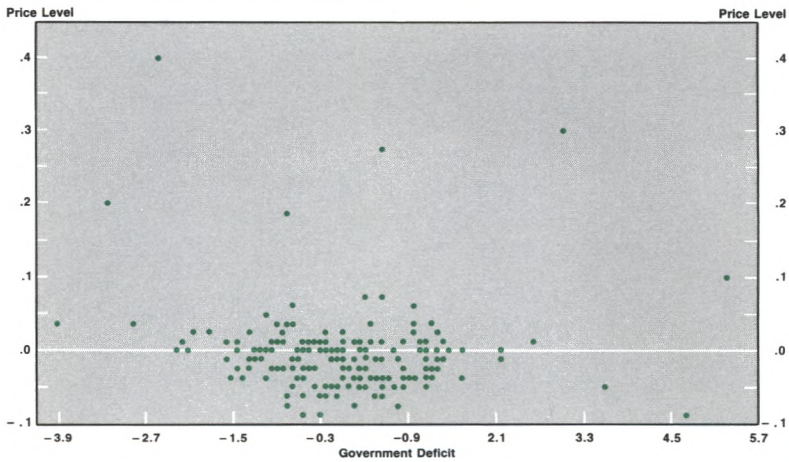


Figure A6
**Change in the Interest Rate and the Government Deficit**

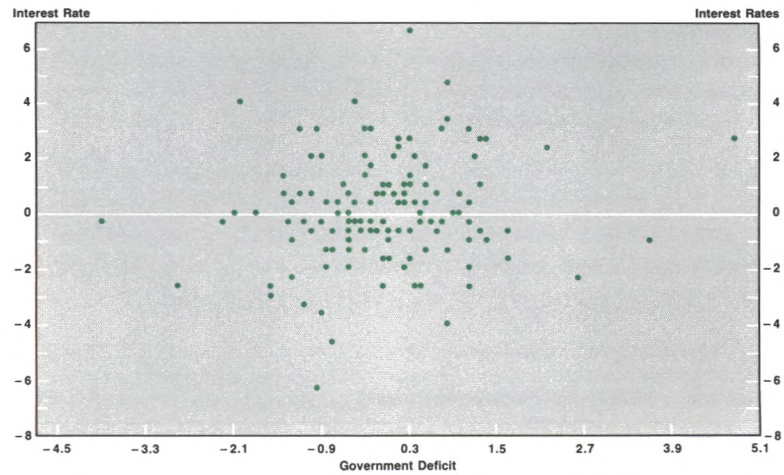

Table A. 2

## Estimates of Two Alternative First-Difference Specifications

| Dependent variable | Greece and Norway deleted | | All alternative dependent variables included | |
|---|---|---|---|---|
| | Constant | Deficit variable | Constant | Deficit variable |
| Trade deficit | −0.611* | 0.128* | 0.072 | −0.013 |
| | (2.03) | (2.22) | (0.21) | (0.23) |
| Personal saving | 0.312 | −0.143* | 0.400 | −0.213* |
| | (1.28) | (2.97) | (1.63) | (4.55) |
| Output growth | −1.056* | 0.342* | −0.930* | 0.330* |
| | (2.31) | (4.01) | (2.26) | (4.66) |
| Inflation | 0.378 | −0.126* | 0.112 | −0.093* |
| | (1.94) | (3.65) | (0.54) | (2.63) |
| Price level | 0.051* | −0.002 | 0.062* | −0.001 |
| | (7.91) | (1.73) | (8.81) | (0.95) |
| Interest rate | −1.093* | 0.128 | −0.934 | 0.090 |
| | (2.29) | (0.78) | (1.95) | (0.61) |

*Indicates statistical significance at the 5 percent level.

*Cletus C. Coughlin*

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# What Do Economic Models Tell Us About the Effects of the U.S.-Canada Free Trade Agreement?

STUDIES OF THE historic U.S.-Canada Free Trade Agreement have produced conflicting estimates of its economic effects.[1] Not surprisingly, the numerous changes resulting from the Free Trade Agreement will benefit some people and harm others. To summarize the agreement's effects, many studies have estimated the minimum amount that individuals who gain would be willing to accept to forego the changes and the maximum that those who lose would be willing to pay to prevent them.[2] Subtracting the value of the losses from the gains produces a measure of net national welfare change. Using such a measure, estimates for Canada, expressed as a percentage of total economic activity, range from large gains to small losses, while estimates for the United States range from small gains to small losses.

This paper closely examines five recent studies to better understand their estimates as well as identify why they contradict each other. While the five studies focus on the U.S.-Canada Free Trade Agreement, they represent the typical modeling approaches used to quantify the impact of changes in trade laws. Thus, the following discussion helps explain why these analyses often reach widely different conclusions about the same trade policy change. In addition, the discussion points out some limitations of these kinds of analyses.

## AN OVERVIEW OF THE U.S.-CANADA FREE TRADE AGREEMENT

To assess the results and limitations of the different studies, the key aspects of the U.S.-Canada Free Trade Agreement first must be identified. The agreement, summarized in table 1, estab-

[1]See Coughlin et al. (1988) for an introduction to the theoretical arguments underlying protectionist trade policies and the empirical evidence indicating that the costs borne by consumers of such policies generally far exceed the benefits captured by domestic producers and government.

[2]This measure of welfare change is called an equivalent income variation. For a brief discussion of this measure, see Henderson and Quandt (1980).

Table 1

## The Major Provisions of the U.S.-Canada Free Trade Agreement

| | |
|---|---|
| Tariffs | Eliminates all tariffs on U.S. and Canadian goods by January 1, 1998. |
| Rule of origin | To prevent third-country goods from receiving preferential tariff treatment, goods must pass a "rule of origin" test. Goods produced entirely in the United States or Canada qualify immediately, while goods containing imports from countries outside the agreement qualify if they are processed enough to result in one of several specified changes in tariff classification. |
| Customs | Ends customs user fees for goods and duty drawback programs, which returns previously paid duties on imports when they are incorporated in goods subsequently exported, by 1994 for bilateral trade and duty waivers linked to performance requirements by 1998 (except for the Auto Pact). |
| Quotas | Eliminates import and export quotas unless allowed by the General Agreement on Tariffs and Trade or grandfathered by the Free Trade Agreement. |
| National treatment | Reaffirms General Agreement on Tariffs and Trade principle preventing discrimination against imported goods. |
| Standards | Prohibits use of product standards as a trade barrier and provides for national treatment of testing labs and certification bodies. |
| Agriculture | Eliminates all bilateral tariffs and export subsidies and limits or eliminates quantitative restrictions on some products, including meat. Eliminates Canadian import licenses for wheat, oats and barley when U.S. crop price supports are equal or less than those in Canada. |
| Wine and distilled spirits | Removes most discriminatory practices against wine or spirits imported from the other country. |
| Energy | Prohibits most import and export restrictions on energy goods, including minimum export prices. Requires any export quotas used to enforce short supply or conservation measures to share resources proportionately. Provides for Alaskan oil exports of up to 50,000 barrels per day to Canada. |
| Autos | Replaces the Canadian content rule for duty-free Auto Pact imports into the U.S. with tougher Free Trade Agreement content rule. (Most auto trade already is duty-free under the U.S.-Canada Auto Pact.) Does not change rules for Auto Pact-qualified companies importing duty-free into Canada, but does not allow new companies to qualify. Permits U.S. auto and parts exports that meet the Agreement rule to enter Canada at Agreement tariff rates, which phase out over 10 years. Ends all Canadian duty remission programs for autos by 1998. |
| Emergency action | Allows temporary import restrictions to protect domestic industries harmed by imports from the other country in limited circumstances. |
| Government procurement | Expands the size of government procurement markets that will be open to suppliers from the other country. |
| Services | Commits governments not to discriminate against covered service providers of the other country when making future laws or regulations. (Exempts transportation services.) |
| Temporary visas | Facilitates travel for business visitors, investors, traders, professionals and executives transferred intra-company. |
| Investment | Provides national treatment for establishment, acquisition, sale and conduct and operation of businesses. (Exempts transportation.) Commits Canada to end review of indirect acquisitions and to raise to C$150 million (in constant 1992 Canadian dollars) the threshold for review of direct acquisitions. Bans imposition of most investment performance requirements. |

Table 1 (continued)

**The Major Provisions of the U.S.-Canada Free Trade Agreement**

| | |
|---|---|
| Financial services | Exempts U.S. bank subsidiaries in Canada from Canada's 16 percent ceiling on assets of foreign banks. Ends Canada's foreign ownership restriction on U.S. purchases of shares in federally regulated insurance and trust companies. Reviews U.S. firms' applications for entry into Canadian financial markets on the same basis as Canadian firms' applications. Permits banks in the U.S. to underwrite and deal in debt securities fully backed by the Government of Canada or political subdivisions. Guarantees continuation of multi-state branches of Canadian banks. |
| General dispute settlement | Establishes a binational commission to resolve disagreements (except for financial services and countervailing duty and anti-dumping duty cases). |
| Countervailing duty and anti-dumping dispute settlement | Allows countries to continue to apply existing national laws. Replaces court review with a binational panel (when requested), which must apply national law in rendering decisions under international law. |
| Softwood lumber | Preserves the 1986 agreement with Canada on provincial pricing practices. |
| Culture | Exempts cultural industries from the Free Trade Agreement, but authorizes measures of equivalent commercial effect in response to actions otherwise inconsistent with the Agreement. Cultural activities exempted include the publication, sale, distribution or exhibition of books, magazines and newspapers; recording of all kinds; and radio, television and cable dissemination. |

SOURCE: U.S. Department of Commerce, International Trade Administration, *Summary of the U.S.-Canada Free Trade Agreement* (February 1988).

lishes a free trade area to be phased in between January 1, 1989, and January 1, 1998.[3] By that time, the United States and Canada will have eliminated nearly all of the barriers restricting trade in goods and services between each other, while retaining their individual trade policies with all other countries.[4]

## *Trade Barriers*

By January 1, 1998, all tariffs on merchandise trade between the United States and Canada will be eliminated. As table 2 reveals, prior to the agreement, U.S. tariff rates on imports from Canada were lower than Canadian tariffs on imports from the United States in every industry except transportation equipment, an industry in which virtually all tariffs on bilateral trade were removed previously. Some of the tariffs listed in table 2 have already been eliminated, some will be eliminated in five equal reductions (20 percent per year) on each January 1 beginning in 1989 and the remainder will be eliminated in 10 equal reductions (10 percent per year).[5]

The agreement is not limited to tariff barriers. Virtually all import and export restrictions, such as import quotas and embargoes, have been eliminated. Less visible trade barriers have been eliminated as well. For example, in government procurement, discrimination between U.S. and Canadian suppliers is prohibited on qualifying nonmilitary purchases exceeding $25,000, as defined in the General Agreement on Tariffs

[3]See Little (1988), Copeland (1989) and the U.S. Department of Commerce (1988) for summaries of the agreement.

[4]The retention of individual trade policies relative to non-partner countries distinguishes a free trade agreement from a customs union. The countries in a customs union, such as the "pre-1992" European Community, have abolished trade barriers among themselves and have the same trade barriers on imports from non-member countries.

[5]According to the U.S. International Trade Commission (1990), requests from traders on both sides have prompted tariffs on more than 400 products to be eliminated more quickly than was originally agreed upon.

Table 2

**Average Post-Tokyo Round Tariff Rates of the United States and Canada[1]**

| Industry | U.S. tariff rates on imports from | | Canadian tariff rates on imports from | |
|---|---|---|---|---|
| | Canada | Other | United States | Other |
| Agriculture | 1.6% | 1.8% | 2.2% | 1.8% |
| Food | 3.8 | 4.8 | 5.4 | 6.1 |
| Textiles | 7.2 | 9.1 | 16.9 | 16.4 |
| Clothing | 18.4 | 21.4 | 23.7 | 22.1 |
| Leather products | 2.5 | 3.8 | 4.0 | 8.7 |
| Footwear | 9.0 | 8.9 | 21.5 | 21.9 |
| Wood products | 0.2 | 3.8 | 2.5 | 4.9 |
| Furniture and fixtures | 4.6 | 2.9 | 14.3 | 14.1 |
| Paper products | 0.0 | 1.3 | 6.6 | 6.5 |
| Printing and publishing | 0.3 | 0.7 | 1.1 | 1.0 |
| Chemicals | 0.6 | 3.5 | 7.9 | 7.0 |
| Petroleum products | 0.0 | 0.1 | 0.4 | 0.1 |
| Rubber products | 3.2 | 2.0 | 7.3 | 6.0 |
| Nonmetal mineral products | 0.3 | 7.2 | 4.4 | 8.5 |
| Glass products | 5.7 | 5.8 | 6.9 | 7.9 |
| Iron and steel | 2.7 | 3.9 | 5.1 | 5.5 |
| Nonferrous metals | 0.5 | 0.8 | 3.3 | 2.7 |
| Metal products | 4.0 | 4.4 | 8.6 | 8.9 |
| Nonelectric machinery | 2.2 | 3.2 | 4.6 | 4.8 |
| Electric machinery | 4.5 | 4.1 | 7.5 | 7.1 |
| Transportation equipment | 0.0 | 2.5 | 0.0 | 2.5 |
| Miscellaneous manufactures | 0.9 | 2.0 | 5.0 | 5.3 |
| Average | 0.7 | 4.3 | 3.8 | 7.4 |

[1]Weighted by bilateral trade.

SOURCE: Brown, Drusilla K. and Robert M. Stern. "A Modeling Perspective," in Robert M. Stern, Philip H. Trezise and John Whalley, eds. *Perspectives on a U.S.-Canadian Free Trade Agreement* (The Brookings Institution, 1987).

and Trade (GATT). Currently, GATT prohibits discrimination on procurements exceeding $171,000.[6]

## *Industry Issues*

The agreement also deals with trade issues peculiar to specific industries such as agriculture, automotive products, energy and alcoholic beverages. Tariffs affecting agricultural trade will be eliminated by 1998. Export subsidies and quantitative import restrictions on some products, like meat, were eliminated immediately. The countries also agreed to cooperate with each other in negotiations with other countries to eliminate all subsidies that distort agricultural trade.

Due to the 1965 U.S.-Canada Auto Pact, 95 percent of bilateral auto trade is already duty-free. A major issue, however, had arisen be-

[6]While the agreement virtually eliminates national discrimination between U.S. and Canadian producers, there is still discrimination between producers within the free trade area and those outside. When imported parts and materials are used in the production of a good that is shipped from one partner country to another, the origin of the good must be determined. In the agreement, goods with imported inputs qualify as North American if they have sufficient value-added to permit them to be exported under a different tariff classification than the one under which the inputs were imported.

cause Canada had been enticing Asian auto producers to locate production facilities in Canada by rebating duties (taxes) paid on parts imported to Canada when these parts, after some production activity, were then exported. All Canadian duty remission programs will be terminated by 1998. Until then, the agreement does not change the rules for companies already qualifying for duty-free imports into Canada under the existing auto agreement, although it does not allow any new firms to qualify.

Most trade restrictions on energy resources are prohibited. The exceptions are limited to cases of shortages, conservation or national security; however, even in the case of shortages, the reduced supplies must be shared between both countries.

Trade barriers on alcoholic beverages have been only partially eliminated. Although the agreement eliminates some barriers limiting the trade of wines and distilled spirits, Canadian barriers limiting the importation of U.S. beer will remain unchanged.[7]

### *Investment*

The agreement provides national treatment for all aspects of the establishment and operation of businesses. This means that U.S.-owned firms in Canada and Canadian-owned firms in the United States will be treated as domestic firms. The agreement addresses U.S. concerns about Canadian policies designed to influence foreign investment. Specifically, Canada agreed to stop imposing performance requirements, such as requiring an investor to export a certain amount of goods, and, beginning in 1992, to stop screening U.S. direct acquisitions of Canadian assets of less than C$150 million (in constant 1992 Canadian dollars).

### *Financial Services*

The concept of national treatment has been extended to financial services, making this the first time that the United States has reached a bilateral agreement covering all financial services. Virtually all discriminatory Canadian practices are eliminated. For example, the Canadian assets of foreign bank subsidiaries operating in Canada previously were limited to no more than 16 percent of all domestic assets of the Canadian banking system. Under the agreement, U.S. bank subsidiaries are no longer subject to this limitation on their market share.

### *Other Services*

The agreement is also noteworthy because it is the first international agreement dealing with trade and investment barriers in the service industries. Many service industries such as transportation, basic telecommunications, health, education and social services, however, are not covered. Nonetheless, the principle of national treatment has been extended to most commercial services such as construction, tourism, computer services, wholesale and retail trade, management services and other business services. Since many of these require the movement of personnel for limited periods, the agreement changes immigration regulations to facilitate business-related travel.

### *Implementation and Dispute Settlement*

The Canada-United States Trade Commission has been established to implement the agreement. This group will resolve disputes on all matters except financial services and those involving charges of either foreign government export subsidies, called countervailing duty cases, or sales of a good abroad at a price lower than is charged in the domestic market, called anti-dumping cases. Disputes involving financial services will be handled by a formal consultative mechanism between the U.S. Department of the Treasury and the Canadian Department of Finance. Countervailing duty and anti-dumping cases are subject to review, upon request, by a special binational panel.[8] This panel, whose decision is final, reviews the case in light of the domestic laws of the importing country. Thus, each country retains the right to enforce its own laws.

## MODELING THE AGREEMENT: UNDERLYING ISSUES

The preceding overview identifies the many legislative changes. Researchers attempting to

[7]For additional information on U.S.-Canada beer trade, see Carter et al. (1989).

[8]The agreement's resolution of countervailing duty and anti-dumping cases is temporary. The United States and Canada have five to seven years to develop a permanent solution; otherwise, either country may terminate the agreement.

estimate their likely consequences face numerous issues involving economic theory, modeling approaches and measurement. While economic theory provides much assistance in modeling the effects of the agreement, it provides no definitive conclusion about the welfare consequences for a specific country. One aspect of the modeling process in which economic theory plays an important role is in the selection of the modeling approach. No matter which approach is chosen, the far-reaching nature of the agreement prevents some aspects from being incorporated into quantitative models. The wide range of trade barriers affected by the agreement poses further problems. To understand fully the usefulness of the studies discussed later, these underlying issues are examined below.

## The Uncertain Welfare Effects of Changes in Trade Laws

International trade theory generally concludes that free trade leads to the most efficient utilization of the world's resources and, consequently, maximizes the value of world output. Every move toward freer trade, such as the elimination of trade barriers among a group of countries, however, does not necessarily increase national welfare.[9] The reason for this apparent contradiction is that the formation of a free trade area, while eliminating one trade distortion, creates another. The tariff reduction resulting from a free trade agreement will eliminate the distortion between domestic goods and imports from the partner country, a change that increases national welfare. A new distortion, however, is created between imports from the partner country and those from non-partner countries that reduces welfare.

These opposing welfare effects, illustrated in the shaded insert on pages 47-50, can be described very simply. If the formation of a free trade area results in the domestic production of some goods and services in one member country being replaced by imports of these goods and services from other member countries, then the greater specialization in production based on comparative advantage will enhance the economic welfare of the member countries. The term for this welfare-increasing reallocation of production is "trade creation."

"Trade diversion," however, occurs when lower-cost imports from outside the free trade area are replaced by imports produced at higher cost from a member country. This can occur because goods imported from a member are not subject to tariffs or other restrictions, while goods potentially imported from non-member countries continue to face the same barriers as before. This trade diversion shifts production away from the pattern consistent with comparative advantage.[10]

The relative magnitudes of trade creation and trade diversion determine whether the welfare of members rises or falls. Thus, it is natural to use quantitative models to assist in assessing whether the agreement is likely to be beneficial or harmful to the two countries.

## Modeling the Effects of Trade Policy Changes: Two Approaches

The standard way to model the effects of international trade policy changes is to construct and solve a theoretical model using assumed values of critical parameters to derive the solution. General equilibrium models usually are chosen to capture the numerous market interactions that take place both within and among countries. Thus, the standard model used for this purpose is called an "applied general equilibrium model."[11]

Equilibrium in this type of model is characterized by a set of prices such that the market demand for each output and input equals the market supply. The market supply for each output reflects the production decisions of firms motivated by profit maximization. Input demand

[9]Viner (1950) showed that the formation of a customs union could have different welfare effects for partner as well as non-partner countries. Viner's finding is an example of the "theory of the second best." This theory shows that, if all conditions required to maximize welfare are not satisfied, then satisfying one or more additional conditions will not necessarily produce a higher level of welfare.

[10]The empirical importance of trade diversion for Canada can be doubted because, prior to the agreement, the majority of Canadian imports—more than 71 percent in 1986, according to the Council of Economic Advisers (1988)—were already provided by the United States. Thus, the chances that the share of Canadian imports provided by the United States would rise substantially are small. Note also that information contained in table 2 shows that average Canadian tariff rates on imports from the United States already were below those on imports from other countries.

[11]See Shoven and Whalley (1984) for an introduction to applied general equilibrium models. This introduction highlights how these models work using a numerical example. In addition, they provide a review of research using these models to examine international trade issues.

functions are derived from production functions that use only capital and labor. The market demand for each product in this model reflects utility-maximizing consumption decisions of individuals. Demand functions are derived from maximizing utility functions subject to a budget constraint. The budget constraint contains a measure of income generated through the supply of inputs that are used in the production process.

Values for parameters in the production and utility functions must be specified to solve such a model. For example, the elasticity of substitution between capital and labor in the production function, as well as that between goods in the utility function, must be specified.[12] The solution to the model, characterized by the market prices of the inputs and outputs and the corresponding quantities, ensures that market demand equals market supply for all inputs and outputs and that profits are zero in each industry. There are major differences, however, among models that fall into this category. The estimates discussed below rely on one of two fundamental theoretical approaches.

The traditional approach focuses on the gains from comparative advantage. A key assumption in the comparative advantage approach is that markets are competitive. Using the Heckscher-Ohlin approach to international trade, production costs vary across countries prior to international trade because of differences in the endowments of productive resources. Countries relatively well-endowed with certain resources are able to produce those goods whose production requires relatively large amounts of these resources at lower cost than other countries.

With free trade, countries gain by exchanging export goods that they produce at relatively lower cost for imports produced at relatively lower cost from other countries. In essence, trade allows each country to export its abundant productive resources in exchange for the relatively abundant productive resources of its trading partners. The existence of trade barriers prevents some of the gains from producing, trading and consuming on the basis of comparative advantage from being realized.

The alternative approach used in estimating the effects of the reduction of trade barriers applies standard models used in industrial organization to international trade. In this approach, most output markets are assumed to be imperfectly competitive rather than perfectly competitive. Frequently, the imperfectly competitive markets result from the existence of economies of scale in production. These economies of scale cause declining average production costs as the level of output expands. In this case, the increase in the size of the market for individual producers allows for gains from trade.[13]

## *Non-Quantified Features of the Agreement*

Irrespective of the modeling approach chosen, several features of the agreement are not quantified.[14] Many of these features are potentially important and, thus, could significantly alter the agreement's net impact.

One of the agreement's goals is the creation of a more stable business environment for all forms of international business activity. Many Canadians believe secure access to the U.S. market is essential for Canadian economic prosperity, and that such access is being threatened by the U.S.' increasing use of trade laws for protectionist reasons.[15] As an example justifying this concern, Copeland (1989) notes that the United States recently placed a 35 percent import duty on Canadian shakes and shingles to protect U.S. producers.

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[12]The elasticity of input substitution is a measure of the responsiveness of the optimal labor/capital combination to a change in the relative prices of these inputs. The elasticity of substitution between goods is defined analogously.

[13]The welfare consequences of economies of scale can be negative. In models of trade between a large and a small country, Markusen and Melvin (1981) and Ethier (1982) show that the output of goods with increasing returns to scale in the small country might decrease rather than increase with a change from autarchy, a situation in which the country engages in no international trade, to free trade. The increase in average production costs in the small country may more than offset the benefits of specialization due to comparative advantage.

[14]Shea (1988) highlights similar aspects of the agreement that are not quantified.

[15]See Lea (1987) and Trezise (1987) for assessments of the Canadian perspective on this issue. The use of trade laws for protectionist reasons is termed "contingent protection." Contingent protection encompasses a range of import restrictions, such as anti-dumping and countervailing duties, escape clause petitions and legislation dealing with "unfair" international trade. Ethier (1988), p. 234, has argued that the "use of the anti-dumping law has greatly increased and the statute is likely to become a principal protectionist tool," while a recent article in *The Economist* (October 22, 1988), p. 16, referred to the "capricious interpretation and enforcement" of U.S. anti-dumping laws as a potentially important trade barrier.

# A Supply and Demand Analysis of the Welfare Consequences of a Free Trade Agreement

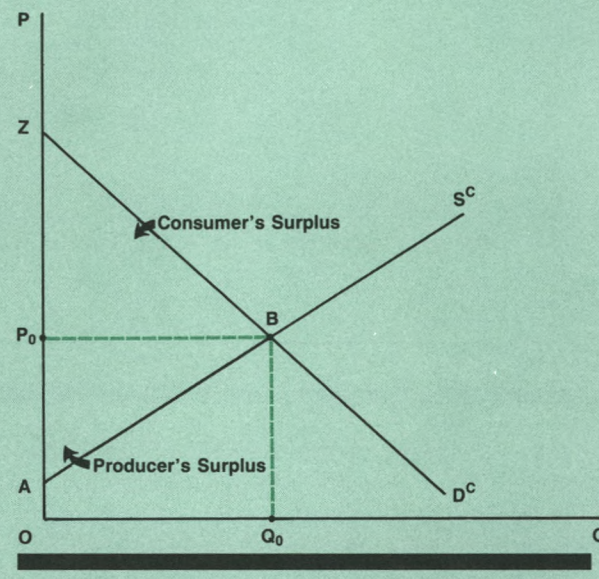
The models discussed in the text are general equilibrium models in that the prices and quantities of nearly all the goods and services are determined simultaneously. This approach is appropriate in assessing the consequences of the U.S.-Canada Free Trade Agreement because the reduction of tariffs on numerous goods sets in motion simultaneous adjustments in a large number of markets. The following discussion, however, is couched in terms of one good. Such an approach, termed partial equilibrium, is used because the primary theoretical welfare consequences of the Free Trade Agreement can be illustrated using supply and demand diagrams that are relatively easy to understand.[1]

## *Consumer's Surplus and Producer's Surplus*

Underlying the welfare consequences of a tariff reduction are two standard welfare measures, consumer's and producer's surplus.[2] These measures can be illustrated simply using a supply and demand diagram. Figure 1 shows the Canadian supply, $S^C$, and demand, $D^C$, for a specific good. Equilibrium in this market is characterized by a price per unit of $P_0$ and a quantity of $Q_0$.

The benefits to Canadians from consuming this good are given by the area under the demand curve from O to $Q_0$ or area $OZBQ_0$. Since Canadian consumers pay a price per unit of $P_0$, their expenditures on the good are $P_0$ times $Q_0$ or area $OP_0BQ_0$. Consumer's surplus is the difference between the total benefits and the total expenditures, which is the triangular area $P_0ZB$. The supply curve indicates the price that producers must receive to induce them to produce each additional unit of the good. The area $OABQ_0$ represents the value of goods foregone (the costs) to produce this good. Producer's surplus is the area above the supply curve and below the horizontal line reflecting the market price or triangular area $AP_0B$.[3] These welfare measures can be added to generate an estimate of the increase in Canadian welfare from producing and consuming this good. Graphically, this is simply area AZB.

Figure 1
**Welfare Analysis Using Supply and Demand Curves**




## *Trade Creation and Trade Diversion*

The effects of a trade-creating free trade agreement are illustrated in figure 2. Identical to figure 1, $S^C$ and $D^C$ remain the Canadian supply and demand for a specific good. In figure 2, however, the Canadians can import the good from the United States at a fixed price of $P_F$.[4] From a national perspec-

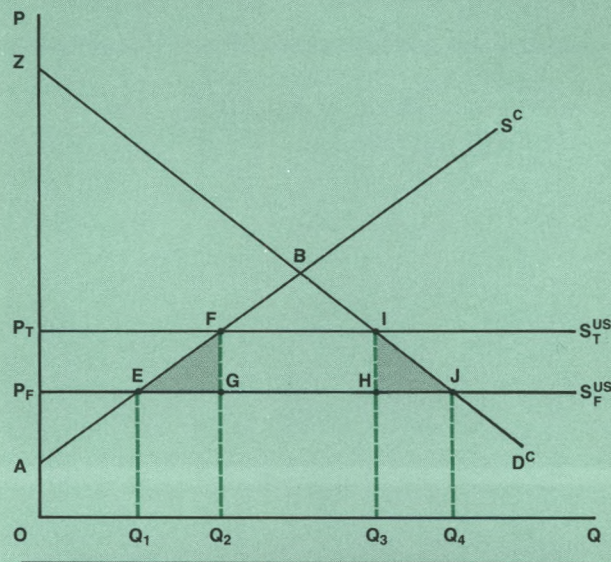
[1]The discussion ignores the welfare consequences of terms-of-trade effects.

[2]These welfare measures are widely used as approximate measures of the equivalent variation measure of welfare change that is actually used in the empirical studies examined in the text.

[3]In the text, a modeling approach based on comparative advantage is discussed. Such models assume production functions with constant returns to scale. When all supply curves are horizontal, producer's surplus is zero.

[4]The models discussed in the text generally assume that products in a given industry are slightly differentiated across countries. This assumption is ignored here to simplify the analysis.

Figure 2
**A Trade-Creating Free Trade Agreement**




tive, the supply of this good from the United States, $S_F^{US}$, is represented by a horizontal line. Even though Canadian production and consumption decisions are assumed to have no effect on the price that Canada pays for imports from the United States, Canadian trade policies can affect the price of this good within Canada. With free trade, the Canadian price of the good is $P_F$, the same price that Canadians pay to import the good from the United States. Thus, $S_F^{US}$ represents the supply of imports of this good from the United States under free trade. If, however, a tariff equal to the distance $P_FP_T$ is imposed on imports, then $S_T^{US}$ represents the supply of imports relevant for Canadian production and consumption decisions.

Before the Free Trade Agreement, imports from the United States were subject to a tariff, so $S_T^{US}$ is the relevant supply of imports. In this case, the price of this good in Canada is $P_T$, which means that Canadian production is $Q_2$ and consumption is $Q_3$. The difference between Canadian consumption and production, represented by the distance $Q_2Q_3$, reflects the quantity of Canadian imports from the United States. These imports are subject to a tariff equal to the distance $P_FP_T$, so the amount of tariff revenue ($P_FP_T$ times $Q_2Q_3$) is the rectangular area GFIH.

The Free Trade Agreement eliminates the tariff on imports, so the price of this good in Canada becomes $P_F$. This lower price causes Canadian consumption to increase from $Q_3$ to $Q_4$ and production to decrease from $Q_2$ to $Q_1$. Thus, imports increase from $Q_2Q_3$ to $Q_1Q_4$. This is an example of trade creation because some production in Canada is replaced by imports from the United States.

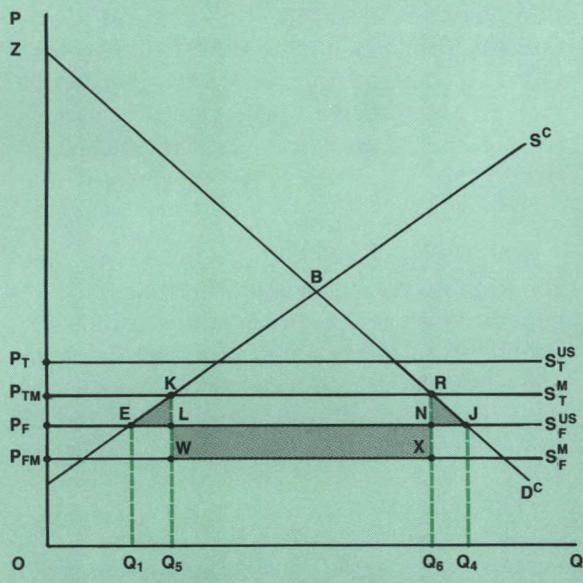
The Canadian welfare gain from this trade creation can be identified graphically. The elimination of the tariff, which allows increased consumption at a lower per unit price, causes consumer's surplus to increase by the area $P_FP_TIJ$. Part of this gain is a transfer from Canadian producers whose surplus drops by the area $P_FP_TFE$ because of the lower prices and the resulting lower output they produce. The elimination of the tariff on imports from the United States means that the tariff revenue on imports from the United States, area GFIH, originally paid by Canadian consumers is returned to them as part of the increase in their consumer's surplus. After considering the transfers to consumers from producer's surplus and tariff revenue, the net Canadian welfare gain is represented by the sum of the triangular areas EFG and HIJ.[5]

The preceding analysis assumes that the United States is the lowest-cost foreign supplier of the imported good. Trade diversion arises, however, if the United States is not the lowest-cost foreign supplier. Figure 3 illustrates a trade-diverting free trade agreement. Figure 3 contains the same supply and demand curves as figure 2 plus two additional curves. $S_F^M$ is the free trade supply curve of imports from a country M that is not a party to the U.S.-Canada Free Trade Agreement. $S_T^M$ is the free trade supply curve adjusted by the tariff that Canada imposes on imports from this country.

Before the Free Trade Agreement, Canada imposes an identical tariff on imports of this

[5]The area EFG is referred to as the production effect, while the area HIJ is the consumption effect. Viner (1950), who pioneered this analysis, concentrated on the production effect and ignored the consumption effect. Thus, the definition of trade creation focuses on the replacement of domestic production by imports. It is now standard practice, however, to view trade creation as encompassing both the production and consumption effects.

Figure 3
**A Trade-Diverting Free Trade Agreement**




good from all countries. Thus, the distance $P_{FM}P_{TM}$ is equal to $P_FP_T$. Because Canada imposed the same tariff on imports from both countries, $P_{TM}$ is less than $P_T$ and Canadian imports of this good will be solely from M. Given the price of $P_{TM}$ for this good, Canadian production is $Q_5$ and consumption is $Q_6$. Thus, imports from M are represented by the distance $Q_5Q_6$. The amount of Canadian tariff revenue is $P_{FM}P_{TM}$ times $Q_5Q_6$ or, more simply, the rectangular area WKRX.

The Free Trade Agreement eliminates the tariff on imports from the United States, but not on those from M. Since the price of the U.S.-produced good without the tariff, $P_F$, is lower than the price of the same good produced in M with the tariff, $P_{TM}$, Canadian imports will be diverted from M to the United States. In addition to the switch in Canada's imports from one country to the other, Canadian production declines from $Q_5$ to $Q_1$, Canadian consumption increases from $Q_6$ to $Q_4$ and Canadian imports rise from $Q_5Q_6$ to $Q_1Q_4$.

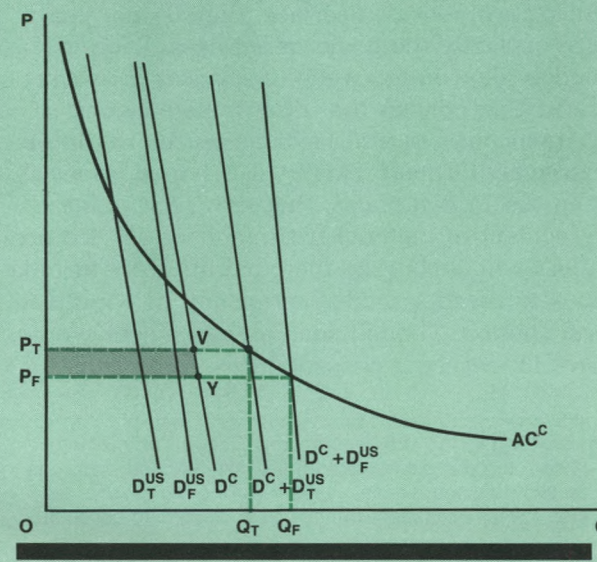
The net welfare consequences are unclear. Consumers are better off as a result of a lower price and increased consumption. The increase in consumer's surplus is represented by the area $P_FP_{TM}RJ$. On the other hand, Canadian producers are harmed by the lower price. The reduction in producer's surplus is the area $P_FP_{TM}KE$. Finally, since imports from the United States are not subject to a tariff, tariff revenue declines from WKRX to zero. Netting out these welfare changes leaves two triangular areas of gain, EKL and NRJ, and one rectangular area of loss, WLNX.

The two triangular areas are the same welfare gains that were highlighted in the previous example. The area of loss, WLNX, reflects the higher price that Canada pays per unit for $Q_5Q_6$, the amount of Q imported before the Free Trade Agreement. Obviously, if the welfare effect associated with trade diversion exceeds the sum of the two triangular areas associated with trade creation, then the net welfare change from the Free Trade Agreement is negative.

## *The Effects of a Free Trade Agreement Assuming Economies of Scale*

The preceding analysis ignores the possibility that Canadian manufacturing may be characterized by economies of scale. Figure 4 shows a case in which Canada exports a good for which there are increasing returns to scale; this is illustrated by the negatively sloped average cost curve, $AC^C$, for Canadian producers. The demand for this product by Canadian consumers is represented by $D^C$;

Figure 4
**Welfare Consequences of a Free Trade Agreement Assuming Economies of Scale**



the demand by U.S. consumers for this product is represented by $D^{US}$. $D_T^{US}$ is the U.S. demand before the Free Trade Agreement, while $D_F^{US}$ represents the larger U.S. demand that results when the U.S. tariff on the Canadian-produced good is eliminated. Thus, $D^C + D_T^{US}$ represents the market demand faced by Canadian producers before the agreement and $D^C + D_F^{US}$ represents the market demand after the agreement.

Following Hill and Whalley (1985), Canadian producers are assumed to price their good at its average cost to highlight graphically the welfare consequences stemming from tariff reductions in the case of economies of scale.[6] With average cost pricing, the price and output levels before the agreement are determined by the intersection of the average cost curve, $AC^C$, with the market demand curve, $D^C + D_T^{US}$. Thus, the equilibrium price and quantity are $P_T$ and $Q_T$. A reduction in U.S. trade barriers shifts the U.S. demand for Canadian exports of this good from $D_T^{US}$ to $D_F^{US}$. This demand shift induces a production response as Canadian production increases from $Q_T$ to $Q_F$. In addition, price declines from $P_T$ to $P_F$.

Even though Canadian producers will not generate increased profits, there are net benefits for Canada. Canadian consumers benefit from increased consumption stemming from the price (cost) savings associated with economies of scale. This increase in consumer's surplus is represented by the area $P_F P_T VY$.

[6]Theory suggests, however, that if there really are increasing returns to scale at all levels of production, the result would be a monopolist who produces at an output level for which marginal revenue equals marginal cost and sets his price accordingly.

To provide a more stable business environment, the agreement set up a binational panel to settle disputes in anti-dumping and countervailing duty cases. Precisely how this panel will function, however, is unknown; moreover, it is virtually impossible to quantify the value of trade currently foregone because of these legal and political uncertainties that the agreement will reduce.[16]

A second feature of the agreement that cannot be quantified easily involves the consequences of the liberalized trade in services. Since models typically view the service sector as producing a non-traded service, they do not analyze explicitly the trade in services. Even if models allowed for trade in services, however, translating policies that discriminate against trade in services into tariff measures would be extremely difficult. Finally, it is hoped, especially in the United States, that the U.S.-Canada agreement of national treatment for service providers will encourage the current GATT negotiations to reach a similar agreement in a multilateral context. Though such an agreement would have far-reaching consequences, these consequences cannot be estimated in the context of the U.S.-Canada Free Trade Agreement.

Because most economic models incorporate the service sector, and all other sectors as well, at aggregation levels that lump many industries together, another problem is created. The costs and benefits of the agreement tend to be understated to an unknown degree; therefore, short of disaggregating the model, there is no way to tell precisely how much the costs or the benefits have been understated.

For example, using a two-digit Standard Industrial Classification scheme, transportation equipment is treated as one industry. The agreement, however, could cause one sector of transportation equipment to contract and another sector to expand. The movement of workers from the contracting to the expanding sector, which entails temporary unemployment and other costs for the affected workers, is not captured by a model that treats transportation equipment as a single industry.

On the other hand, this aggregation also underestimates the benefits of the agreement.

[16]According to the U.S. International Trade Commission (1990), the dispute settlement process reached decisions on two noncontroversial cases involving red raspberries and paving equipment during 1989. Upcoming cases involving steel rails and pork are expected to be controversial. The amount of trade under dispute in all current cases, which involve primarily agricultural commodities, is less than 0.5 percent of the value of bilateral trade.

Highly aggregated models, by averaging tariff rates across sectors within an industry, underrepresent the distortions caused by tariffs. In other words, tariffs appear to distort relative import prices by less than they actually do.[17] Eliminating these distortions is one source of the gains from the agreement because production and consumption decisions no longer will be artificially distorted. Since the elimination of larger distortions generates larger benefits, highly aggregated models understate the benefits associated with tariff reductions.

The models are also not well-suited to identify the gains resulting from other possible effects of the agreement. Positive effects can result from the increased competition stemming from reductions in trade barriers. When firms are insulated from competition, they may not minimize their production costs.[18] When owners are separated from managers, the absence of competitive pressures may allow managers to incur costs to achieve their own interests at the expense of reduced profits. The increase in competitive pressures from increased international trade increases the probability that production costs will be minimized.

In addition, these firms might be pressured into additional research and development expenditures that generate either new products or cost-saving production processes. The enlargement of the market might also attract new investment from non-partner countries. These possibilities, which are potentially significant, tend to be ignored by quantitative trade models.

Finally, all models share one other quantification problem: how to incorporate the elimination of non-tariff barriers into the analysis. This poses a problem because non-tariff barriers must first be identified and, then, converted into their tariff-equivalents.[19] Even if a non-tariff barrier can be identified, it is often difficult to calculate its tariff-equivalent accurately. For example, government procurement policies, a well-known non-tariff barrier, are not easily converted into an equivalent tariffs. As a result, estimates of the effects of eliminating trade barriers typically omit some non-tariff barriers. In addition, estimates based on non-tariff barriers must be viewed cautiously. Indeed, some researchers ignore non-tariff barriers entirely and simply report the consequences of eliminating tariffs alone.

## EMPIRICAL ESTIMATES

Models based on either the perfect competition/comparative advantage or the imperfect competition approaches have been estimated to identify the welfare consequences of eliminating trade barriers in the agreement. To make the discussion of the agreement's overall effect on the United States and Canada manageable, the results of five recent studies are examined: Hamilton and Whalley (1985), Brown and Stern (1987 and 1989), Cox and Harris (1986) and Wigle (1988). As table 3 shows, these studies exemplify the different approaches and yield conflicting results. The studies by Hamilton and Whalley, and Brown and Stern (1987) are based on comparative advantage, while those by Cox and Harris, Wigle, Brown and Stern (1989) are based on imperfect competition.

The results conflict in terms of the gainers and losers as well as the magnitudes of these gains and losses. Depending on which study is used, the results show both the United States and Canada gaining, the United States losing and Canada gaining or the United States gaining and Canada losing. Relative to each country's gross domestic product, the welfare consequences for the United States range from −0.03

[17]A simple example can illustrate this argument. Assume two import-competing industries, each protected by an average 5 percent tariff rate; thus, the relative price distortions caused by the tariffs in each industry appear similar. For one industry, however, the average 5 percent tariff rate results from a 5 percent tariff rate for each sector. For the other industry, the average results from averaging a 10 percent rate and a zero percent rate. The latter industry has more distortions that the former because the differential tariff rates distort the relative prices across sectors. The effect of aggregation is to treat every sector within an industry as if it had the same level of protection from import competition. Consequently, the gains from eliminating the distortions within an industry are ignored. The higher the level of aggregation, the more these distortions within industries are ignored.

[18]This possibility, termed X-efficiency, has been stressed in a more general context by Leibenstein (1980).

[19]The tariff-equivalent of a specific non-tariff barrier is the tariff rate that would generate the same effect on the price of the imported good as the non-tariff barrier. To illustrate, assume first that world prices of some imported good are fixed. Like a tariff, a non-tariff barrier causes the price of the imported good to rise. A non-tariff barrier, such as a quota, causes this price increase by reducing the supply of imports. The percentage increase in the price of the imported good is the tariff-equivalent. For many non-tariff barriers, it is difficult to quantify the supply-reducing consequences of the barriers.

Table 3

**Welfare Consequences of the U.S.-Canada Free Trade Agreement, Selected Studies**

| Authors | Model type | Trade barriers removed | United States[1] | Canada[1] |
|---|---|---|---|---|
| Hamilton/Whalley (1985) | Perfect competition/ comparative advantage | All<br>Tariffs | 0.03%<br>−0.03 | 0.63%<br>0.54 |
| Brown/Stern (1987) | Perfect competition/ comparative advantage | All | 0.04 | −0.35 |
| Cox/Harris (1986) | Imperfect competition/ economies of scale | All | — | 8.74 |
| Wigle (1988) | Imperfect competition/ economies of scale | Tariffs | 0.06 | −0.05 |
| Brown/Stern (1989) | Imperfect competition | Tarrifs | 0.09 | 1.00 |

[1]The value of the welfare effect in each country, calculated by an equivalent income variation, is expressed as a percentage of gross domestic product.

percent to 0.09 percent and for Canada, from −0.35 percent to 8.74 percent.[20]

Whether these changes seem large or small depends on your point of view. Hamilton and Whalley (1985), for example, found that the elimination of tariff and non-tariff barriers increased U.S. welfare by only 0.03 percent of gross domestic product in 1977, which may seem trivial. In dollar terms, however, the effect could be called substantial. Using 1977 prices, this rise in welfare is $0.6 billion. Using 1989 prices, the rise is $1.1 billion.

The conflicting and substantially divergent results from these studies are due to a variety of reasons. One key reason is that the values chosen for the elasticities of substitution between capital and labor and between different consumer goods vary across these studies. Table 4 lists several other characteristics that could explain the conflicting findings. These include the numbers of countries and goods, production functions, market structure, how prices are set and the mobility of resources. Some insights into the importance of these differences are provided below.

## *Perfect Competition/Comparative Advantage Models*

Hamilton and Whalley's (1985) model departs from the textbook comparative-advantage model using the Heckscher-Ohlin approach in two ways. First, demand and production function parameters differ across countries and, second, products are heterogeneous rather than homogeneous across countries.[21]

The differences in demand and production function parameters across countries require specific assumptions about the structure of substitution possibilities for both demand and production. The assumed values for the elasticities of substitution in these functions determine the price elasticities associated with goods and factors of production. In turn, since products are differentiated by the country in which they are produced and their physical characteristics, these elasticities of substitution determine import and export demand elasticities for each country as well. Not surprisingly, the values chosen for these substitution elasticities determine the results generated by the model,

[20]Gross domestic product is gross national product less net property income from abroad. In 1987, Canadian gross domestic product was approximately 3 percent larger than gross national product, while U.S. gross domestic product was less than 1 percent smaller than gross national product.

[21]The disaggregation of imports of a product according to their places of origin is called the Armington assumption. For details, see Armington (1969).

Table 4

**Summary of Model Characteristics**

| Characteristic | Hamilton/Whalley (1985) | Brown/Stern (1987) | Cox/Harris (1986) | Wigle (1988) | Brown/Stern (1989) |
|---|---|---|---|---|---|
| Number of countries | 8 | 4 | 3 | 8 | 4 |
| Number of goods | | | | | |
| Traded | 5 | 22 | 29 | 5 | 22 |
| Non-traded | 1 | 7 | 0 | 1 | 7 |
| Returns to scale | | | | | |
| United States | Constant | Constant | Not modeled | Constant | Constant |
| Canada | Constant | Constant | Increasing-manufacturing Constant-nonmanufacturing | Increasing-manufacturing Constant-nonmanufacturing | Constant |
| Market structure | | | | | |
| United States | Perfect competition | Perfect competition | Not modeled | Perfect competition | Imperfect and perfect competition |
| Canada | Perfect competition | Perfect competition | Imperfect competition-manufacturing Perfect competition-nonmanufacturing | Imperfect competition-manufacturing Perfect competition-nonmanufacturing | Imperfect and perfect competition |
| Price setting by noncompetitive firms | None | None | Monopolistic competition and collusive | Monopolistic competition and collusive | Monopolistic competition |
| Labor mobility | | | | | |
| Across industries | Yes | Yes | Yes | Yes | Yes |
| Internationally | No | No | No | No | No |
| Capital mobility | | | | | |
| Across industries | Yes | Yes | Yes | Yes | Yes |
| Internationally | No | Yes | Yes | No | No |

and different assumptions yield quite different results.

The assumption of national product differentiation enables the model to generate intra-industry, bilateral trade flows since each country exports (and imports) differentiated products. Welfare analysis is complicated beyond the calculation of the efficiency gains and losses stemming from trade creation and trade diversion. Terms-of-trade changes occur because all countries in the model can have some control over their export prices by changing their tariffs on imports.

For example, a Canadian tariff reduction on imports from the United States, which lowers the price of these goods for Canadian consumers (but not for Canada as a whole), will cause Canadian consumers to substitute imports from the United States for some goods produced domestically. The reduction in demand for Canadian-produced goods causes a fall in the price of these goods both in Canada and the world market. *Ceteris paribus*, Canada is harmed by this decline in the price of Canadian exports relative to the price of Canadian imports; this decline produces an adverse terms-of-trade effect.

The welfare consequences, however, are not limited to the preceding terms-of-trade effect, because other things are changing as well. There are efficiency gains that benefit Canada associated with trade creation between the United States and Canada. In addition, the corresponding tariff reduction on U.S. imports from Canada allows for increased Canadian

sales in the U.S. market. The resulting increase in U.S. demand for some Canadian-produced goods will increase the price of these goods in Canada and the world market; this is another change that benefits Canada. Thus, there are beneficial and adverse terms-of-trade effects occurring simultaneously.

The net welfare consequences for Canada and the United States depend on the relative importance of these effects. From the Canadian perspective, the adverse terms-of-trade effects are larger if Canada's tariffs on U.S. exports are higher on average than U.S. tariffs on Canadian exports. This is, in fact, what is shown in table 2. Canadian terms of trade will also decline the more (less) similar U.S. and Canadian goods are to Canadian (U.S.) consumers.

Although Canada's tariffs on U.S. exports before the agreement were higher on average than U.S. tariffs on Canadian exports, Hamilton and Whalley still find that the gains from the agreement primarily accrue to Canada (see table 3). They attribute this finding to the fact that Canada is the smaller partner. The smaller partner's production and consumption behavior are less likely to affect world prices, enabling it to take greater advantage of the trade diversion effects in the larger region.

Yet, using a model with features similar to that used by Hamilton and Whalley, Brown and Stern (1987) found that the United States gained, but Canada lost. As shown in table 3, the bilateral removal of trade barriers by Canada and the United States leads to an increase in U.S. welfare, 0.04 percent of gross domestic product, but a decrease in Canadian welfare, 0.35 percent of gross domestic product. Brown and Stern argue that the reduction in Canadian welfare stems from the relatively higher Canadian tariff rate prior to the agreement. The removal of this protection, which causes Canadian consumers to substitute imported goods from the United States for Canadian-produced goods, leads to a reduction in the relative price of Canadian goods.

Why do these two studies differ so much with respect to the outcome for Canada? Brown and Stern found their results were sensitive to the assumptions about the elasticity of substitution among imports from various sources. In other words, the results were sensitive to the degree of substitutability between U.S. imports from Canada and the rest of the world and between Canadian imports from the United States and the rest of the world.

The greater the degree of substitutability, the larger the U.S. gain and the smaller the Canadian loss. If imports from various sources are close substitutes, the preferential tariff reduction induces a substitution from third-country suppliers to the partner. Relatively speaking, little substitution out of the domestically produced good occurs. As the demand for output from the third-party countries declines, the terms of trade for both Canada and the United States improves. Even for very high assumed values for the elasticity of substitution among imports, however, Brown and Stern found a decline in Canadian welfare.

Brown and Stern also examined whether the decline in Canadian welfare was associated with a movement of capital from Canada to the United States; this possibility could not occur in Hamilton and Whalley's model. While Brown and Stern did find a capital movement from Canada to the United States, the Canadian welfare loss is nearly invariant to different assumptions about the sensitivity of capital flows to U.S. and Canadian rate-of-return differences.

## *Models with Imperfect Competition and Economies of Scale*

Models based on comparative advantage assume that all markets are perfectly competitive. This assumption is inaccurate for many markets in Canada. To address this issue and others, Cox and Harris (1985) developed a general equilibrium model of the Canadian economy that incorporates both economies of scale and imperfect competition.[22] In a later paper, Cox and Harris (1986) present estimates of economic effects of the Free Trade Agreement.

Wonnacott (1987) notes that the difference between many U.S. and Canadian manufacturing

[22]The model is not a complete general equilibrium model. The two sectors "foreign" to Canada, the United States and all other countries in the rest of the world, are summarized by exogenous import prices and a set of export demand functions.

operations has been a research topic for Canadian economists since the mid-1960s. Canadian manufacturers, especially those producing consumer durables, have tended to produce a wide range of products, each in relatively small quantity. The standard explanation is that diversified, small-scale production is caused by the trade barriers of both countries.

Canadian trade barriers, by protecting domestic producers from foreign competition, enable Canadian firms to produce a variety of products profitably, even though these products are expensive by international standards. Meanwhile, U.S. trade barriers restrict Canadian access to the U.S. market and, in turn, provide an incentive for Canadian producers to focus on the Canadian market.[23] Thus, the reduction of tariff barriers in the agreement should lead to expanded production with lower per-unit costs. The gains stemming from these changes are called rationalization gains.

Cox and Harris' modeling innovation was to incorporate economies of scale into the analysis. Production in each manufacturing industry is assumed to be characterized by increasing returns to scale, which results in lower per unit average production costs as output increases. Production in each non-manufacturing industry is assumed to be characterized by constant returns to scale.

Since non-competitive firms are price-searchers and, hence, set their prices to maximize their profits, assumptions about price-setting are required. Two price-setting hypotheses are used. One is a monopolistic competitive pricing hypothesis in which profit-maximizing firms set the price of their products as a given mark-up over their marginal cost of production. The size of the mark-up depends on the price elasticity of demand. The second hypothesis relies on a collusive model in which all firms set their prices equal to the world price plus the tariff.[24]

Cox and Harris combine these hypotheses by assuming that the actual prices are a weighted average of the monopolistically competitive and collusive prices. The set of these weighted prices that clears both goods and factor markets is the equilibrium set of prices for Canadian firms.

Irrespective of the pricing assumption, tariff reductions increase import competition and, thus, the prices of imported goods for Canadian consumers tend to decline. For monopolistically competitive firms, the increased competition raises the elasticity of demand and, thereby, reduces the mark-up over marginal cost. Similarly, the collusive price declines because it is set equal to the world price plus the shrinking tariff. The resulting stimulation of Canadian consumption is accompanied by an increase in output by Canadian firms to satisfy the zero-profit condition.[25]

Five sets of parameters, whose specific values are based primarily on previous estimates in other studies, are especially important in determining the equilibria.[26] A set of export price elasticities for Canadian firms is one set of parameters. The removal of U.S. tariffs on imports from Canada eliminates the difference between prices paid by U.S. consumers and prices received by Canadian exporters. The removal of U.S. tariffs tends not only to lower the prices for U.S. consumers of imported goods from Canada, but also to increase the prices received by Canadian exporters. The extent of Canadian penetration of the U.S. market depends on the responsiveness of Canadian exports to these price increases. Conversely, a set of Canadian import price elasticities is needed to assess the consequences of the reduction of Canadian tariffs.

As suggested above, an assumption about the weighting parameter is necessary to determine whether prices tend to be set more according to monopolistic or collusive behavior. The price-setting behavior influences the degree of the reallocation of productive resources that the agreement causes.

Estimates for the elasticity of the average cost curves for the Canadian manufacturing industries are used. These parameters play a key role in determining numerous results such as the potential gains from the reallocation of productive resources and the degree of increased sales in U.S. markets.

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[23]An additional incentive noted by Wonnacott (1987) for diversified, small scale production is caused by Canadian exposure to U.S. advertising that reinforces Canadian demand for a wide range of products.

[24]A fundamental problem with this assumption is that, because firms do not make profits in this model, there is no incentive to collude.

[25]This general description is only suggestive of the general tendency for firm output to expand. With Canadian resources fixed and numerous relative price changes, the output of each and every firm will not have risen when the new equilibrium is attained.

[26]Additional details on the calibration of the model can be found in Cox and Harris (1985).

A fifth set of parameters is the trade policy parameters. Foreign and Canadian tariffs, as well as tariff equivalents of some non-tariff barriers, are used.

Cox and Harris (1986) estimate that the elimination of all barriers to bilateral trade results in Canadian welfare gains of 8.74 percent relative to its gross domestic product (see table 3). They argue that this large gain is due to the preferential access to the U.S. market that Canadian producers will receive. As a small country, Canada benefits because the source of U.S. imports is diverted from other countries to Canada.[27] The Canadian benefits of this diversion are magnified because of the assumed economies of scale in Canadian manufacturing.

Another study of the agreement that incorporated scale economies was done by Wigle (1988). Despite incorporating similar features to those used by Cox and Harris, Wigle did not find large Canadian gains. As shown in table 3, Wigle estimates that the bilateral abolition of tariffs produces a slight reduction in Canadian welfare, 0.05 percent relative to its gross domestic product. Meanwhile, U.S. welfare increased by 0.06 percent relative to its gross domestic product. The sharp contrast between his results and those of Cox and Harris caused Wigle to explore the specific features of the two models that were responsible for the very different conclusions.

Cox and Harris combined the two assumptions about price-setting behavior—monopolistic competitive pricing and collusive pricing—by assuming that prices are set as a weighted average of the prices set by these methods. Wigle, on the other hand, assumed that all firms in the nonmechanical manufacturing sector used monopolistic competitive pricing, while firms in the equipment and vehicles sector used collusive pricing. According to Wigle, the differences in the pricing assumptions are negligible, and changes in them did not eliminate the difference in his and Cox and Harris' results.

Differences in the assumed values of trade elasticities, on the other hand, can produce substantively different results. Since Cox and Harris used much higher price elasticities of export supply and import demand for both Canada and the United States, Wigle reestimated his model using trade elasticities that were approximately twice as high as he used originally. In addition, he introduced capital mobility between Canada and the United States; this feature was used by Cox and Harris. These features did make Wigle's amended results closer to those of Cox and Harris; however, the latter's results were still twice as large as Wigle's new ones.

Wigle speculates that the rest of the difference between the results in these two studies are produced by two other factors. First, Cox and Harris assumed higher values for economies of scale; the greater economies of scale increase the welfare gains because the economy will become more specialized.[28] Second, Wigle used two manufacturing industries in his model, while Cox and Harris used 20. Disaggregated models may generate larger efficiency gains than more aggregated ones, because there is more scope for reallocating resources across industries.

While both the Cox and Harris and the Wigle models stress the role of economies of scale, Brown and Stern (1989) estimated a model with imperfectly competitive industries, but without economies of scale. Their model addresses criticisms that can be raised about previous models.

Brown and Stern ruled out economies of scale in their model because they doubted its significance for Canada. Canadian firms, because of already low U.S. tariffs, had access to the U.S. market. Thus, they argue, gains from the interindustry reallocation of resources are likely to be more important than intra-industry changes.

The Cox and Harris and Wigle models also incorporated collusive pricing. Given this assumption, trade liberalization causes increased output per firm. Brown and Stern suggest, however, that a collusive market structure is not likely to persist in the face of free entry. They also point out that market structures in Canada, as well as the United States, show much more variety than has been assumed in previous models. As a re-

[27]With bilateral free trade, the proportion of total Canadian trade accounted for by the United States rises from 71 percent to 76 percent. The volume of Canadian trade with the United States increases by more than 97 percent.

[28]Wonnacott (1987) notes that Cox and Harris did not make independent estimates of the economies of scale, but rather relied on previous estimates based on econometric and engineering studies. He notes that many econometric issues remain unsettled and that the engineering estimates are likely biased upward.

sult, Brown and Stern incorporate a variety of imperfectly competitive market structures into their analysis that do not rely on what they view as questionable assumptions about firm behavior.

Like the previously discussed Brown and Stern (1987) study, the model uses four countries and 29 industries, 22 tradeable and seven non-tradeable. Each industry is characterized by one of five market structures: perfect competition; monopolistic competition with free entry; monopolistic competition without entry; market segmentation with free entry; and market segmentation without entry.

Both perfectly competitive and monopolistically competitive industries are characterized by product differentiation. Product differentiation by country applies to perfectly competitive industries, while products are differentiated by firms in monopolistically competitive industries. Perfectly competitive firms determine their profit-maximizing output levels by setting price equal to marginal cost, while monopolistically competitive firms maximize profits by setting price as a mark-up over marginal cost.

Homogeneous (that is, identical) products are assumed for the remaining imperfectly competitive industries that are characterized by market segmentation. With segmented markets and each firm producing the same product within an industry, all firms selling to consumers in a specific country must charge the same price, though this price may vary across countries. Each firm, assuming that output by other firms is fixed, establishes a profit-maximizing price for each national market.

Equilibrium in each industry is characterized by zero profits. With free entry, the number of firms in equilibrium assures that price equals average total cost. For market structures without entry, the number of firms remains constant. Equilibrium prices are determined in world markets. Tariffs and exchange rates connect the equilibrium prices to the prices paid by consumers and received by sellers in the individual regions.

As shown in table 3, the welfare consequences of the bilateral elimination of tariffs are small. Canadian welfare rises by $2 billion, which is 1 percent of its gross domestic product in 1976. U.S. welfare rises as well, but only by $1.6 billion, 0.09 percent of U.S. gross domestic product in 1976.

## CONCLUSION

Quantitative models produce conflicting results about the economic effects of the U.S.-Canada Free Trade Agreement. Results for the United States range from small negative to small positive effects on welfare, while results for Canada range from small negative to large positive effects. The conflicting results emerge both from different assumptions about market structures and the values of certain parameters associated with supply and demand and from differences in the level of detail as to commodities and countries. Since there is no consensus about the "best" assumptions, and because international trade theory provides no definitive conclusion about a nation's welfare following the formation of a free trade area, it is important that users of these models understand the reasons for their conflicting results.

Since the assumption of perfectly competitive markets throughout all sectors of all countries is unlikely to hold, the incorporation of imperfectly competitive markets is a promising development. Models that incorporate such markets raise a number of problems, however, because of the various pricing assumptions that have been used and the need for characterizing the extent of the economies of scale. These newer models are also more sensitive to the values chosen for the parameters than those based on perfect competition.

Perhaps just as important, several key aspects of the agreement are not included in these models because they are extremely difficult to quantify. These unmeasured aspects may be more important than the measured ones in terms of the final outcomes. Changes in the rules and procedures governing international trade and investment can yield large benefits that are not included in these models. For example, many Canadians believe that secure access to the U.S. market is essential for Canadian economic prosperity. Consequently, the Canadian assessment of the desirability of the agreement might hinge on whether or not the agreement provides this security. Analogously, the precedent-setting aspects of the agreement concerning services are likely to influence the U.S. assessment of the benefits of this agreement.

Thus, quantitative estimates derived from models are simply some of the many pieces of information that are useful in the decision process and, in some cases, may not represent the most important pieces.

Quantitative trade models have improved substantially in recent years. Nevertheless, as this review points out, let the user beware.

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# Monetary Policy on the 75th Anniversary of the Federal Reserve System: Summary of a Conference Proceedings

THE FEDERAL RESERVE BANK OF ST. LOUIS held its fourteenth annual Economic Policy Conference on October 19-20, 1989. Nearly 75 years since November 16, 1914, when it and the other regional banks of the Federal Reserve System opened for business, the Bank chose this occasion to review the recent monetary policy experience in the United States. The papers and discussion below offer an overview of the conference proceedings that will be published later this year.[1]

## FEDERAL RESERVE PERFORMANCE SINCE 1964: A CRITIQUE

Allan H. Meltzer, University Professor and John M. Olin Professor of Political Economy at Carnegie Mellon University, presented the conference's main paper, a critique of Federal Reserve performance since 1964. Because extensive surveys by Friedman and Schwartz (1963) and Brunner and Meltzer (1964) thoroughly examined the policy record of the System's first 50 years, Meltzer chose to analyze recent Federal Reserve performance. Overall, he argued that the Fed's performance has been poor and that whether the public has benefitted from the existence of the Federal Reserve System is questionable.

His reasons for this assessment were several. Perhaps foremost among these has been the Federal Open Market Committee's (FOMC's) focus on money market conditions and free reserves (member bank excess reserves minus member bank discount window borrowings) as indicators of monetary policy's restraint or stimulus. This focus, in the view of Meltzer and many others, inevitably translates into an objective for the federal funds rate that creates two systematic policy problems. The first problem is that short-term interest rates often give an incorrect view of monetary policy's thrust. For example, by interpreting rising nominal interest

[1]Copies of these proceedings may be obtained by writing to the publisher. Please direct inquiries to: Kluwer Academic Publishers, 101 Philip Drive, Norwell, MA 02061, Attn: Customer Service, or contact the Kluwer order department at: (617) 871-6300.

rates as an indication of "tight" monetary policy when, in fact, they merely reflect the inflationary consequences of excessive past money growth, the Fed gets a mistaken signal to ease; falling nominal interest rates provide the opposite (and still incorrect) signal to tighten monetary policy.

By reading market conditions incorrectly, Meltzer argued, the Fed's approach creates a second problem: procyclical patterns in money growth. To support his argument Meltzer cited several episodes when monetary policy was restrictive when viewed from a fed funds rate perspective, but expansionary when viewed from a money growth perspective. In Meltzer's view, these procyclical policy actions caused or contributed importantly both to the rising and permanent inflation of the last 25 years and to every recession of the postwar period.

Meltzer also argued that the FOMC's reliance on forecasts of future economic activity to implement current monetary policy has led to serious policy mistakes. The reason is that the forecast errors made by the Board of Governors' staff are so large that its analysis cannot distinguish whether in the current quarter the economy is in a boom or a recession. Moreover, the forecasts appear to be biased, consistently underestimating future inflation. This is not to say, as Meltzer was careful to note, that the Board staff's forecasts demonstrate inferior performance on its part; to the contrary, many studies have shown these forecasts to be at least as accurate as any available alternative. Instead, even if the Board's forecasts reflect the highest standards of the economics profession, the wide range of forecast errors can mislead policymakers into making policy changes in the wrong direction.

Among other criticisms of Federal Reserve performance discussed by Meltzer are vague and changing policy statements that confuse market participants about the course of policy, mistakes associated with implementation of the FOMC's "monetarist experiment" of 1979-82 and the return to an interest rate objective for policy since 1982 disguised as an objective for borrowings from the discount window.

To improve future Federal Reserve performance, Meltzer advocates the adoption of a rule for monetary policy with explicit targets for growth of the monetary base. Should these targets be missed, the Board would be required to explain the reasons for its failure to achieve them. In another change from the current structure, the President would be given the option of accepting the Board's explanation or requiring the resignation of the members.

## *Comments on Meltzer's Overview*

Because Meltzer's paper covered a broad range of topics, three discussants were asked to comment on specific pieces of his analysis. Jeffrey A. Miron, University of Michigan, investigated whether the Federal Reserve has contributed to economic stability by reviewing a consistent data set since 1870. Over intervals of 10 years or longer, Miron's analysis concluded that real economic growth has been nearly a full percentage point lower in the post-World War II period compared with 1870-1913; even more striking was the contrast of price stability (actually, a slight average annual decline in the price level) in the period before 1913 with the 4.4 percent average annual inflation rate since 1947. Finally, comparisons of standard deviations showed little change in the variability of output over time. Overall, Miron's analysis supported Meltzer's arguments about monetary policy actions causing the extended peacetime inflation, but contradicted the argument that the Federal Reserve had reduced output variability significantly. Miron argued, however, that finding the Fed to be associated with only small reductions in output variability should not be surprising since its emphasis has been on smoothing financial market conditions (interest rates) in ways and at times that often exacerbate output variations.

K. Alec Chrystal, City University of London, then made comparisons between monetary policy in the United States and the policies implemented by the world's other major central banks. He argued that Switzerland, West Germany and Japan, by adhering to monetary targets in most years, have been able to achieve reasonable price stability. Moreover, when external pressures on exchange rates induced these central banks to abandon their money growth targets, the cost was higher inflation in subsequent years. Chrystal also was critical of efforts by the Federal Reserve and foreign central banks to influence exchange rates through intervention activities because, in his view, it added considerable uncertainty about the thrust of monetary policy and economic performance in the future. Finally, he argued that the financial system in the United States undoubtedly would be more stable if geographic restrictions

# Monetary Policy on the 75th Anniversary of the Federal Reserve System

A Conference Sponsored by the

**Federal Reserve Bank of St. Louis**

October 19-20, 1989

SESSION I. *An Overview of Federal Reserve Performance*

"The Federal Reserve at Seventy-Five"

Allan H. Meltzer, Carnegie Mellon University

"Has the Fed Made a Difference? A Comparison of Pre- and Post-1914 Conditions"

Jeffrey A. Miron, University of Michigan and NBER

"The Behavior of Foreign Central Banks: Comparisons and Contrasts with Fed Performance"

K. Alec Chrystal, The City University of London

"The Federal Reserve Policy Process"

Donald L. Kohn, Board of Governors of the Federal Reserve System

SESSION II. *Monetary Policy Objectives*

"Why Does the Fed Smooth Interest Rates?"

Alex Cukierman, Tel Aviv University and Princeton University

Comment by Michelle R. Garfinkel, Federal Reserve Bank of St. Louis

"Precommitment to Rules in Monetary Policy"

Edmund S. Phelps, Columbia University

Comment by Manfred J.M. Neumann, University of Bonn

SESSION III. *Money Stock Measurement And The Effect Of Money On Real Activity*

"Monitoring Monetary Aggregates under Risk Aversion"

William A. Barnett, University of Texas at Austin

Comment by Julio J. Rotemberg, Massachusetts Institute of Technology

"Money and Business Cycles: A Real Business Cycle Interpretation"

Charles I. Plosser, University of Rochester and NBER

Comment by N. Gregory Mankiw, Harvard University and NBER

on banking were removed. The primary argument against this sort of change, however, was that a different microeconomic banking structure could have important influences on the macroeconomic relationships of monetary policy (e.g. velocity growth). Although he did not offer an explicit answer to this question, Chrystal emphasized the importance of recognizing trade-offs between micro-efficiency gains in banking and (perhaps) greater ambiguity about the macro effects of central bank policies.

Donald L. Kohn, director of the Division of Monetary Affairs at the Board of Governors of the Federal Reserve System, was asked to present the Board's view of its performance. Kohn acknowledged that difficulties in distinguishing between real and nominal interest rates (among other factors) created operational problems for a policy procedure based on nominal interest rates. Moreover, Kohn recognized that these difficulties—and the accelerating rate of inflation they produced in the late 1970s—led to the

adoption of a money stock target for policy that, in his mind, was quite similar to the proposal made at the end of Meltzer's paper. But, Kohn recalled, this procedure failed as well, perhaps suggesting that the implementation of monetary policy in practice is different from that in theory.

Kohn explained why the money stock targets were abandoned as a guide to policy in 1982 by listing well-known arguments: the impact of financial innovations, especially nationwide introduction of NOW accounts, on M1; the increasing interest elasticity of M1; the abrupt shift in the trend growth rate of velocity. Although Kohn did not make the case directly, he implied that many of these problems might have been expected because the monetarist arguments for money stock targets were based on empirical regularities rather than an underlying structural theory of how monetary policy affects economic activity. Meltzer's discussion of targeting the monetary base also was rejected for the instability in its velocity and the belief (based on a simulation experiment by the Board staff) that it would produce unacceptably large variations in interest rates.

Kohn ended his discussion by summarizing the current policy process adopted by the FOMC. He noted that the Committee's members monitor the economy's performance by using a variety of indicators and that both interest rates and exchange rates receive considerable attention as variables that transmit policy actions to the economy; the monetary aggregates continue to receive some attention as well but more in terms of long-run economic performance. Current procedures lead to frequent, small adjustments in the thrust of policy to achieve the Committee's stated goal of promoting economic expansion through price stability.

## A POSITIVE THEORY OF FEDERAL RESERVE BEHAVIOR

Having debated the successes and failures of actual Federal Reserve behavior in the first session, Alex Cukierman, Tel Aviv University, attempted to explain *why* the Fed had chosen to behave in a particular manner. Specifically, he tried to answer the question: "Why Does the Fed Smooth Interest Rates?"

Cukierman constructed a choice-theoretic model of Fed behavior in which the Fed was concerned both with price stability and financial market stability as policy objectives. In his model, changes in bank profits affect financial stability by altering the risks of bank failures; moreover, bank profits are assumed to be negatively correlated with interest rates. These relationships provide the intuitive result that the Fed will focus relatively more on price stability when bank profits are high (and the risk of bank failures is low) and more on financial stability when bank profits are low (and the risk of failures is high). In practice, this systematic switching between the two goals of monetary policy leads to interest rate smoothing and that such a policy of interest rate smoothing has an inflationary bias. Finally, he noted that his theoretical model is consistent with changes in interest rate behavior after the founding of the Fed reported by Mankiw, Miron and Weil (1987).

In commenting on Cukierman's analysis, Michelle R. Garfinkel, Federal Reserve Bank of St. Louis, chose to focus on ambiguities in the definition of "financial stability" and the Federal Reserve's objective function that could affect Cukierman's qualitative results. For example, she questioned whether maximizing bank profits was a socially desirable objective for monetary policy in the context of the model. Moreover, she argued that the Fed might have *two* policy instruments (e.g., reserve requirements and the growth of reserves) to achieve two of its objectives; in this event, the tradeoff between price stability and financial stability implied by Cukierman need not exist. Garfinkel also argued that Cukierman's particular choice of a one-shot Nash equilibrium was responsible for the inflationary bias in his model and that choosing another equilibrium could eliminate this feature of his analysis. She then presented an alternative model in which the Fed could achieve its goal of financial stability while simultaneously reducing the inflationary bias.

## LIMITING DISCRETION AND ACHIEVING PRICE STABILITY

Following this positive discussion of why the Fed has chosen to adopt various policies and practices, Edmund S. Phelps, McVickar Professor of Political Economy at Columbia University, addressed two normative aspects of central bank behavior: Should its discretion be limited by a policy rule and should price stability be its primary (if not sole) objective? The focus of this broad topic was narrowed and made more relevant to the actual policy process by limiting the

discussion to a group of concrete proposals that have been offered to limit the Fed's discretion and achieve price stability. The proposals reviewed included those by Hall (1984), McCallum (1988), Meltzer (1984), and Melzer (1987).

Phelps raised several criticisms with the general notion of policy rules to achieve price stability. Perhaps most relevant to the experience of the 1980s is that the growth rate of velocity must be trend-stationary. If not, shocks to velocity may carry it far from its trend path without eventually returning to it. Under these circumstances, the targeted ranges for the monetary base or some monetary aggregate would have to be revised occasionally to account for shocks to its behavior. But, in Phelps' view, this reasonable response to dealing with actual shocks would, in reality, give a central bank convenient excuses for missing its announced targets; eventually, the potential to offer *ex post* explanations for target misses would remove credibility from the rule and render it ineffective as a constraint on policy discretion.

Another criticism of a rule such as that proposed by McCallum is that greater stability in the growth of, say, the monetary base, can be expected to be associated with greater volatility in other variables; of particular concern to Phelps in this regard were the CPI and employment. Sluggish adjustment of wages, for example, could exacerbate the negative employment effects of a supply shock if the mechanics of a policy rule did not permit some monetary accommodation of the shock. Phelps also raised the important issue of defining "price stability" precisely as (1) a constant inflation rate, (2) a constant aggregate price level or (3) limiting the variability of the price level within some narrow band. Finally, he was concerned about the unknown, but potentially large, start-up costs as the transition was made from discretionary policies to the implementation of the rule.

Manfred J.M. Neumann, University of Bonn, criticized Phelps for not providing a clear framework to evaluate each rule's operating characteristics relative to its final goals. Neumann analyzed whether several proposed rules could respond to current shocks, changes in trend velocity or output shocks and whether any of them would guarantee an expected inflation rate equal to zero. Against these criteria, Neumann found that only Meltzer's (1984) proposal was consistent with each standard.

Neumann, however, questioned the need for a coercive rule when, instead, better monetary policy performance might be achieved from a monetary constitution that creates "the ultra-conservative central banker." This constitution would free the central bank from responsibility for supporting the government's output, employment or exchange rate policies and leave it free to concentrate only on price stability. Moreover, the people making monetary policy would serve for long terms and be paid salaries comparable to those in the private sector. These features (and several others) would create a central bank truly independent from political pressures, a condition that in Neumann's view is crucial for the achievement of price stability.

## MEASUREMENT OF THE U.S. MONEY STOCK

Like most activities, conducting monetary policy generally will produce results that are above or below the desired objective if the wrong phenomenon is being analyzed. Thus, while many observers have commented on the "anomalous" behavior of M1 and its velocity in the 1980s, another viewpoint argues that their "unusual" behavior stems from the fact that the monetary aggregates, as currently constructed and reported, do not measure the theoretical concept that we call "money." William A. Barnett, University of Texas at Austin, reported the results of his continuing attempt to construct a monetary aggregate consistent with microtheoretic foundations.[2]

Barnett's previous investigations of the characteristics of a desirable monetary index number assumed risk-neutrality on the part of individuals. In this conference paper, he considered the consequences of incorporating risk aversion, an issue that had been raised in work by Poterba and Rotemberg (1987). In his extended framework, Barnett argued that an aggregate monetary variable has to be derived from a four-step process consisting of checks for admissibility, approximation, monitoring and application. These steps determine which assets can be grouped to form an aggregate, how the

[2]Barnett's paper was co-authored with Melvin Hinich, University of Texas at Austin and Piyu Yue, visiting scholar at the Federal Reserve Bank of St. Louis.

individual assets will be weighted within the aggregate, how closely the resulting index tracks the theoretically ideal measure and how well the aggregate performs in its final use.

After deriving and applying the microeconomic and index number principles consistent with these guidelines, Barnett advocated the use of a monetary measure that he calls "Theoretic M2." He then demonstrated that large empirical differences exist between the theoretic aggregates and the official simple-sum aggregates reported by the Federal Reserve. He also found differences, although much smaller, between Divisia aggregates constructed under the assumption of risk neutrality and the theoretic aggregates that allowed for risk aversion. Barnett concluded that the Federal Reserve should abandon its simple-sum measures of the money stock and construct new measures following the statistical practices of the Bureau of Labor Statistics and other government agencies.

Although generally in agreement with Barnett's argument, Julio J. Rotemberg, Massachusetts Institute of Technology, raised several issues regarding Barnett's strategy. For example, he suggested a revision in weighting the dollar values of individual asset categories when constructing an aggregate monetary variable. Rather than using $r^b_o - r^i_o$, the difference between the interest rate on a benchmark asset (one that yields no liquidity services) and the $i^{th}$ asset's own rate of return at some base period, Rotemberg suggested using $\left(\frac{r^b_t - r^i_t}{r^b_t}\right)$.

This revised measure has the advantage that sensitivity to choice of a base period is eliminated and the addition of new assets to the aggregate is a straightforward operation, should that become necessary. Perhaps more important, however, is that a model with risk aversion will include some measure of *expected* returns, which will introduce errors into the measurement of any aggregate. But while an error in a Divisia aggregate will persist forever, the error will appear only in the period it occurs in Rotemberg's "currency equivalent" (CE) measure. Rotemberg also suggested that a different benchmark rate of return should be used (stock market returns rather than the yield on a long bond) and that further testing is required to determine which assets legitimately can be aggregated as a group (rather than merely re-weighting the Board's official groupings called M1, M2, etc.). In his reply to Rotemberg's comments, Barnett demonstrated that Rotemberg's suggested revisions to his currency-equivalent index do indeed produce a measure of the economic stock of money.

## DOES MONETARY POLICY REALLY MATTER?

The real business cycle approach to economic fluctuations raises the question of whether monetary policy has any significant effect on real economic activity. While most economists acknowledge the primary, if not exclusive, relationship between changes in the nominal quantity of money and changes in the aggregate price level, establishing a link between nominal money and the business cycle has long been debated by macroeconomists. Charles I. Plosser, University of Rochester, examined this issue; his conclusion was that explanations of variations in real economic activity should focus on shocks to "tastes and technology" rather than on changes in the money stock.

Plosser first surveyed prominent studies that attribute an important role to the money stock for explaining fluctuations in real output. Primary among these references are those by Friedman and Schwartz (1963) and Romer and Romer (1989) who identify explicit business cycles and discuss the monetary policy changes that coincide with them. Plosser noted that, while several of the important episodes clearly reflected changes in monetary policy, these policy changes were "real" as opposed to "nominal" ones. That is, rather than a change in the nominal money stock (as one often thinks of a monetary policy change), these episodes often involved adjustments in reserve requirements, which are better classified as real changes that affect relative prices and, in turn, induce reallocations of resources. Thus, Plosser argues, while previous authors may have been correct to attribute a particular business cycle movement to a monetary policy change, they were wrong to conclude that the causal factor was a change in the nominal stock of money. Instead, in his view, it was a real change (such as a change in reserve requirements) that was the cause of the economic fluctuation.

Plosser supported his argument by examining correlations of the components of M1 and M2 (the source base, the reserve adjustment magnitude (RAM) and the appropriate multiplier) and various deposit to currency ratios with the

growth of real output to see whether real or nominal aspects of monetary policy changes were more closely related to output growth. In these simple correlations, as well as more elaborate VAR results, Plosser found the evidence generally to be consistent with his view that changes in the nominal quantity of money alone have had relatively minor effects on real economic activity.

In his comments on Plosser's paper, N. Gregory Mankiw, Harvard University, generally agreed with Plosser's specific conclusion that it is difficult to find a significant correlation between changes in nominal money and real output. However, Mankiw disagreed with Plosser's overall conclusion that money is neutral even in the short run. Mankiw argued that, even if the Fed were not the cause of fluctuations in output, monetary policy still could be very important to how the economy reacts to an exogenous real shock. For example, if shocks to technology caused output fluctuations, monetary policy may be able to help the economy adjust to this new output path and avert even larger declines in output. Mankiw also disagreed with Plosser's criticisms of theories that attempt to explain why changes in money may affect output. Mankiw argued that, while perhaps correct in his comments on specific theories, Plosser had overlooked a more fundamental issue—because no economic theory is "complete," a combination of different theories may be necessary to explain real world phenomena. Because the real world is "messy," then perhaps, in Mankiw's view, economic reasoning will inevitably be messy as well.

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