5

The Impact of Monetary and Fiscal Instruments

Changes in the instruments of monetary and fiscal policy have powerful effects on real economic activity according to the estimated multicountry model presented in Chapter 3. Despite the presence of rational expectations, short-term nominal price and wage rigidities translate changes in the money supply into changes in real interest rates and exchange rates and hence into changes in real output and employment. The effects are temporary, however; eventually real output returns to the path it was previously following, as it did in the stylized model presented in Chapter 1.

For most practical policy applications we need to estimate the size of these effects. By how much can we expect output, inflation, long-term interest rates, and exchange rates to change if the Federal Reserve lowers the federal funds rate by 1 percent? Does it matter if the Bundesbank or the Bank of Japan lower their interest rate target at the same time? Presumably the dollar depreciates if the Fed eases monetary policy. But does it overshoot? Does the depreciation cause more inflation in the United States and less inflation abroad? How long does it take before the depreciation improves the trade balance? Or is the improvement in the trade balance offset by the increased demand for imports due do the expansion in the U.S. economy? Do the answers to these questions change if easing of monetary policy is anticipated to occur several quarters in the future?

Knowing the magnitude of the impact of the instruments of fiscal policy is also important. What is the size of the effect of a 1-percent decrease in government purchases in the United States? Do real interest rates fall by enough to have a net stimulative effect on economic activity? Does the

exchange rate depreciate by enough to stimulate exports and add to this effect? How large is the impact on other countries? And as with the questions pertaining to monetary policy, does it matter if the spending cut is anticipated?

This chapter provides quantitative estimates of the dynamic—short-run and long-run—impact of changes in the *instruments* of monetary and fiscal policy by using the empirical mulitcountry model described in Chapter 3. When combined with the information about the stochastic structure of the model presented in Chapter 4, the estimates provide the raw material for the analysis of how monetary and fiscal policy *rules* should be designed, implemented, and operated in an uncertain and dynamic world environment.

I focus the analysis on two canonical policy shocks: a monetary policy shock and a fiscal policy shock. The monetary policy shock is a permanent increase in the money supply. The fiscal policy shock is a permanent increase in real government spending. Recall that these are the two policy shocks considered in the stylized two-country model of Chapter 1. The effects of the shocks on the behavior of output, investment, consumption, the trade balance, inflation, exchange rates, and other key variables in the United States and other countries are examined by deterministically simulating the estimated multicountry model, using the extended path method described in Chapter 1. Both anticipated and unanticipated policy changes are studied. From this information one can easily determine the effects of combinations of the two canonical shocks, such as the effect of a combined tightening of fiscal policy and loosening of monetary policy.

It should already be clear that the rational expectations assumption plays a role in evaluating the impact of anticipated changes in policy. However, the quantitative significance of this role is an empirical question that is answered here by using the parameters estimated in Chapter 3. Of course, the rational expectations assumption plays a role even in the case of unanticipated shocks, especially in an international model, when the behavior of exchange rates is heavily influenced by expectations. For example, when the money supply increases, the exchange rate usually changes by a larger amount in a forward-looking model than in a traditional model.

In addition to providing quantitative input to policy analysis, these deterministic simulations provide useful insights into the dynamic properties of the model. These insights are of help in interpreting more complex stochastic simulations used to evaluate the effect of different monetary rules such as fixed exchange-rate rules versus floating exchange-rates rules. The insights from these deterministic simulations remain even if these particular canonical changes in the paths of the monetary and fiscal instruments never occur.

The next section describes how the simulations were performed. Subsequent sections then present the impacts of unanticipated monetary and fiscal shocks under flexible and fixed exchange rates. Finally the impacts of anticipated monetary and fiscal policy shocks are considered. A summary is provided in the final section.

5.1 The Nature of the Simulations

We are generally interested in obtaining "elasticity type" information: the percentage changes in output, employment, or other variables that occur in response to a given percentage change in a policy instrument. Because the multicountry model is neither log-linear nor linear, the initial starting values for the variables and for the period over which one conducts policy experiments can in principle make a difference for these percentage changes. In practice, however, the time period and the level of the variables appear to make only small differences for this model. To a close approximation, the percentage changes do not depend on the level of the variables or the time period. Hence, although these simulations focus on a particular ten-year period—1975:1 through 1984:4—they can be interpreted as applying to any other ten-year period, for example, from 1993:1 through 2002:4.

The simulation procedure differs according to whether the policy change is anticipated or unanticipated. In the case of *unanticipated* changes, the first period in which the policy instruments differ from the baseline values is the first quarter of the simulation; the results are reported through the full ten years of the simulation. In the case of *anticipated* changes, the first period in which people learn about the policy change is the first quarter of the simulation, even though the actual change does not occur until two years later. The results are again reported through the full ten-year period. (In order to solve the model for ten years, it is of course necessary to solve beyond ten years when using the extended path method, but the results are only reported for ten years.)

For the *baseline* simulation—that is, the simulation with no change in policy instruments—the endogenous variables are set so as to track the actual historical values perfectly. This is done by adding residuals to each equation. The residuals are computed as if the future expectations of the endogenous variables that appear in the model are equal to the actual values. These residuals therefore include not only the shocks to the equations, but also the forecasting errors. They are not the structural errors computed in Chapter 4. The historical path is a natural baseline for such comparisons. A less attractive alternative from this perspective would be to set the residuals to zero—their unconditional mean. As already mentioned, however, the results of the experiments on this model—stated as percentage deviations of the variables from the baseline path—do not seem to be much affected by the choice of baseline path or historical period.

The experiments reported in this chapter begin with changes in United States policy variables and then go on to consider policy in other countries. For most of the experiments, flexible exchange rates are assumed with the levels of money supplies in each country held to the baseline path with the exception of the country whose monetary policy is being investigated. For fixed exchange-rate simulations, one country keeps its money supply on a set exogenous path and all other countries must manipulate their money supplies to keep their exchange rates fixed with respect to the

dollar. Although this characterization of fixed exchange rates is probably a historically accurate description of the dollar standard that existed under the Bretton Woods agreement, it is not the only fixed exchange-rate system. For example, another type of a fixed exchange-rate system would hold *world* money growth—a weighted average of money in the different countries—constant. This and other variants of a fixed exchange-rate regime are not considered in the results reported in this chapter.

The results of the experiments are summarized in graphical form in Figures 5-1 through 5-17. These charts are easier to digest than numerical tables. Although there are many charts, only a selection of the variables is reported. The charts all show the percentage deviation of a particular variable—real output, price level, and so on—from the baseline path. Note that in the case of interest rates, the charts show percentage *point* deviations from the baseline. Note also that when the change is large relative to the baseline values—as is sometimes the case with inventory investment—the fluctuations in the percentage change can be influenced by fluctuations in the baseline path. This is one explanation for the occasional finding that the impacts display a nonsmooth path over time.

5.2 Unanticipated Increase in Money Supply

Consider the case of an unanticipated permanent 3-percent increase in the level of the money supply relative to the historical baseline in one country. The money supplies in all other countries are held to the baseline path, and exchange rates are flexible. The 3-percent increase is completed in one year but is phased in gradually during the year at an average increase of ¾ percentage points per quarter.[1] Thereafter, the money supply is 3 percent greater than the baseline path. Although unanticipated at the time of the initial increase, the entire path of the money supply is assumed to be incorporated into people's forecasts as of the first quarter of the simulation. In particular, people know that the increase in money is permanent.

Theoretical Insights

Money is neutral in the long run in the multicountry model. Hence, in the long run, the price level should increase by 3 percent above its baseline along with nominal wages and other prices, and the exchange rate should depreciate by 3 percent. Real output, the components of real spending, real interest rates, and real exchange rate should return to the baseline. In the other countries, all variables—real and nominal—should return to the baseline. *(continued on p. 206)*

[1]The exact pattern of the percentage increase in the money supply from the baseline in the first four quarters was .14, .73, 1.88, and 2.80. This pattern was chosen to conform with a model comparison project organized by Lawrence Klein in the late 1980s and described in Klein (1991).

FIGURE 5-1A U.S. Monetary Expansion
Effect on U.S. Output and Prices

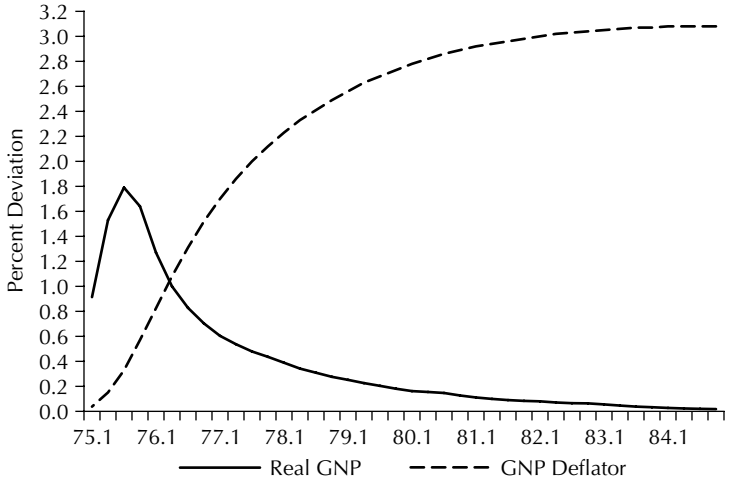


FIGURE 5-1B U.S. Monetary Expansion
Effect on U.S. Interest Rates, Exchange Rate

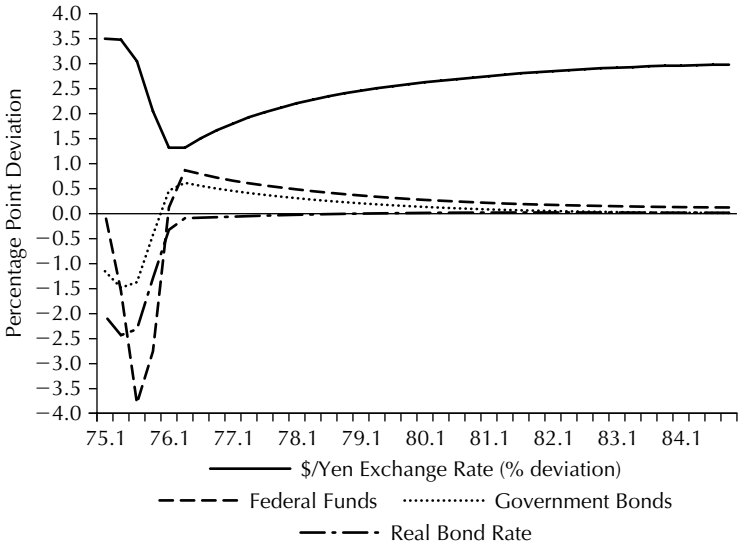


FIGURE 5-1C U.S. Monetary Expansion
Effect on U.S. Net Export Ratios

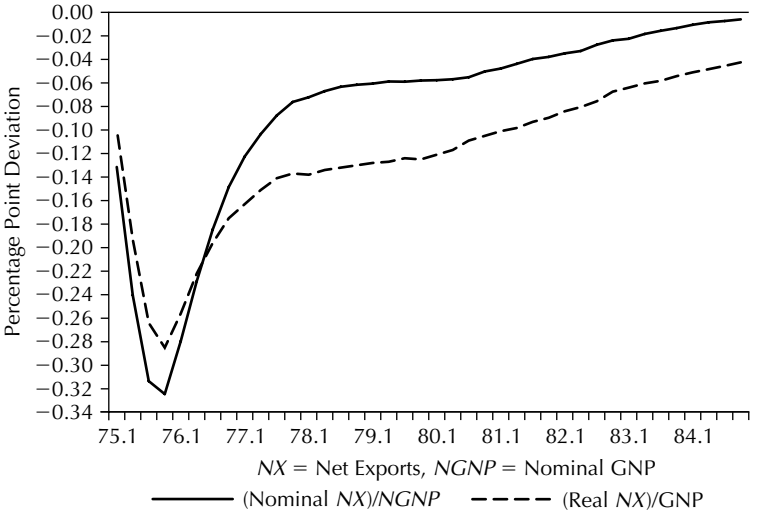


FIGURE 5-1D U.S. Monetary Expansion
Effect on U.S. Wage, Import Prices

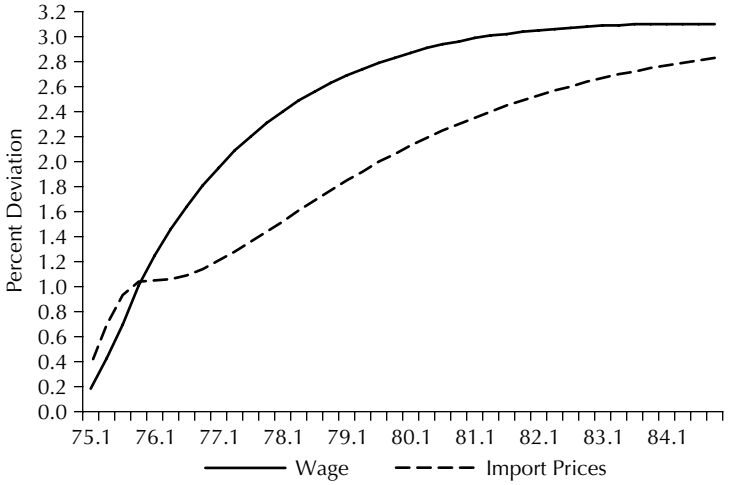


FIGURE 5-1E U.S. Monetary Expansion
Effect on U.S. Demand Components

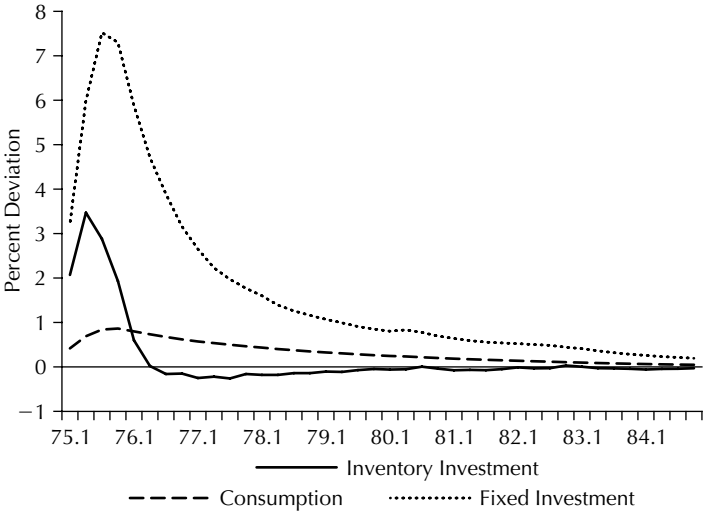


FIGURE 5-1F U.S. Monetary Expansion
Effect on U.S. Exports, Imports

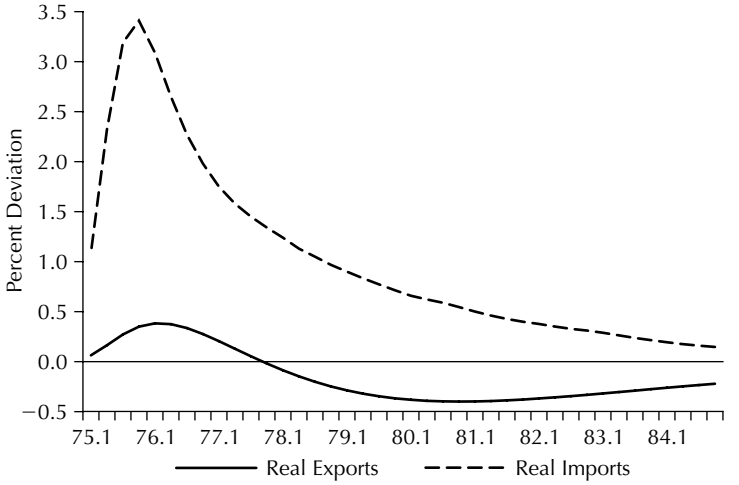


FIGURE 5-1G U.S. Monetary Expansion
Effect on Output Abroad

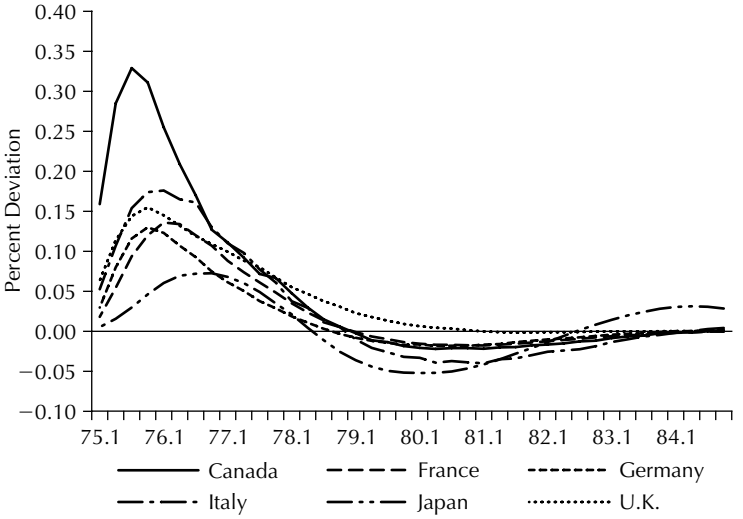


FIGURE 5-1H U.S. Monetary Expansion
Effect on Prices Abroad

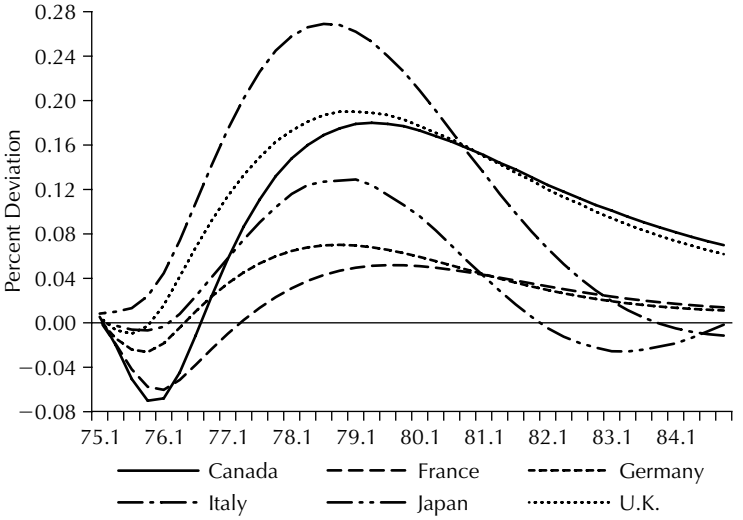


FIGURE 5-2A Canadian Monetary Expansion
Effect on Canadian Output and Prices

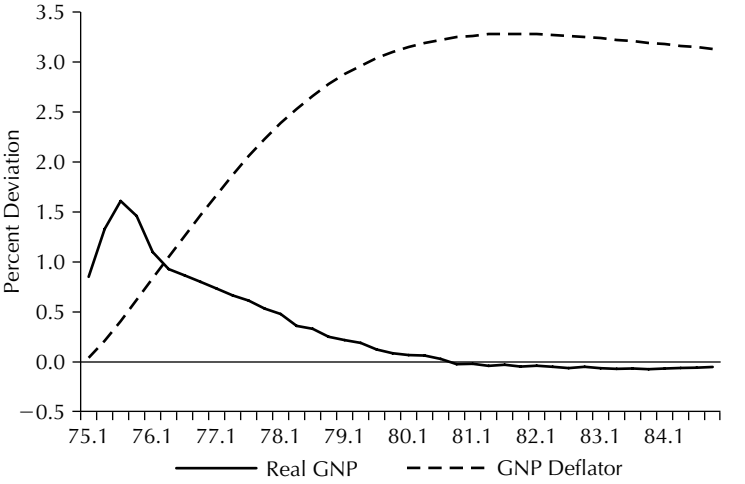


FIGURE 5-2B Canadian Monetary Expansion
Effect on Canadian Interest Rates, Exchange Rate

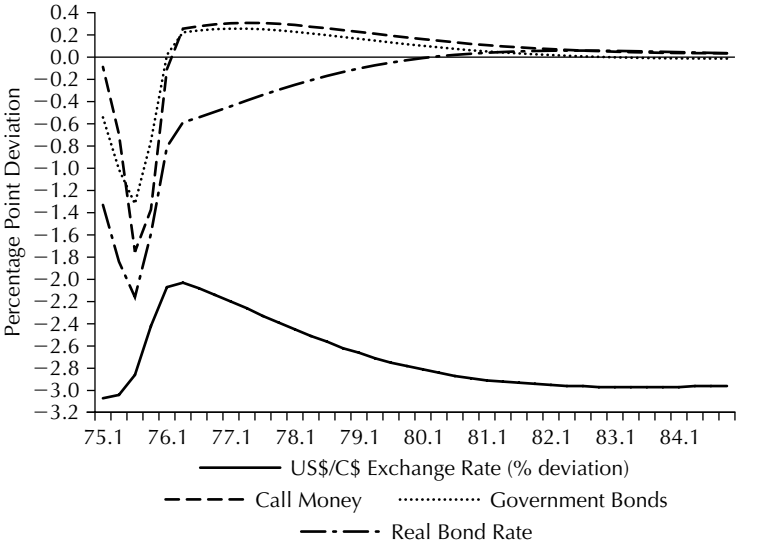


FIGURE 5-2C Canadian Monetary Expansion
Effect on Canadian Net Export Ratios

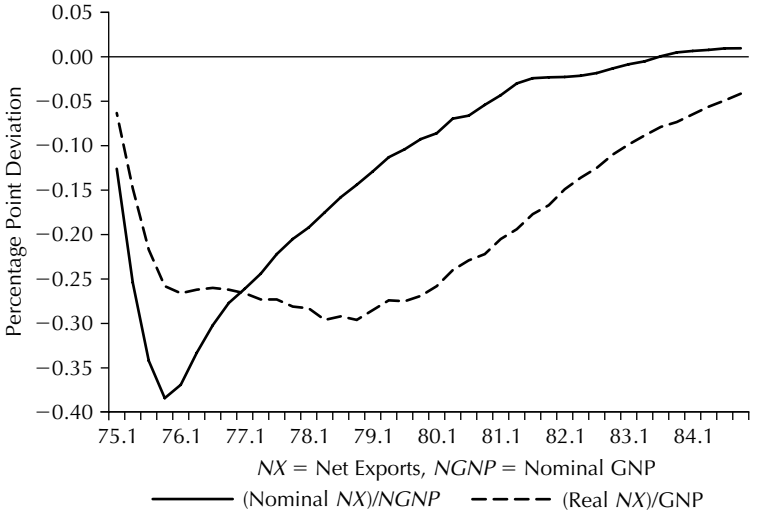


FIGURE 5-2D Canadian Monetary Expansion
Effect on Canadian Wage, Import Prices

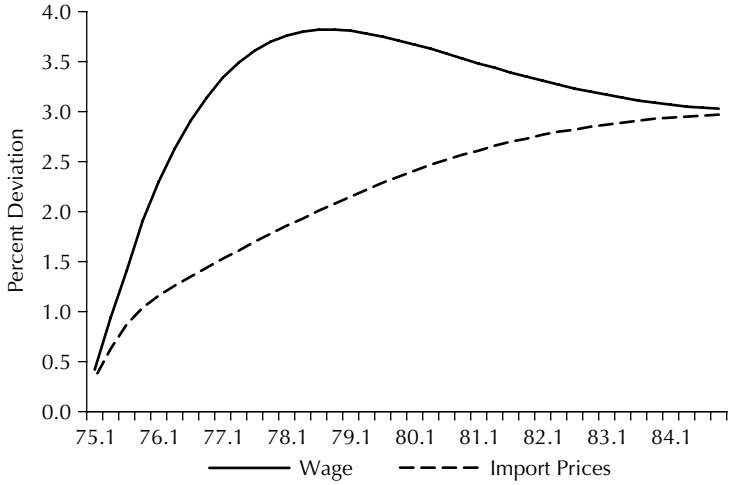


FIGURE 5-2E Canadian Monetary Expansion
Effect on Canadian Demand Components

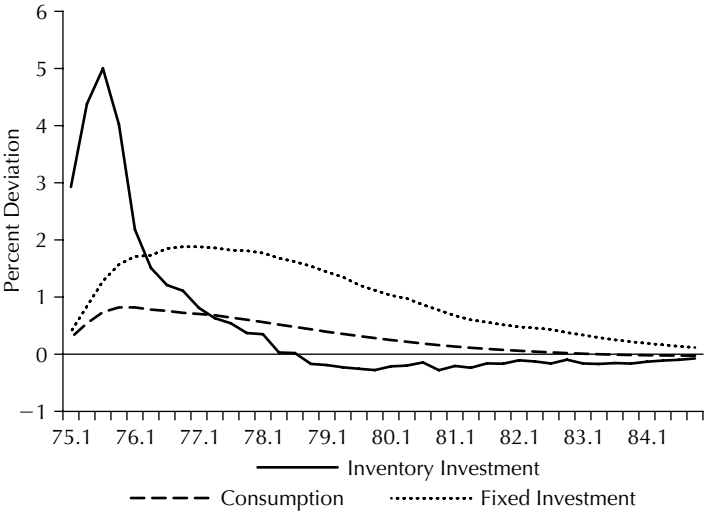


FIGURE 5-2F Canadian Monetary Expansion
Effect on Canadian Exports, Imports

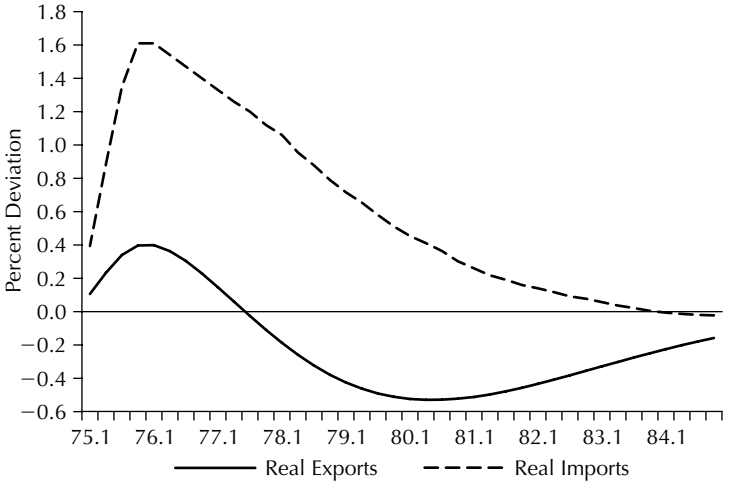


FIGURE 5-2G Canadian Monetary Expansion
Effect on Output Abroad

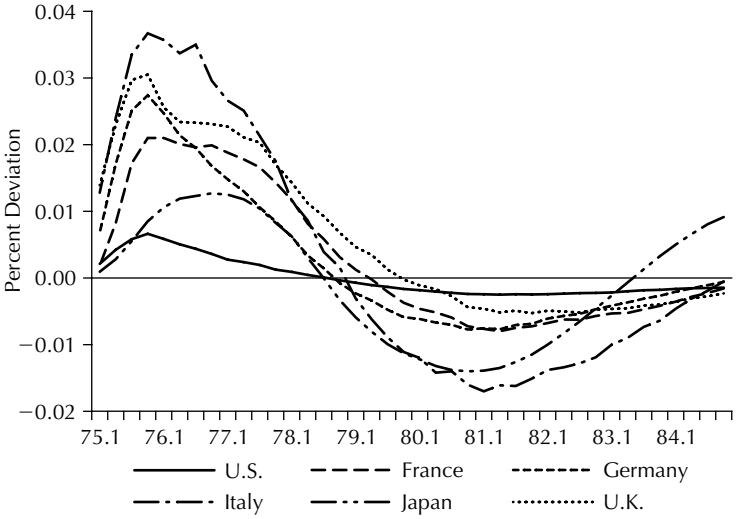


FIGURE 5-2H Canadian Monetary Expansion
Effect on Prices Abroad

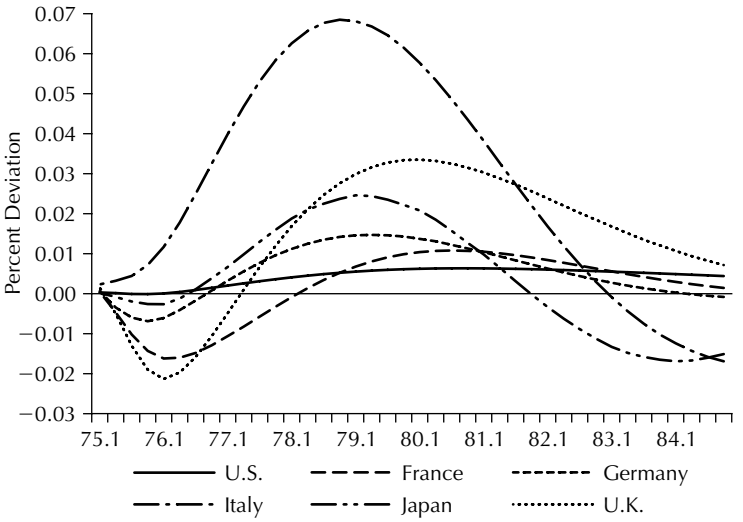


FIGURE 5-3A French Monetary Expansion
Effect on French Output and Prices

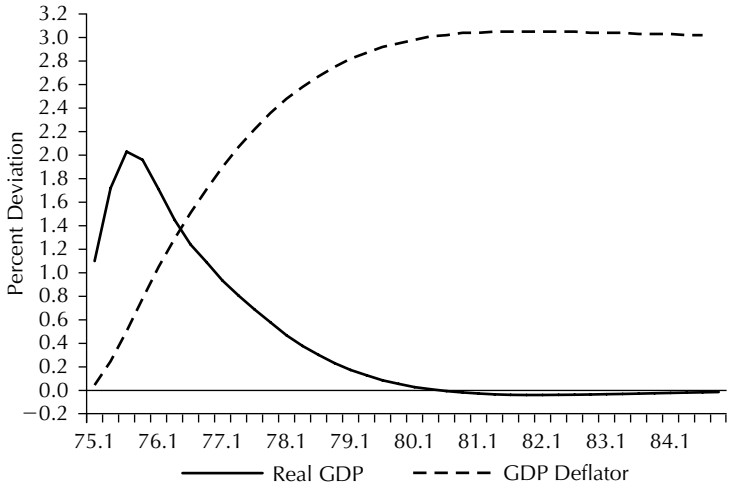


FIGURE 5-3B French Monetary Expansion
Effect on French Interest Rates, Exchange Rate

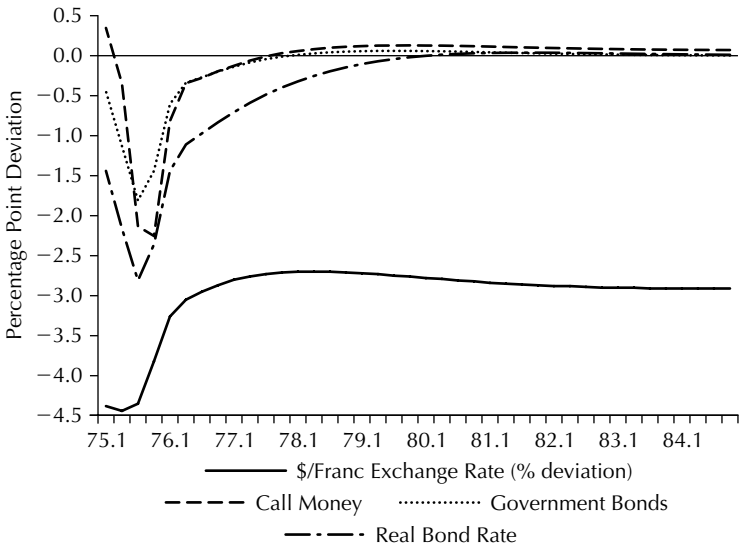


FIGURE 5-3C French Monetary Expansion
Effect on French Net Export Ratios

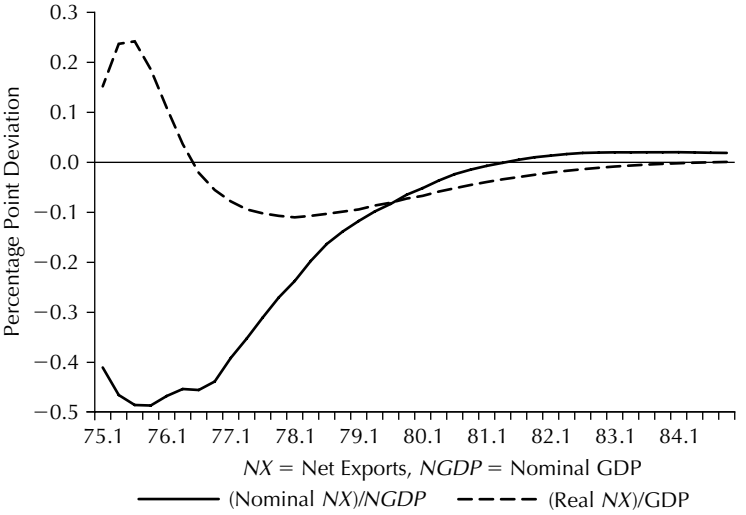


FIGURE 5-3D French Monetary Expansion
Effect on French Wage, Import Prices

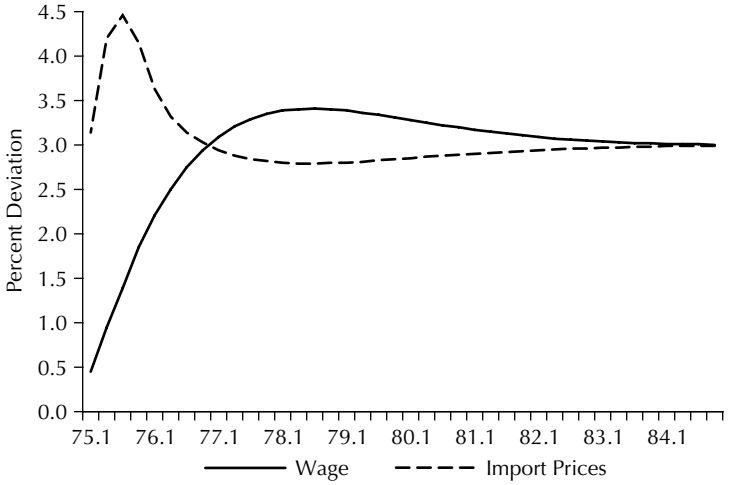


FIGURE 5-3E French Monetary Expansion
Effect on French Demand Components

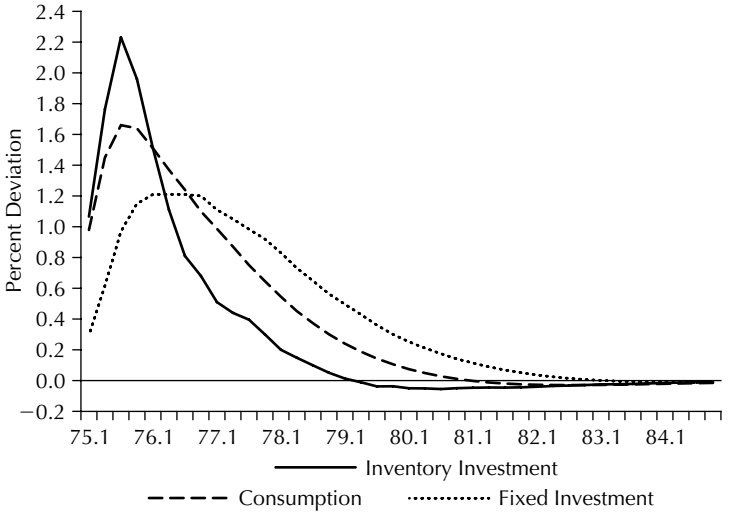


FIGURE 5-3F French Monetary Expansion
Effect on French Exports, Imports

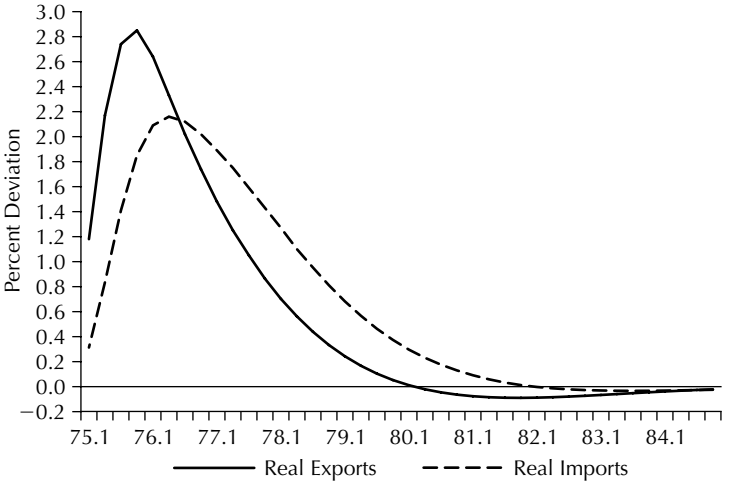


FIGURE 5-3G French Monetary Expansion
Effect on Output Abroad

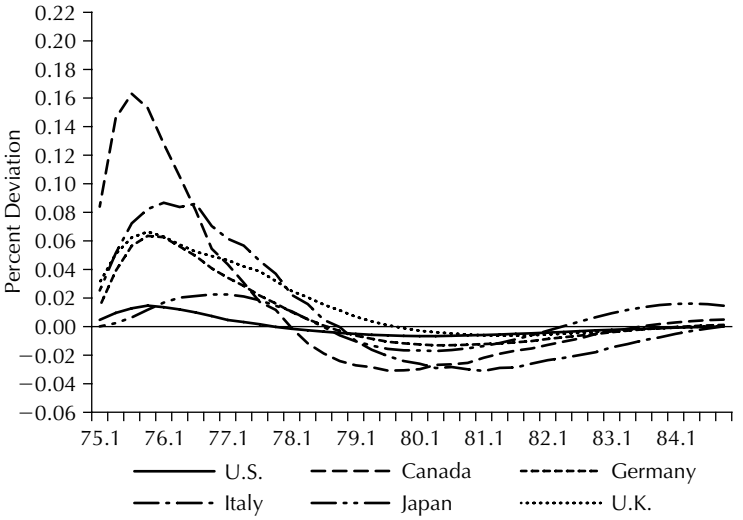


FIGURE 5-3H French Monetary Expansion
Effect on Prices Abroad

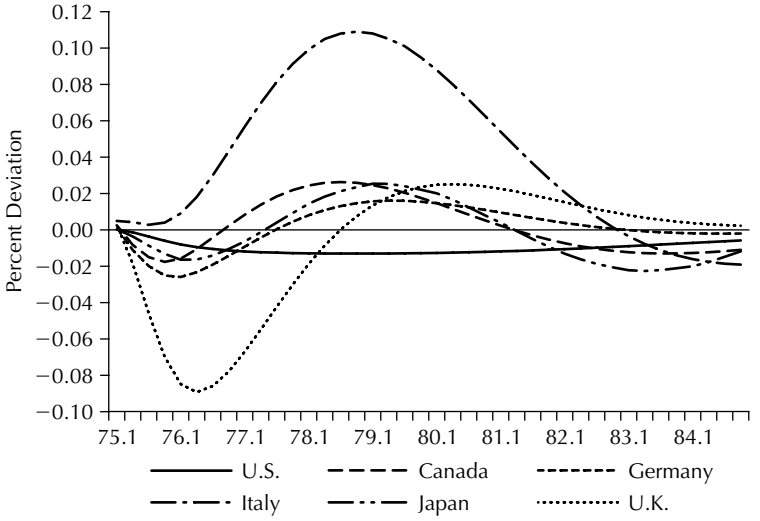


FIGURE 5-4A German Monetary Expansion
Effect on German Output and Prices

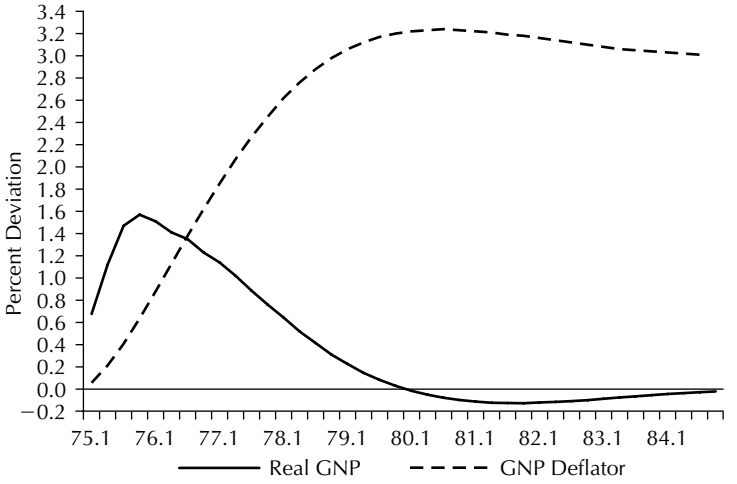


FIGURE 5-4B German Monetary Expansion
Effect on German Interest Rates, Exchange Rate

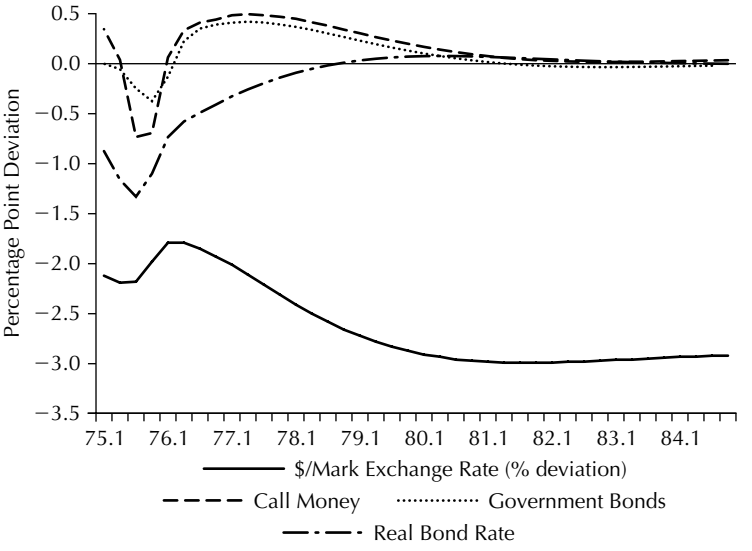


FIGURE 5-4C German Monetary Expansion
Effect on German Net Export Ratios

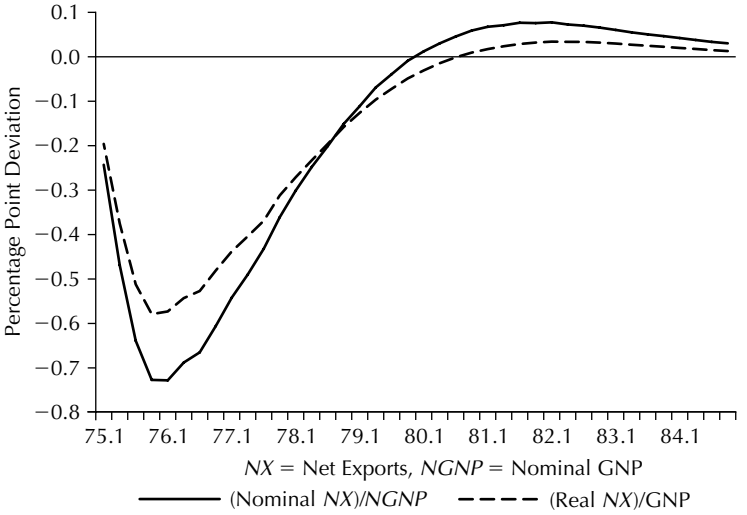


FIGURE 5-4D German Monetary Expansion
Effect on German Wage, Import Prices

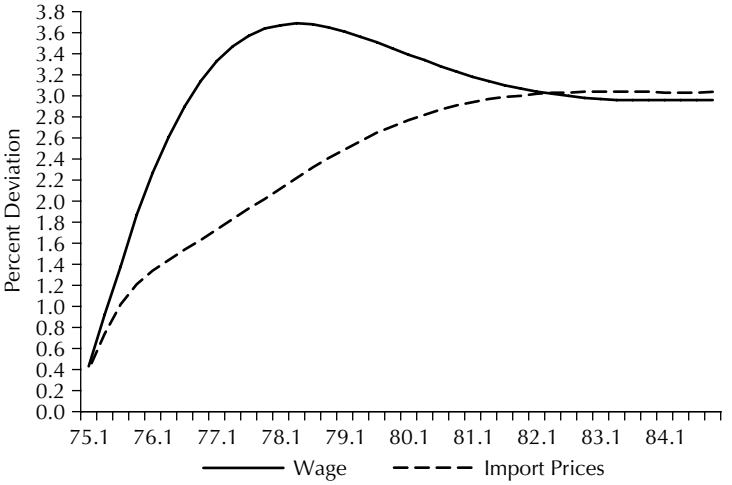


FIGURE 5-4E German Monetary Expansion
Effect on German Demand Components

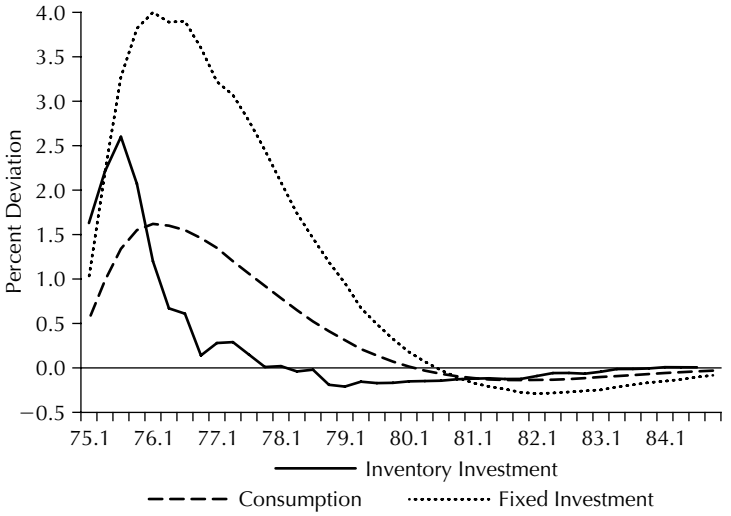


FIGURE 5-4F German Monetary Expansion
Effect on German Exports, Imports

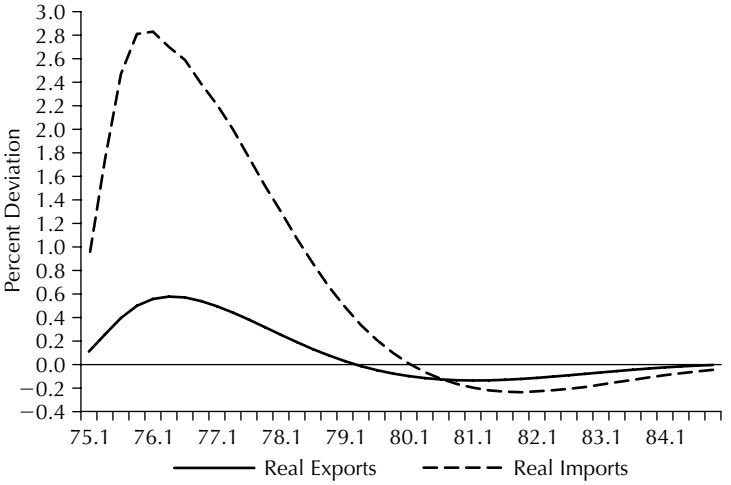


FIGURE 5-4G German Monetary Expansion
Effect on Output Abroad

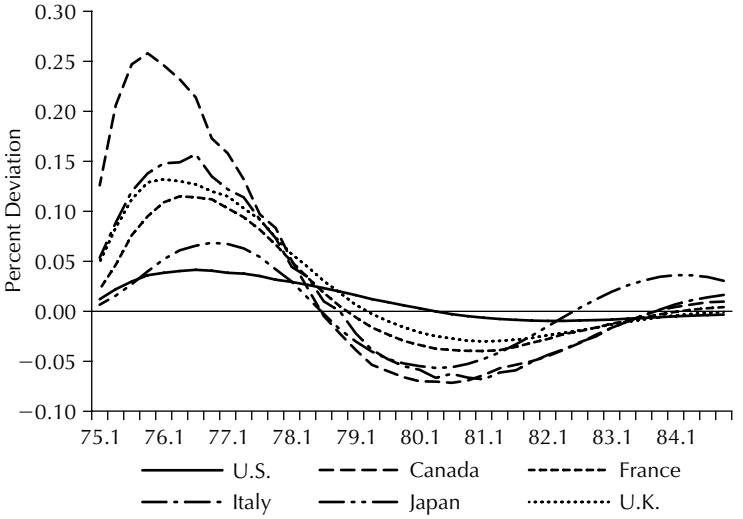


FIGURE 5-4H German Monetary Expansion
Effect on Prices Abroad

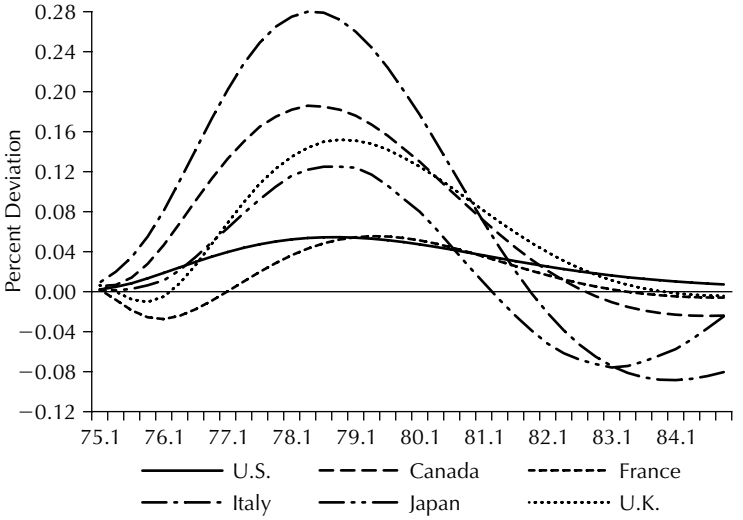


FIGURE 5-5A Italian Monetary Expansion
Effect on Italian Output and Prices

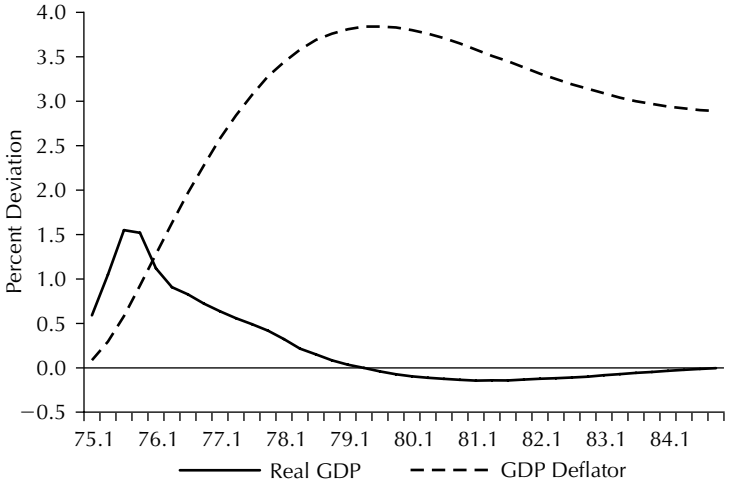


FIGURE 5-5B Italian Monetary Expansion
Effect on Italian Interest Rates, Exchange Rate

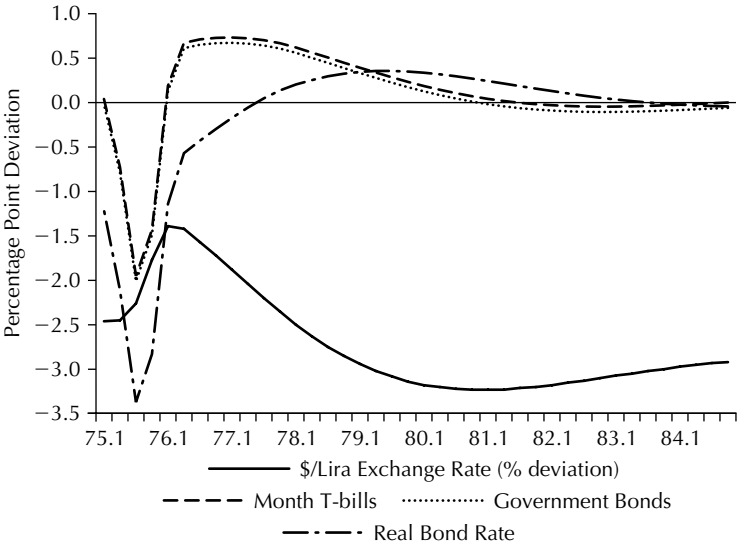


FIGURE 5-5C Italian Monetary Expansion
Effect on Italian Net Export Ratios

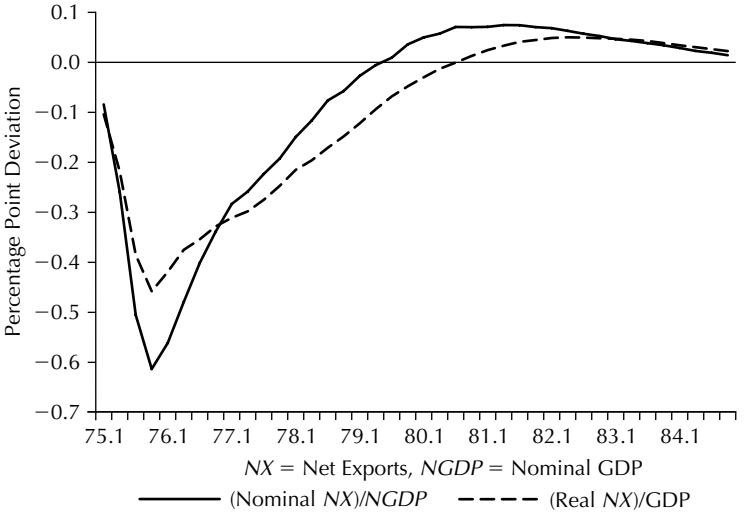


FIGURE 5-5D Italian Monetary Expansion
Effect on Italian Wage, Import Prices

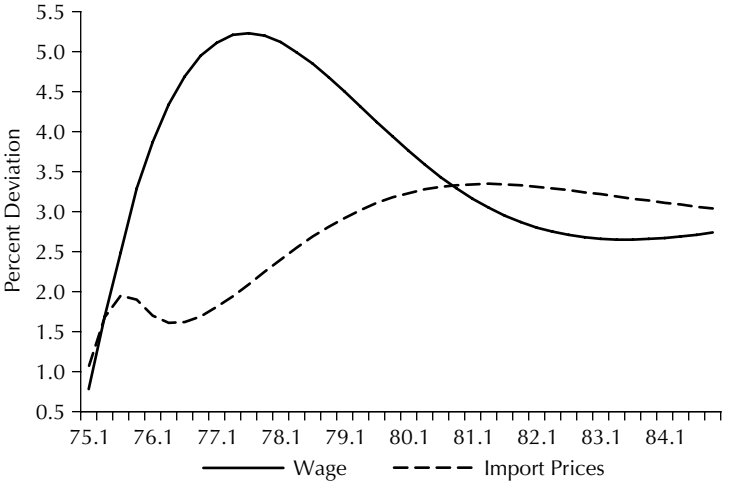


FIGURE 5-5E Italian Monetary Expansion
Effect on Italian Demand Components

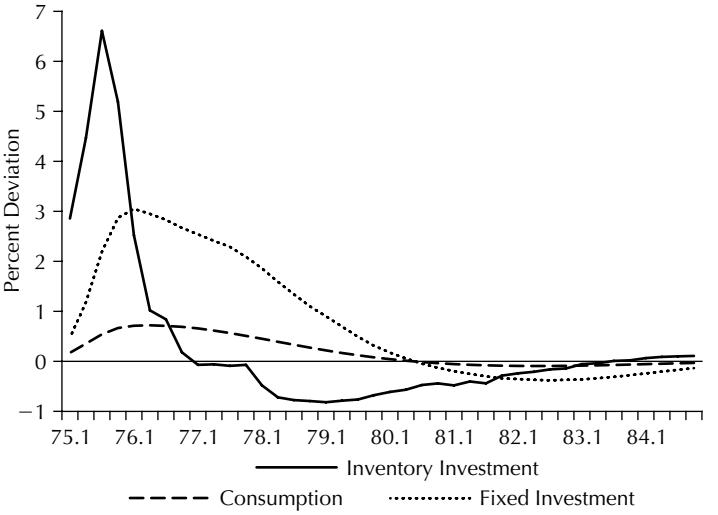


FIGURE 5-5F Italian Monetary Expansion
Effect on Italian Exports, Imports

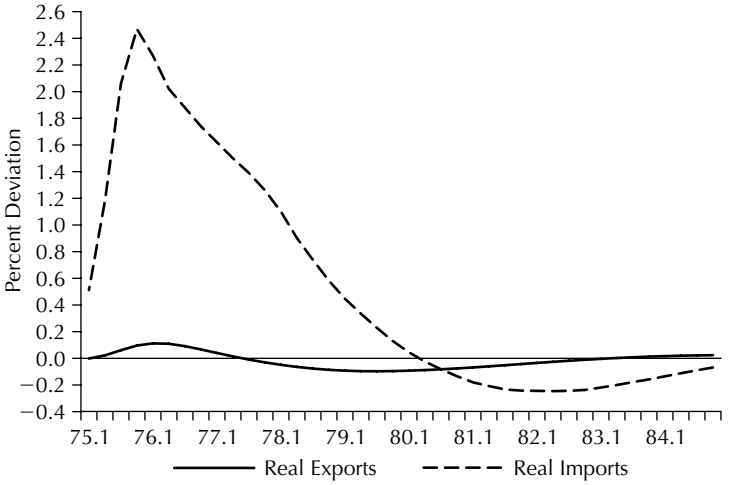


FIGURE 5-5G Italian Monetary Expansion
Effect on Output Abroad

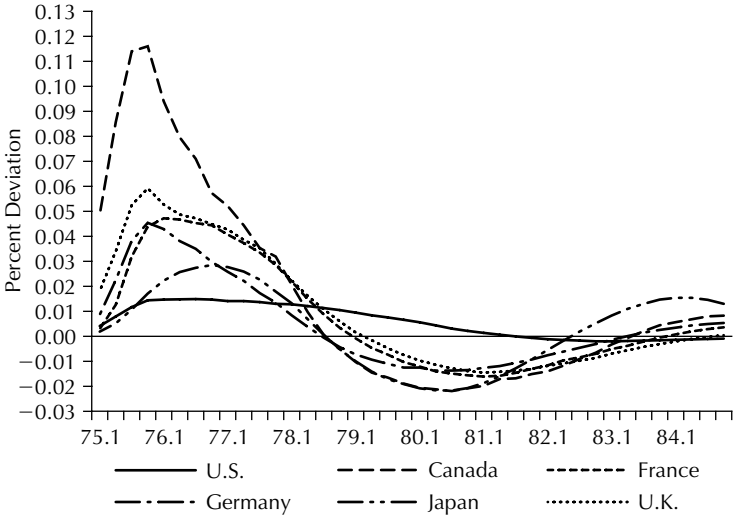


FIGURE 5-5H Italian Monetary Expansion
Effect on Prices Abroad

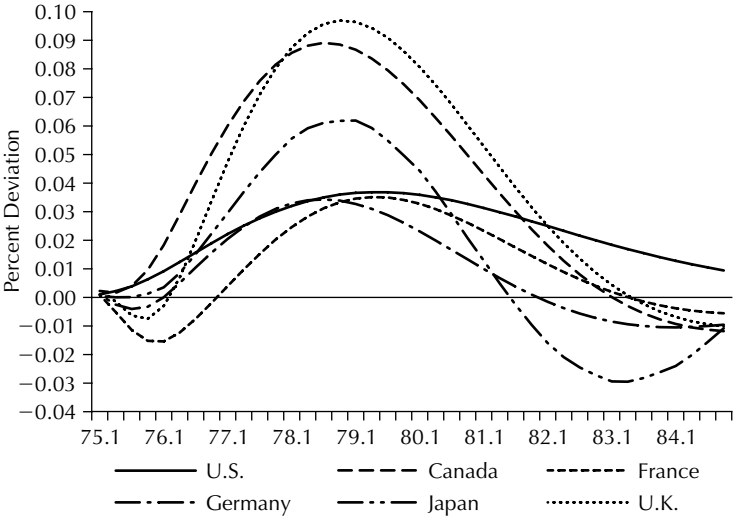


FIGURE 5-6A Japanese Monetary Expansion
Effect on Japanese Output and Prices

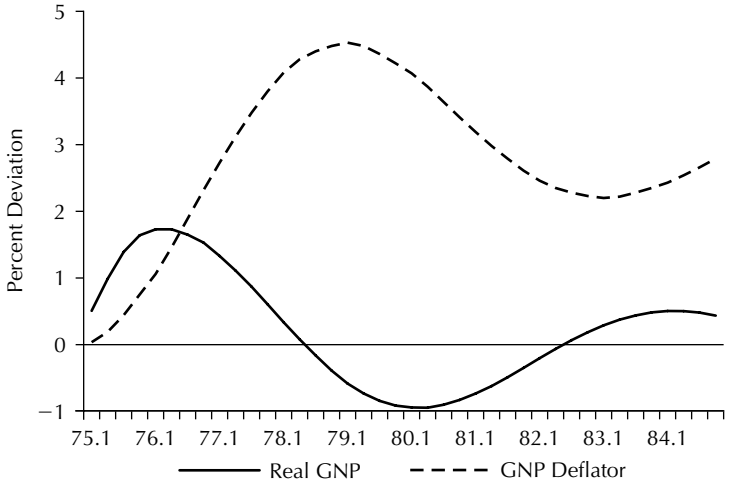


FIGURE 5-6B Japanese Monetary Expansion
Effect on Japanese Interest Rates, Exchange Rate

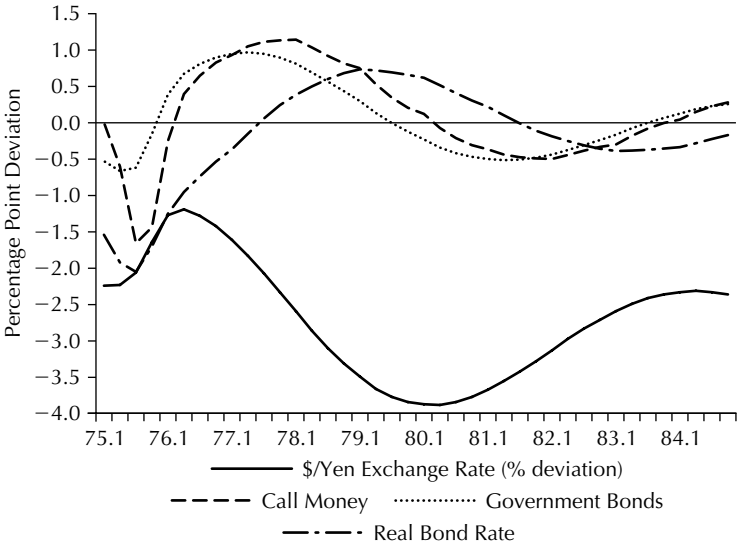


FIGURE 5-6C Japanese Monetary Expansion
Effect on Japanese Net Export Ratios

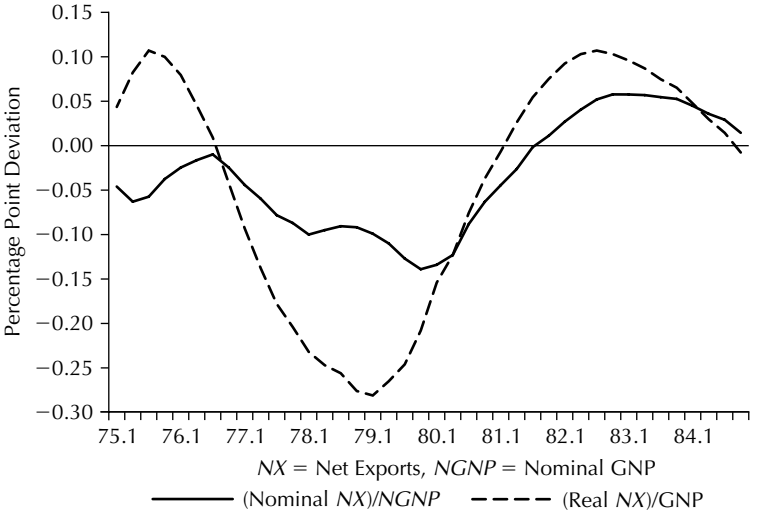


FIGURE 5-6D Japanese Monetary Expansion
Effect on Japanese Wage, Import Prices

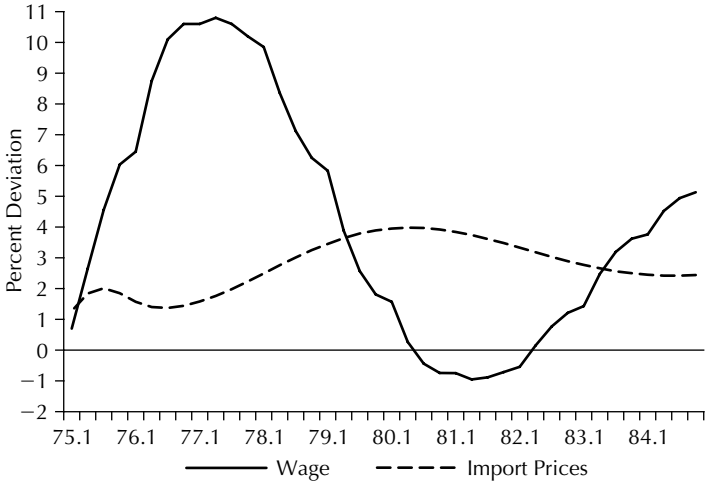


FIGURE 5-6E Japanese Monetary Expansion
Effect on Japanese Demand Components

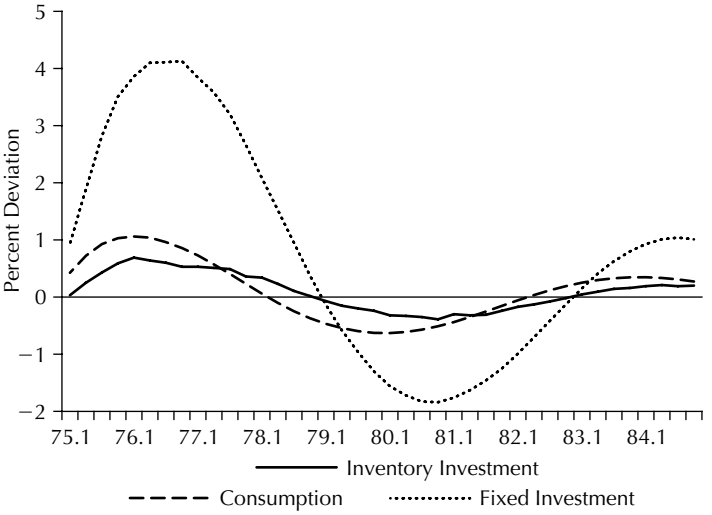


FIGURE 5-6F Japanese Monetary Expansion
Effect on Japanese Exports, Imports

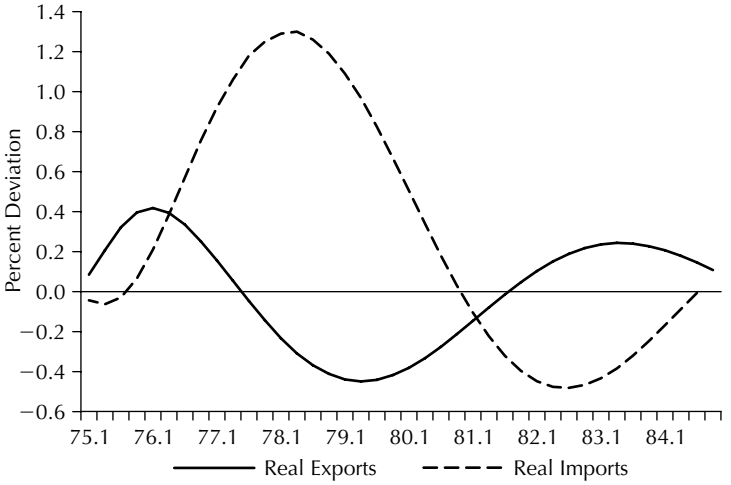


FIGURE 5-6G Japanese Monetary Expansion
Effect on Output Abroad

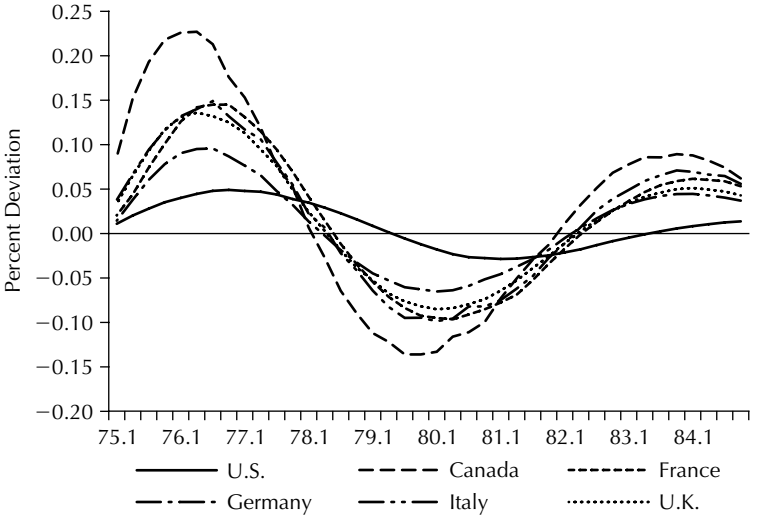


FIGURE 5-6H Japanese Monetary Expansion
Effect on Prices Abroad

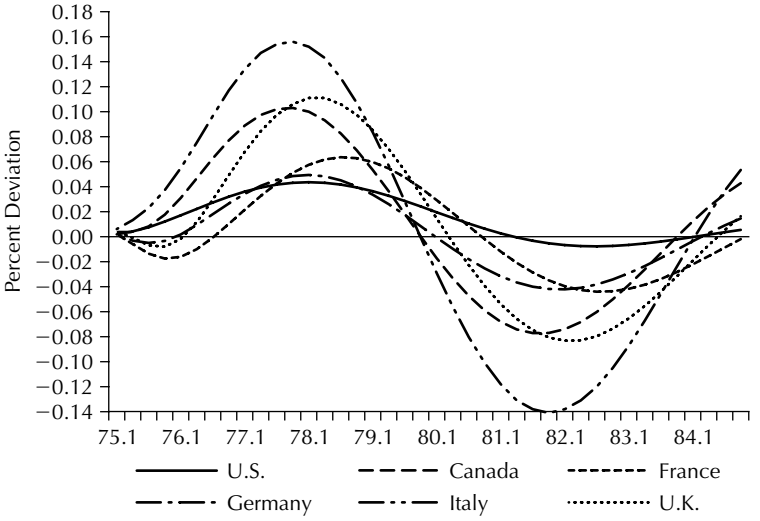


FIGURE 5-7A U.K. Monetary Expansion
Effect on U.K. Output and Prices

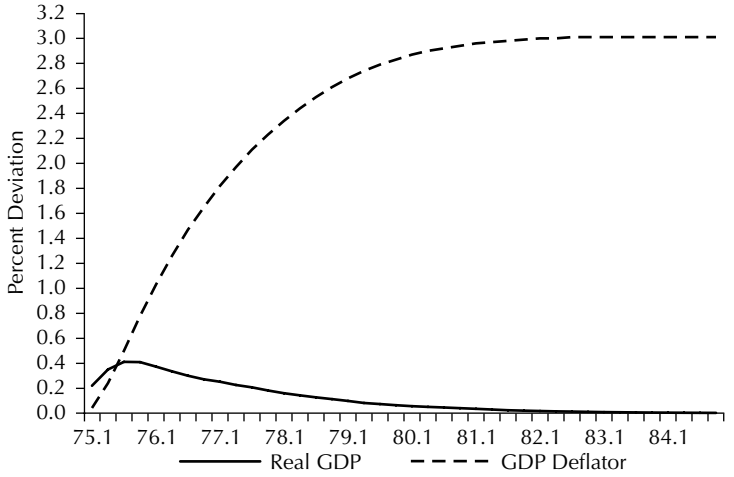


FIGURE 5-7B U.K. Monetary Expansion
Effect on U.K. Interest Rates, Exchange Rate

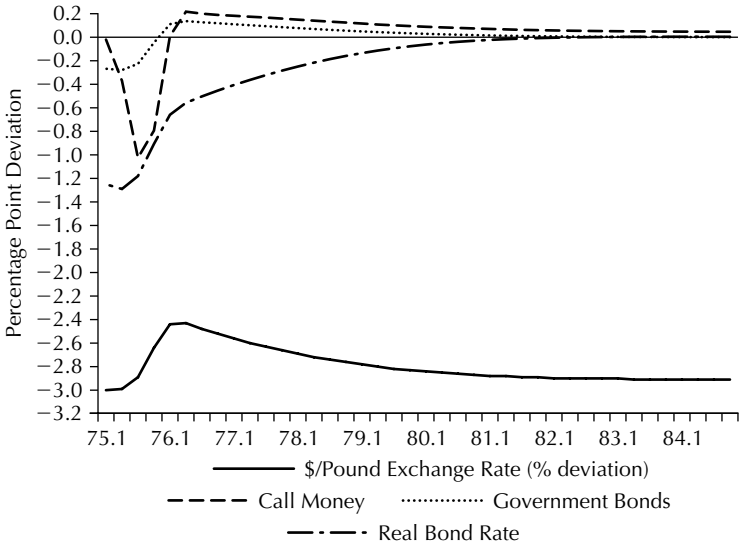


FIGURE 5-7C U.K. Monetary Expansion
Effect on U.K. Net Export Ratios

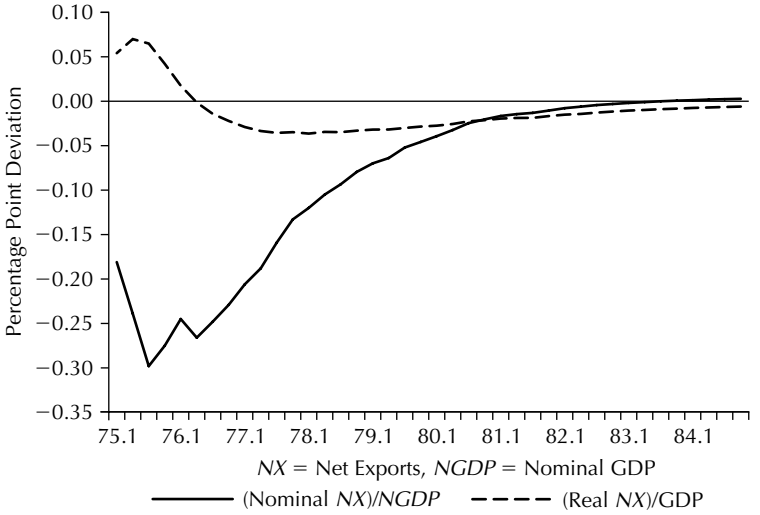


FIGURE 5-7D U.K. Monetary Expansion
Effect on U.K. Wage, Import Prices

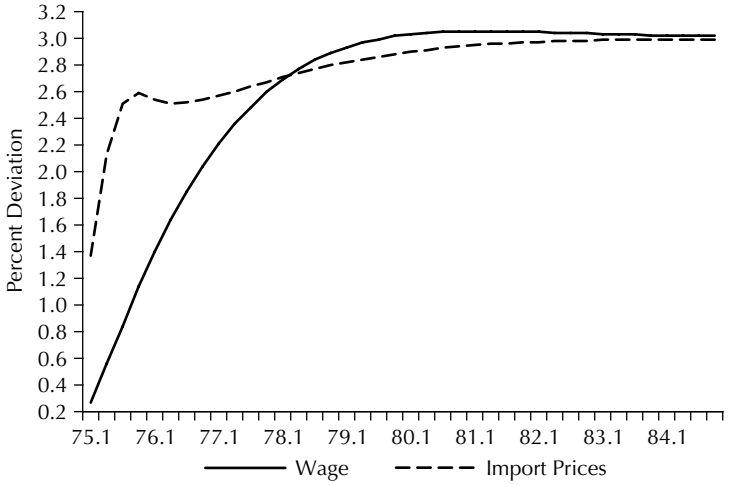


FIGURE 5-7E U.K. Monetary Expansion
Effect on U.K. Demand Components

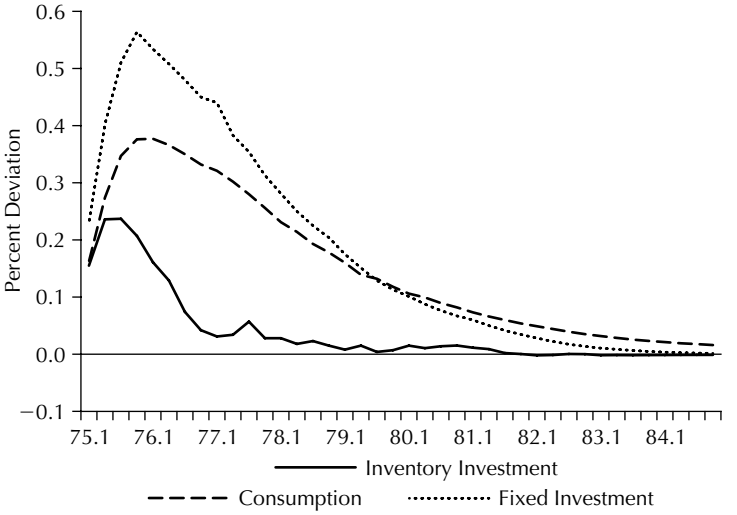


FIGURE 5-7F U.K. Monetary Expansion
Effect on U.K. Exports, Imports

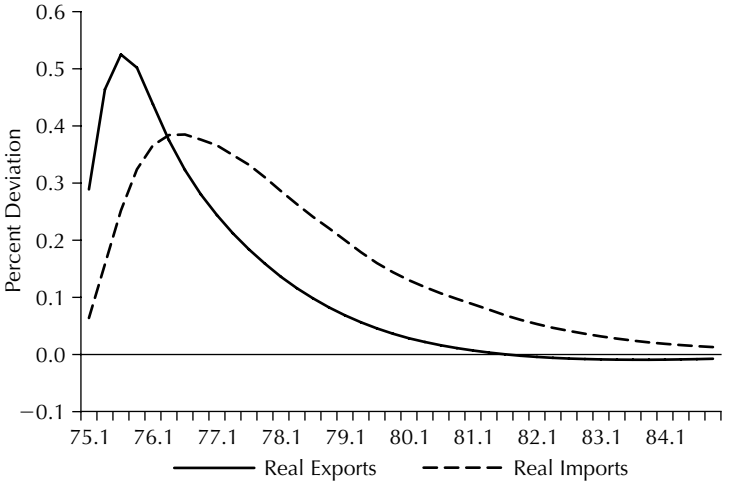


FIGURE 5-7G U.K. Monetary Expansion
Effect on Output Abroad

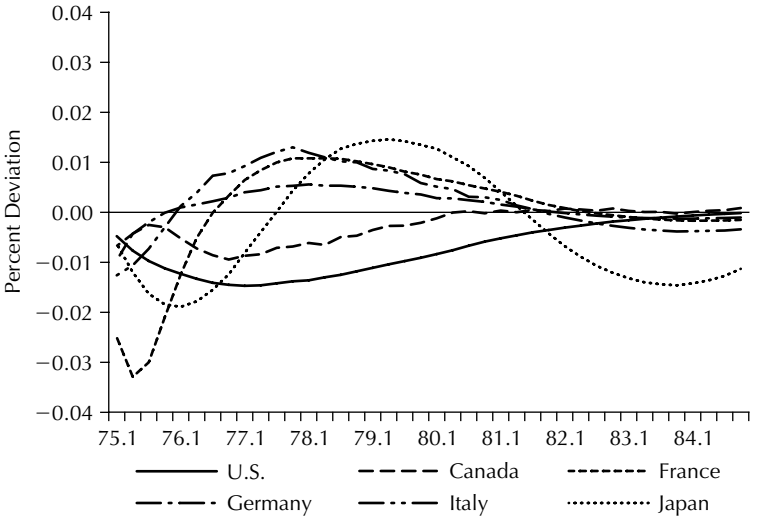


FIGURE 5-7H U.K. Monetary Expansion
Effect on Prices Abroad

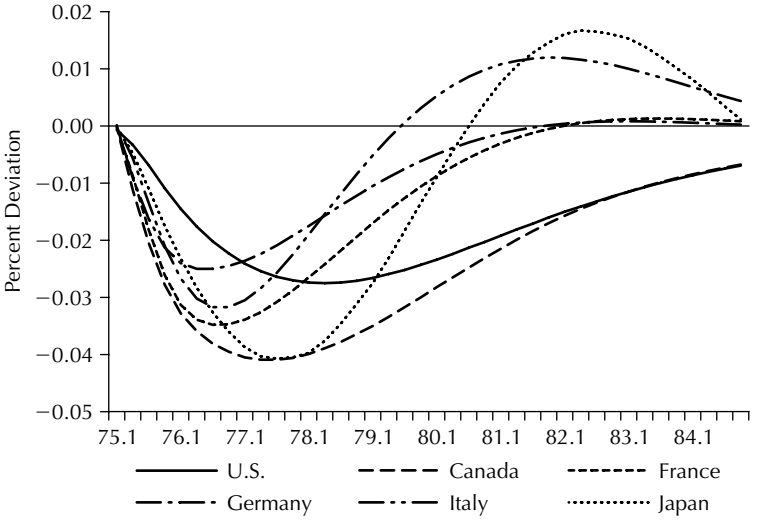


FIGURE 5-8A U.S. Fiscal Expansion
Effect on U.S. Output and Prices

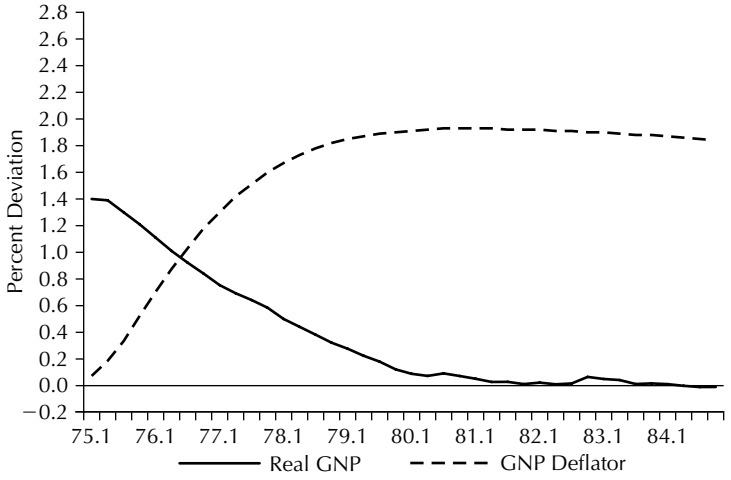


FIGURE 5-8B U.S. Fiscal Expansion
Effect on U.S. Interest Rates, Exchange Rate

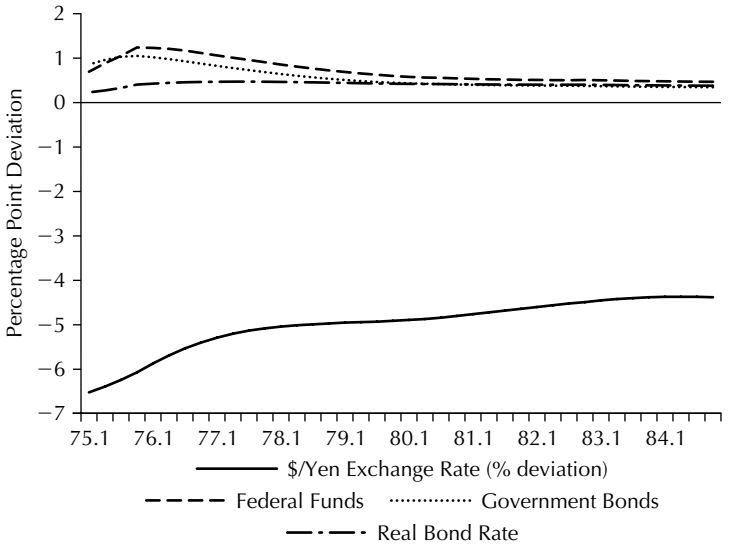


FIGURE 5-8C U.S. Fiscal Expansion
Effect on U.S. Net Export Ratios

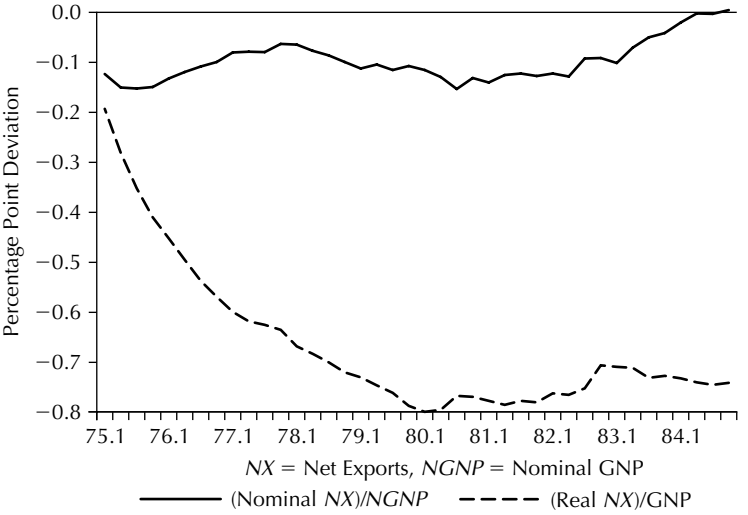


FIGURE 5-8D U.S. Fiscal Expansion
Effect on U.S. Wage, Import Prices

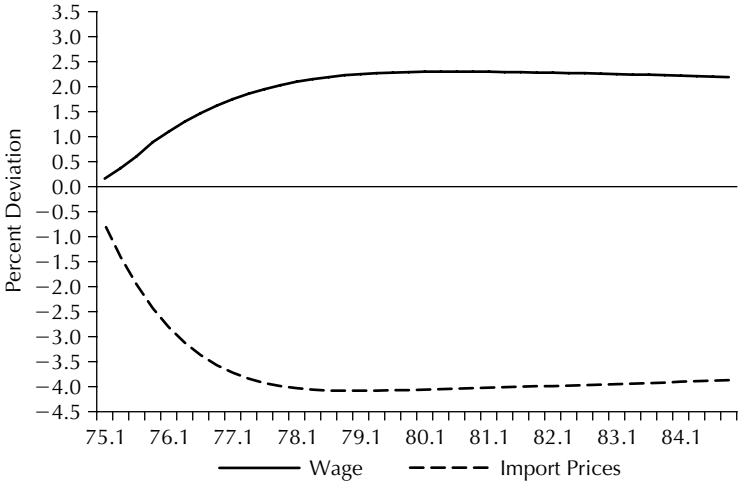


FIGURE 5-8E U.S. Fiscal Expansion
Effect on U.S. Demand Components

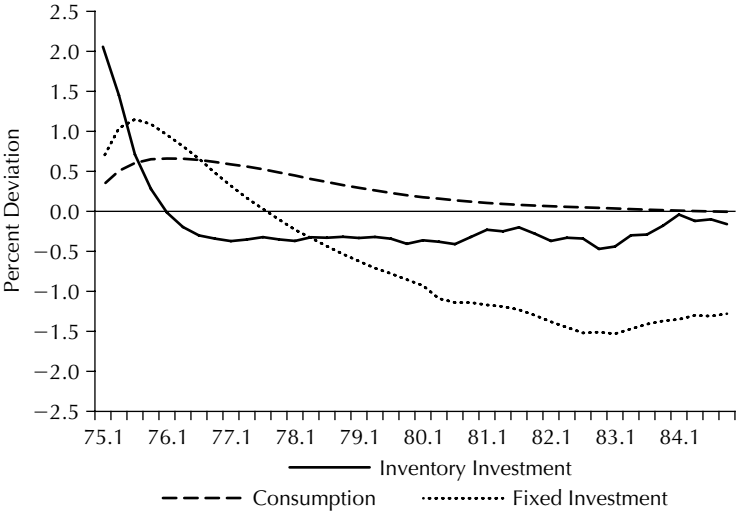


FIGURE 5-8F U.S. Fiscal Expansion
Effect on U.S. Exports, Imports

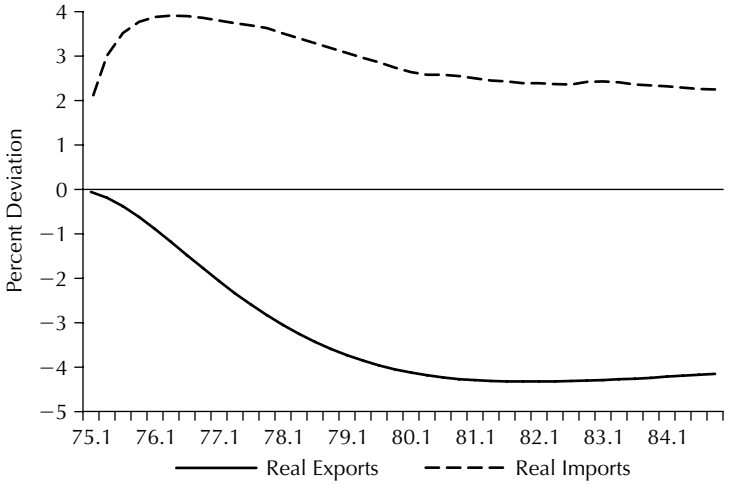


FIGURE 5-8G U.S. Fiscal Expansion
Effect on Output Abroad

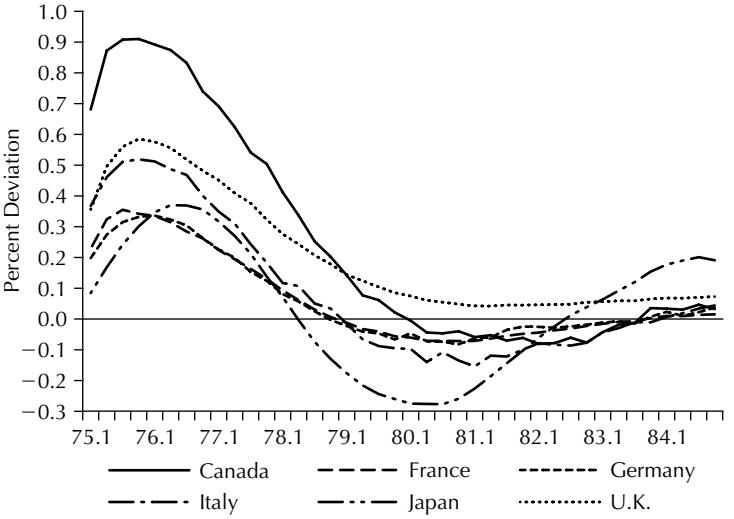


FIGURE 5-8H U.S. Fiscal Expansion
Effect on Prices Abroad

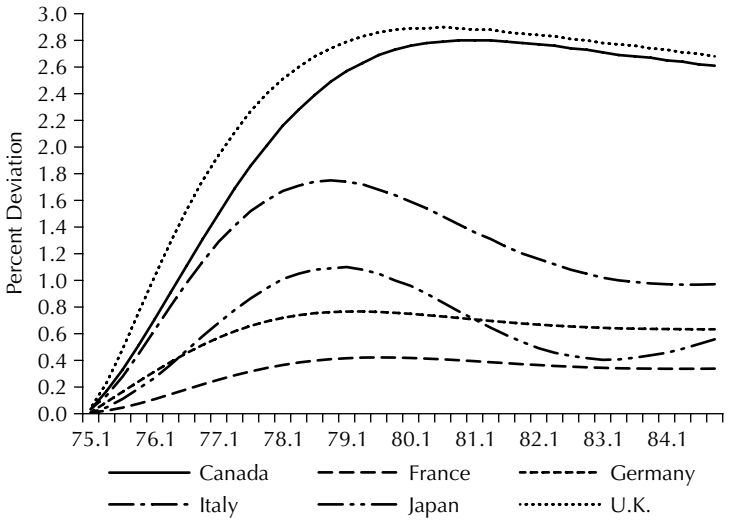


FIGURE 5-9A Canadian Fiscal Expansion
Effect on Canadian Output and Prices

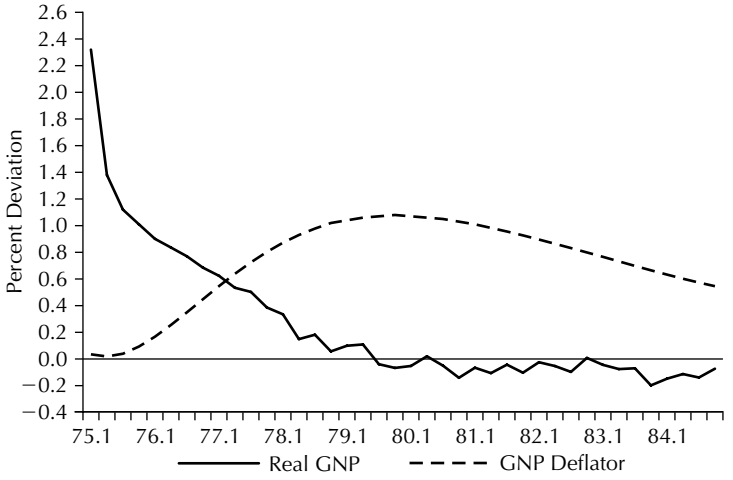


FIGURE 5-9B Canadian Fiscal Expansion
Effect on Canadian Interest Rates, Exchange Rate

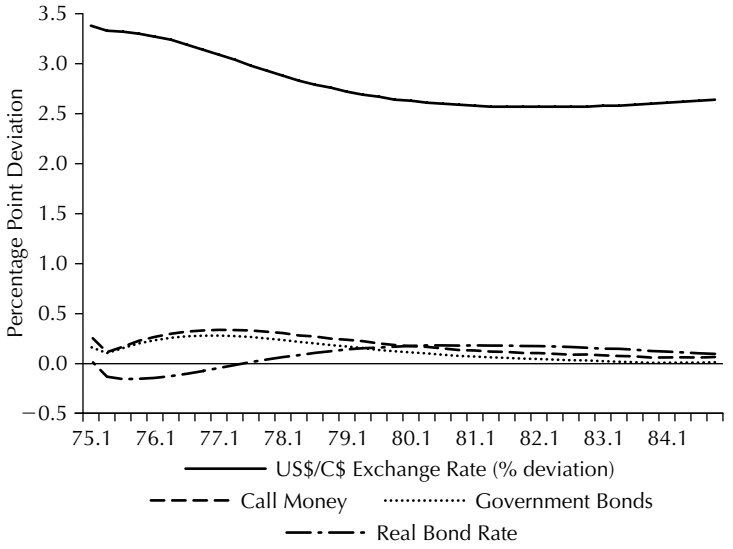


FIGURE 5-9C Canadian Fiscal Expansion
Effect on Canadian Net Export Ratios

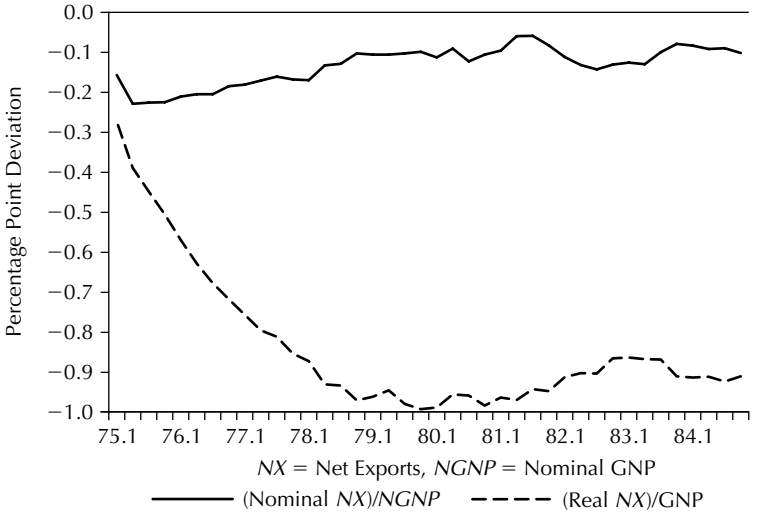


FIGURE 5-9D Canadian Fiscal Expansion
Effect on Canadian Wage, Import Prices

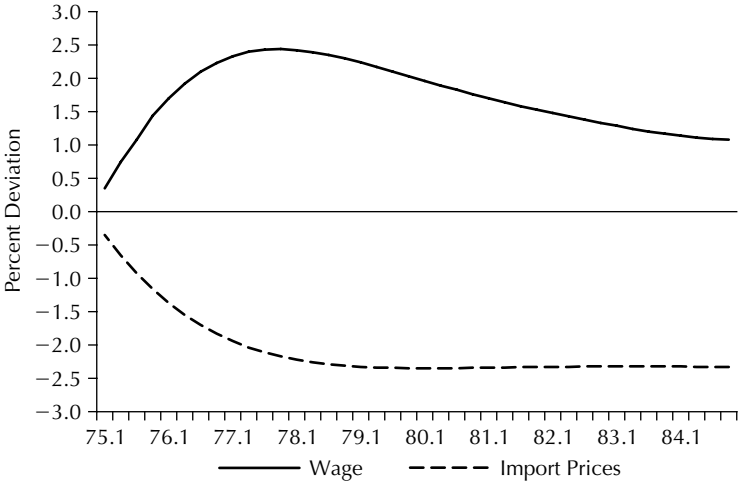


FIGURE 5-9E Canadian Fiscal Expansion
Effect on Canadian Demand Components

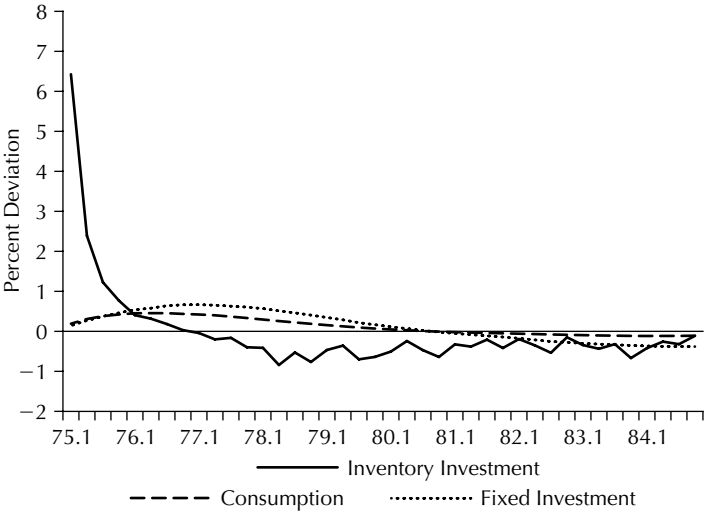


FIGURE 5-9F Canadian Fiscal Expansion
Effect on Canadian Exports, Imports

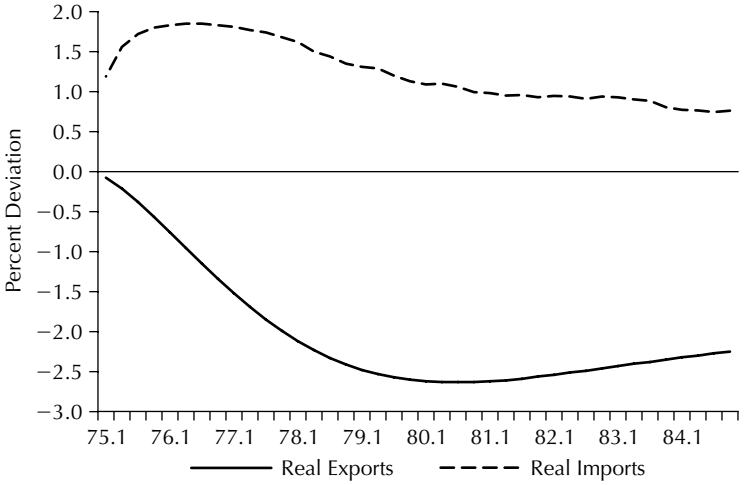


FIGURE 5-9G Canadian Fiscal Expansion
Effect on Output Abroad

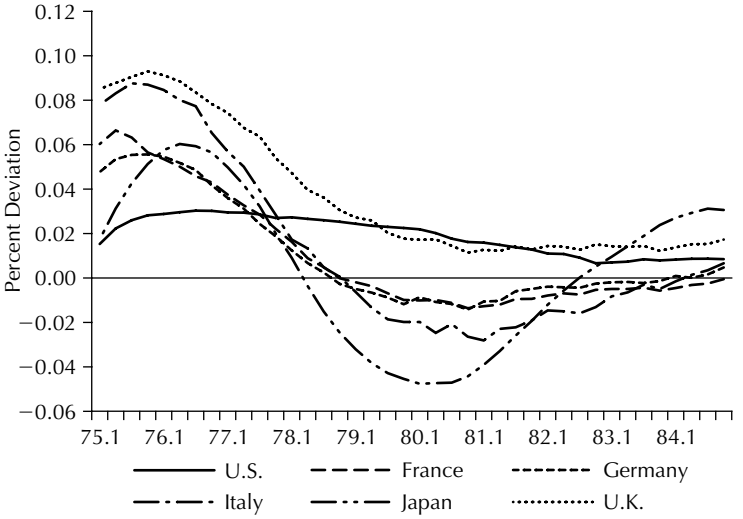


FIGURE 5-9H Canadian Fiscal Expansion
Effect on Prices Abroad

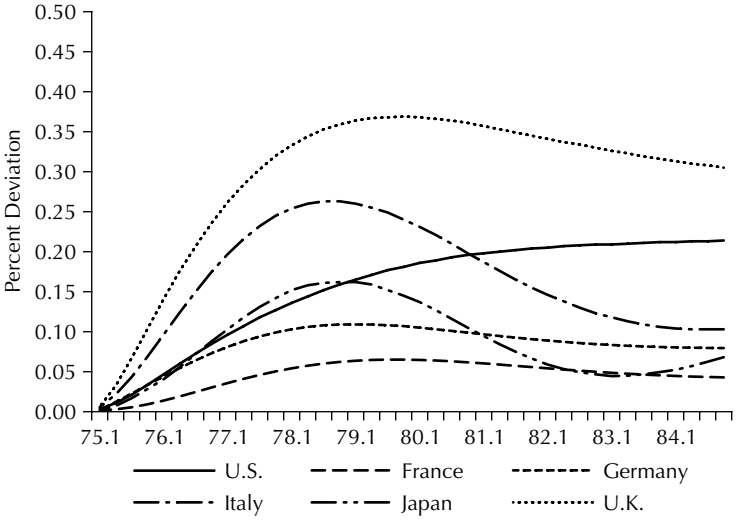


FIGURE 5-10A French Fiscal Expansion
Effect on French Output and Prices

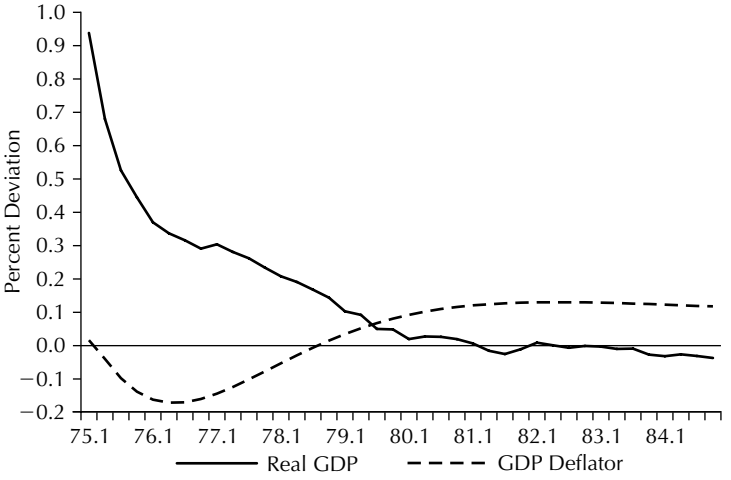


FIGURE 5-10B French Fiscal Expansion
Effect on French Interest Rates, Exchange Rate

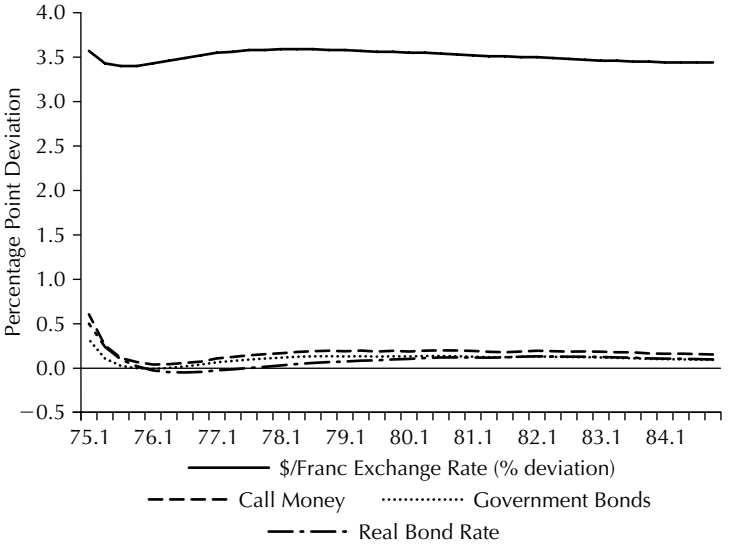


FIGURE 5-10C French Fiscal Expansion
Effect on French Net Export Ratios

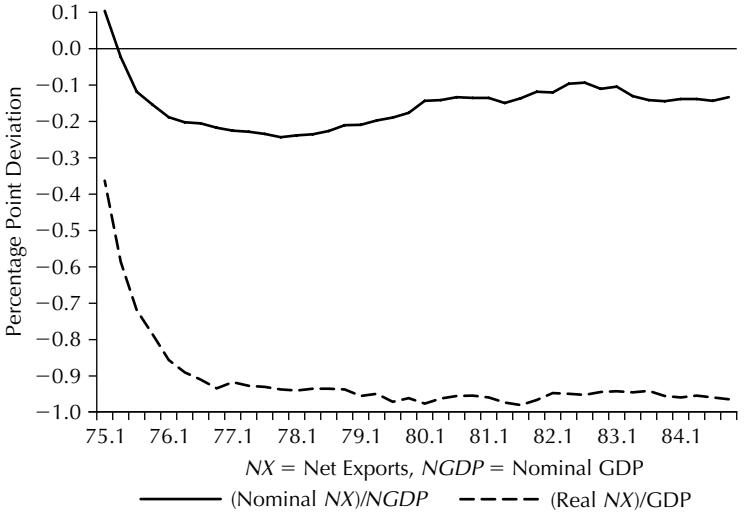


FIGURE 5-10D French Fiscal Expansion
Effect on French Wage, Import Prices

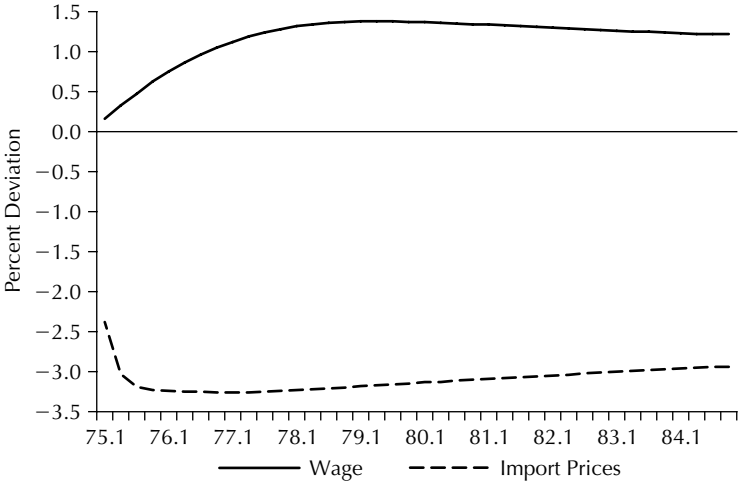


FIGURE 5-10E French Fiscal Expansion
Effect on French Demand Components

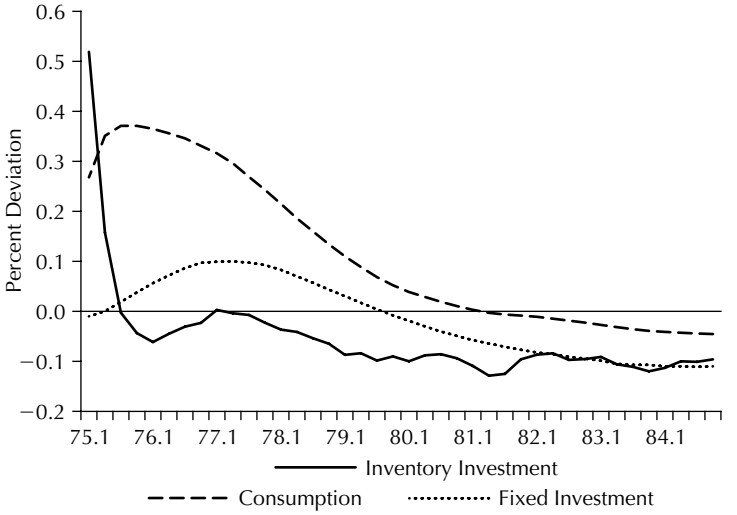


FIGURE 5-10F French Fiscal Expansion
Effect on French Exports, Imports

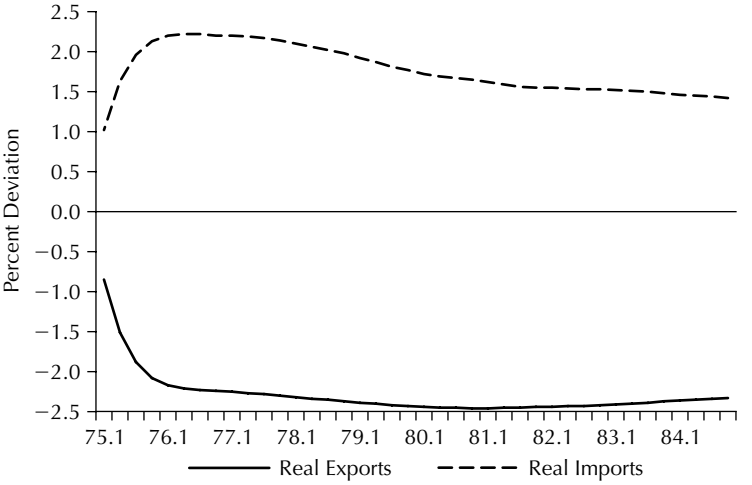


FIGURE 5-10G French Fiscal Expansion
Effect on Output Abroad

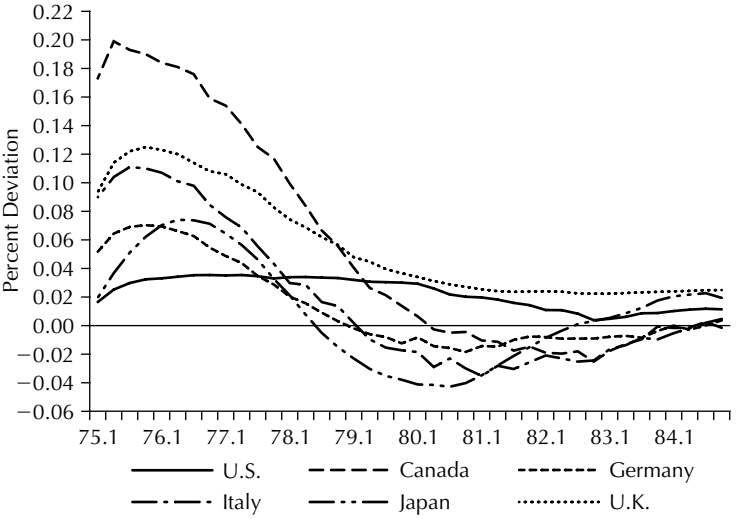


FIGURE 5-10H French Fiscal Expansion
Effect on Prices Abroad

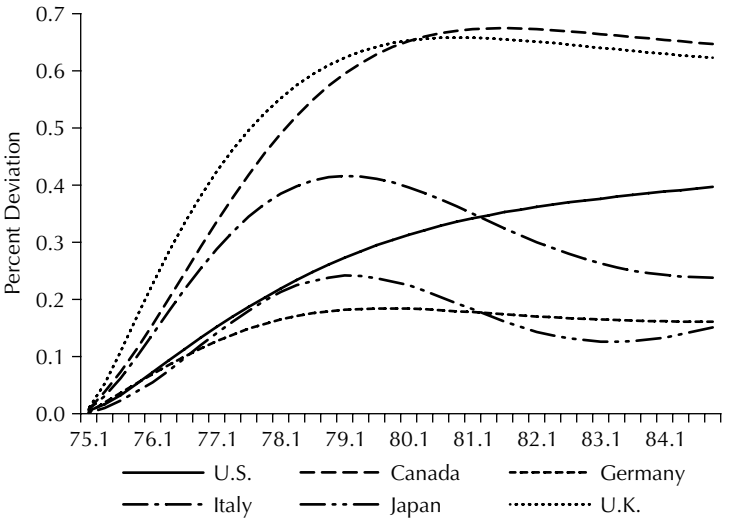


FIGURE 5-11A German Fiscal Expansion
Effect on German Output and Prices

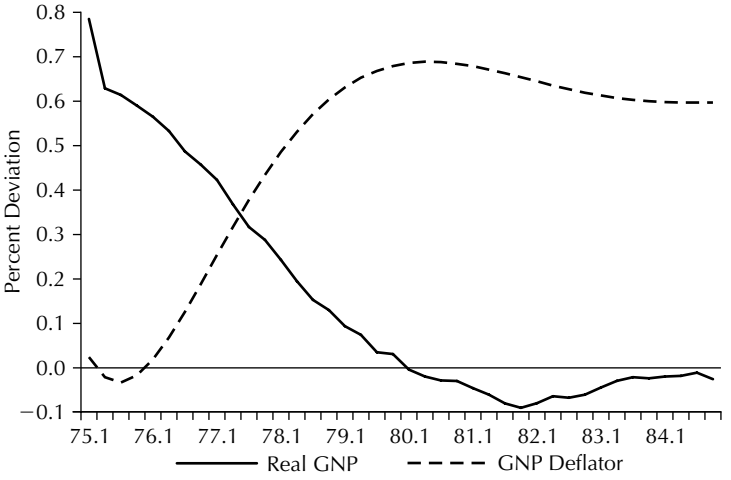


FIGURE 5-11B German Fiscal Expansion
Effect on German Interest Rates, Exchange Rate

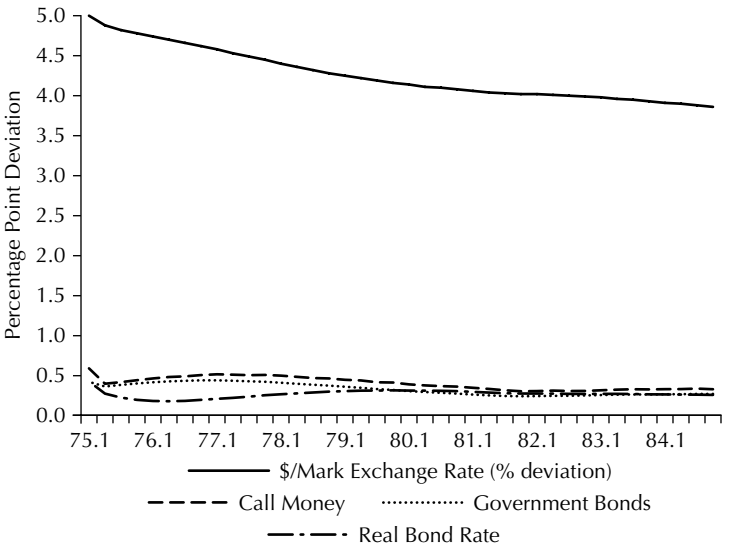


FIGURE 5-11C German Fiscal Expansion
Effect on German Net Export Ratios

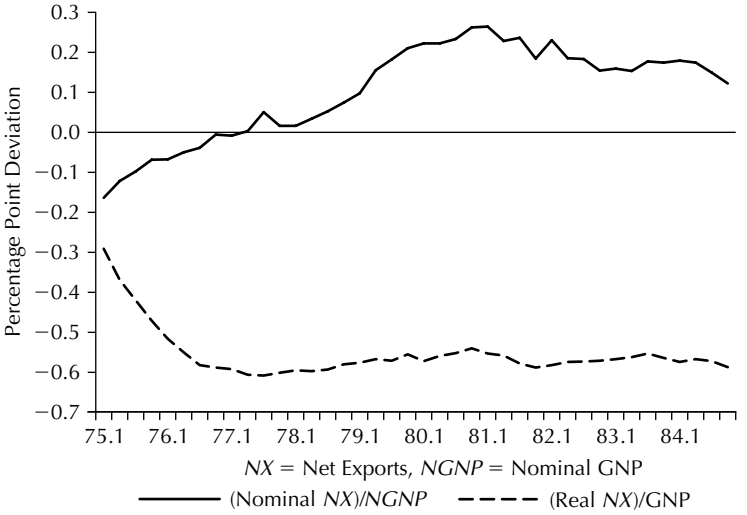


FIGURE 5-11D German Fiscal Expansion
Effect on German Wage, Import Prices

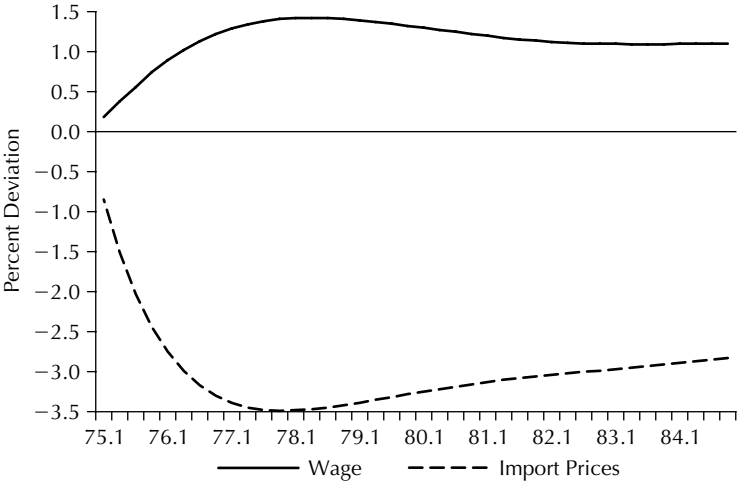


FIGURE 5-11E German Fiscal Expansion
Effect on German Demand Components

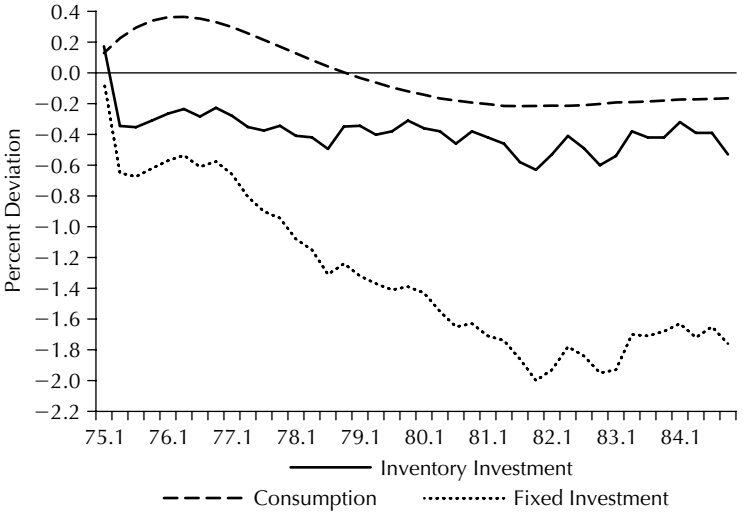


FIGURE 5-11F German Fiscal Expansion
Effect on German Exports, Imports

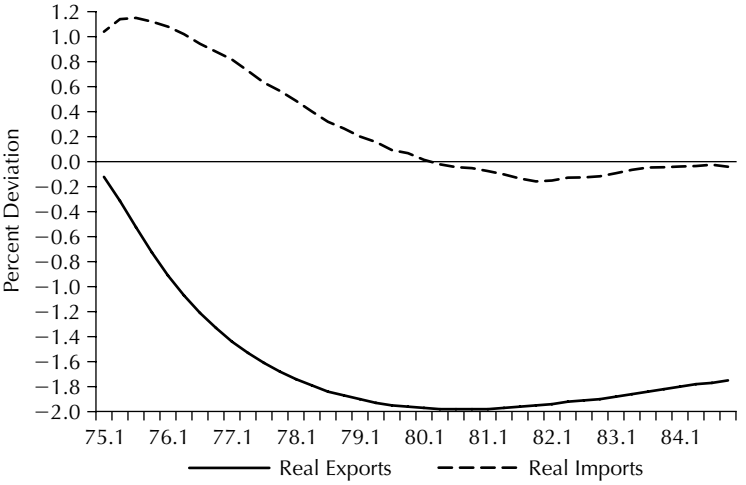


FIGURE 5-11G German Fiscal Expansion
Effect on Output Abroad

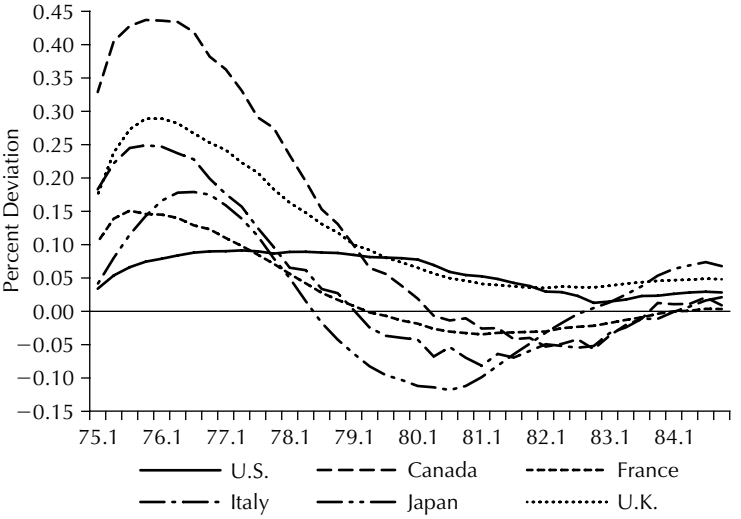


FIGURE 5-11H German Fiscal Expansion
Effect on Prices Abroad

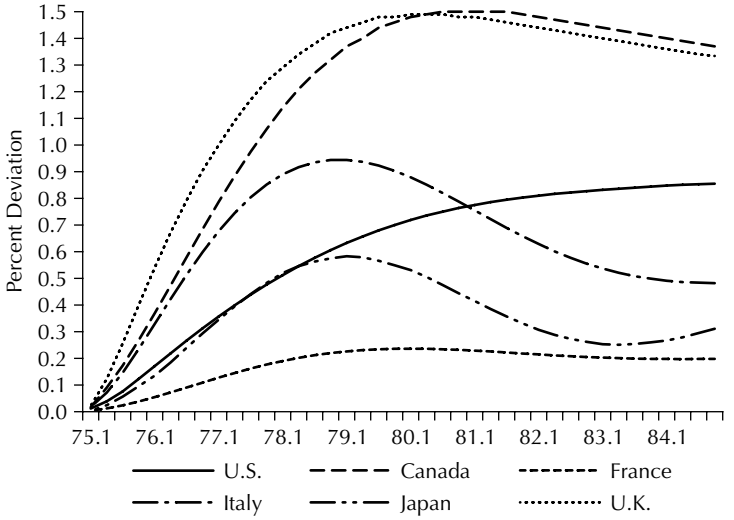


FIGURE 5-12A Italian Fiscal Expansion
Effect on Italian Output and Prices

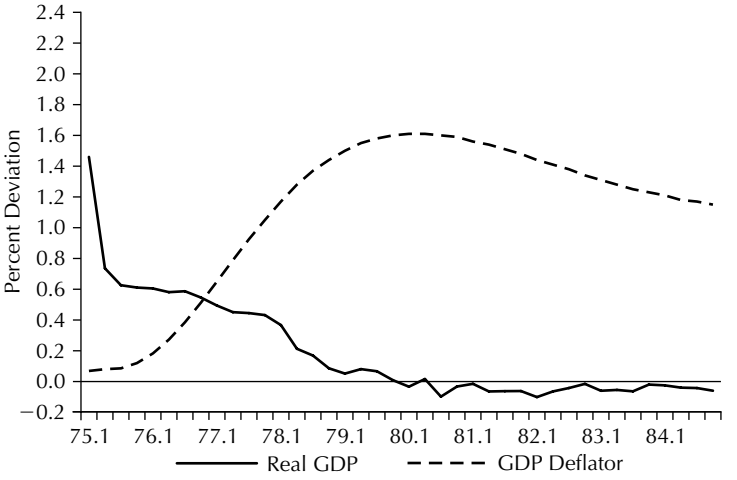


FIGURE 5-12B Italian Fiscal Expansion
Effect on Italian Interest Rates, Exchange Rate

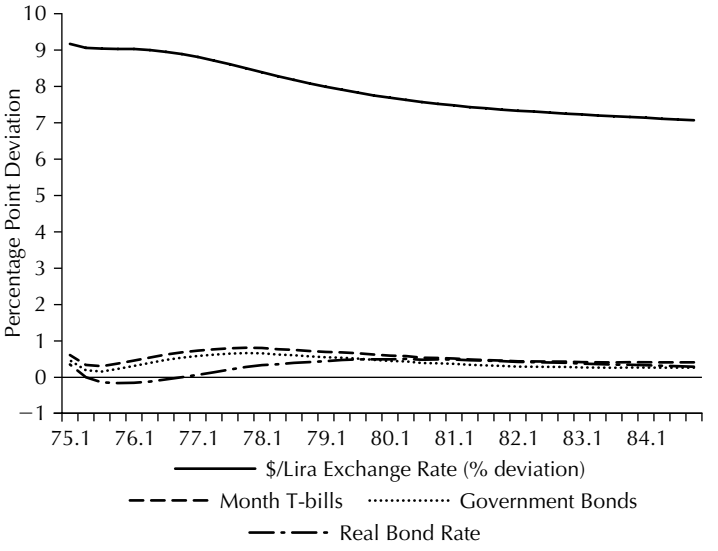


FIGURE 5-12C Italian Fiscal Expansion
Effect on Italian Net Export Ratios

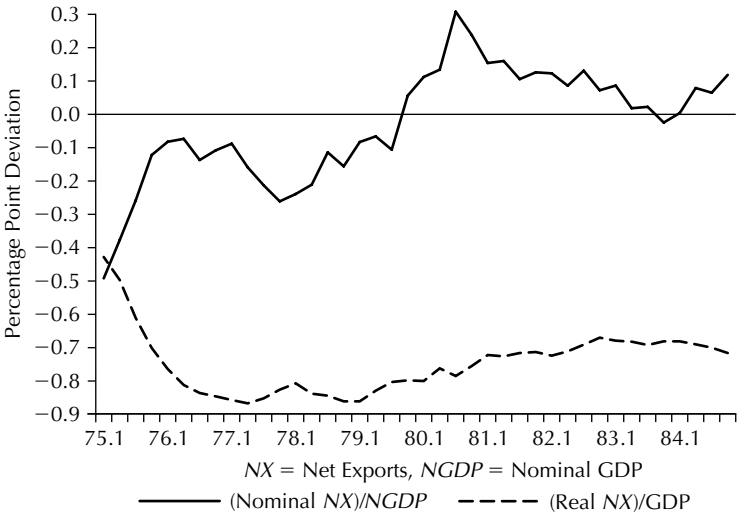


FIGURE 5-12D Italian Fiscal Expansion
Effect on Italian Wage, Import Prices

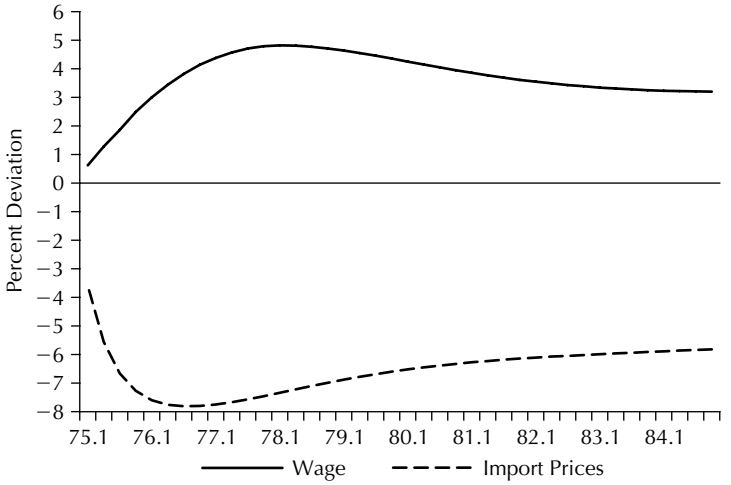


FIGURE 5-12E Italian Fiscal Expansion
Effect on Italian Demand Components

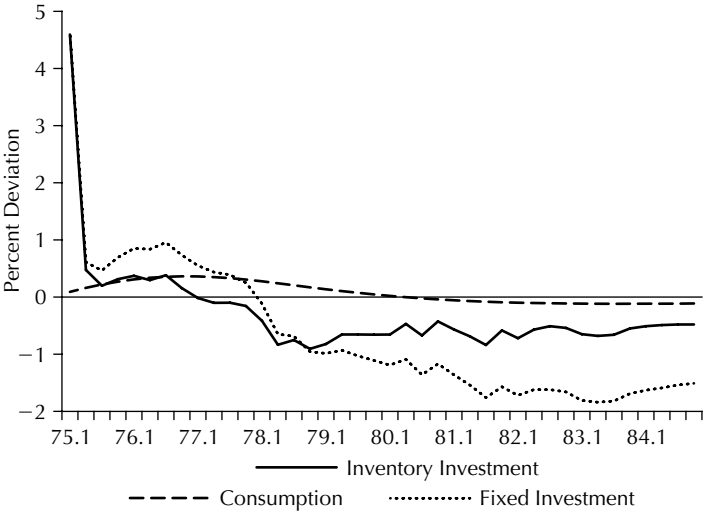


FIGURE 5-12F Italian Fiscal Expansion
Effect on Italian Exports, Imports

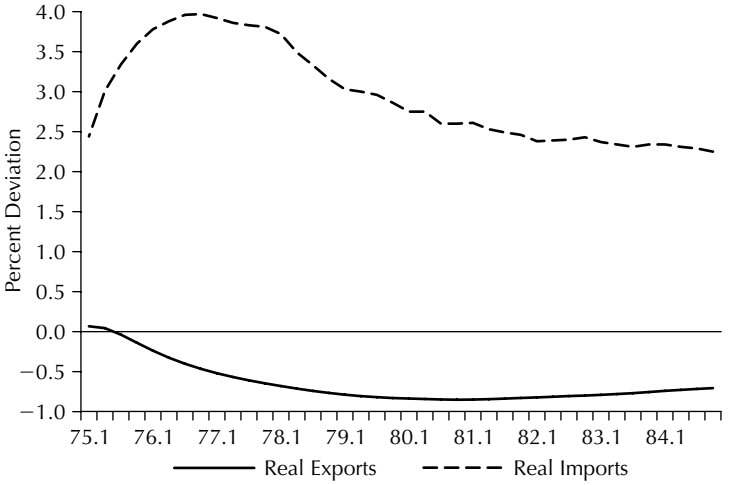


FIGURE 5-12G Italian Fiscal Expansion
Effect on Output Abroad

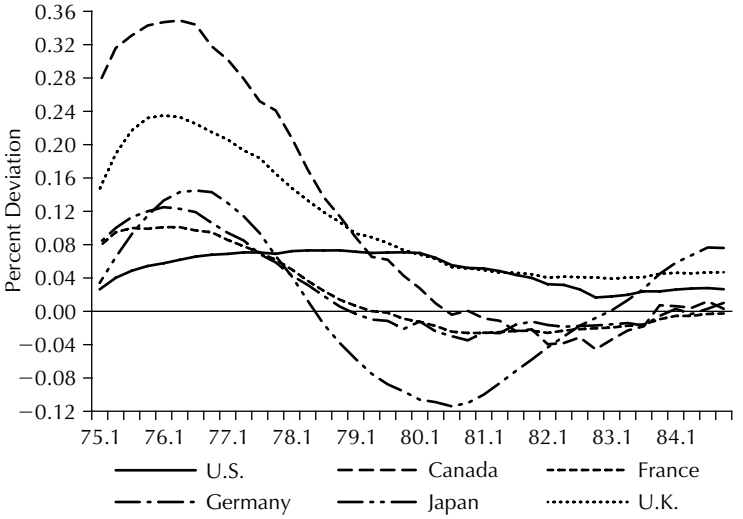


FIGURE 5-12H Italian Fiscal Expansion
Effect on Prices Abroad

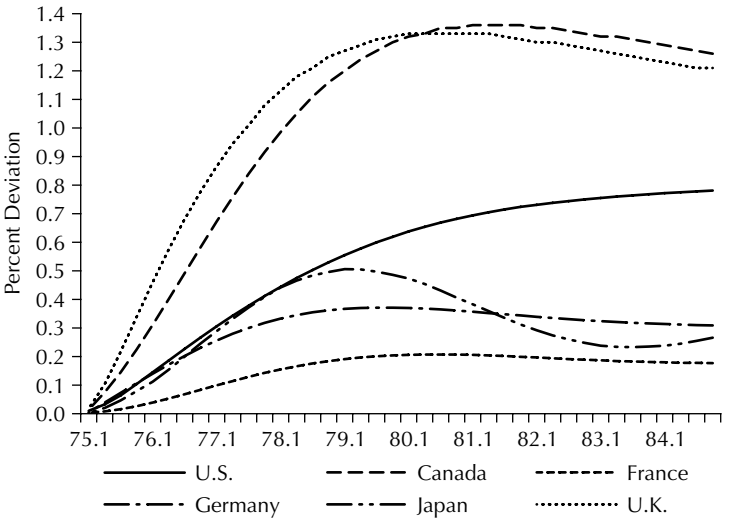


FIGURE 5-13A Japanese Fiscal Expansion
Effect on Japanese Output and Prices

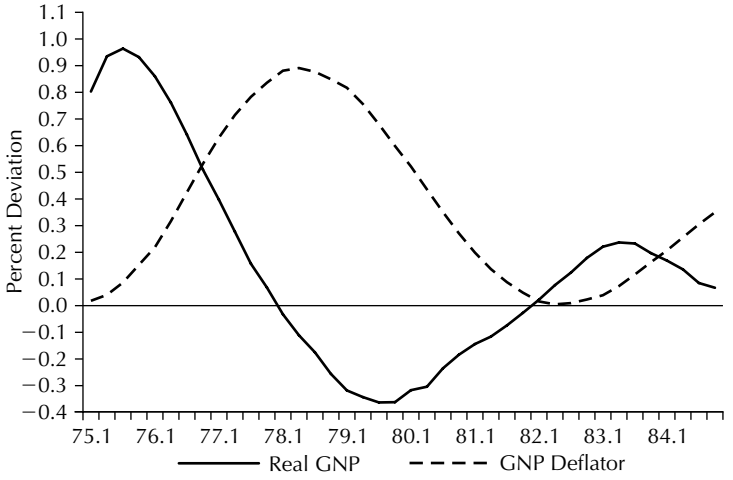


FIGURE 5-13B Japanese Fiscal Expansion
Effect on Japanese Interest Rates, Exchange Rate

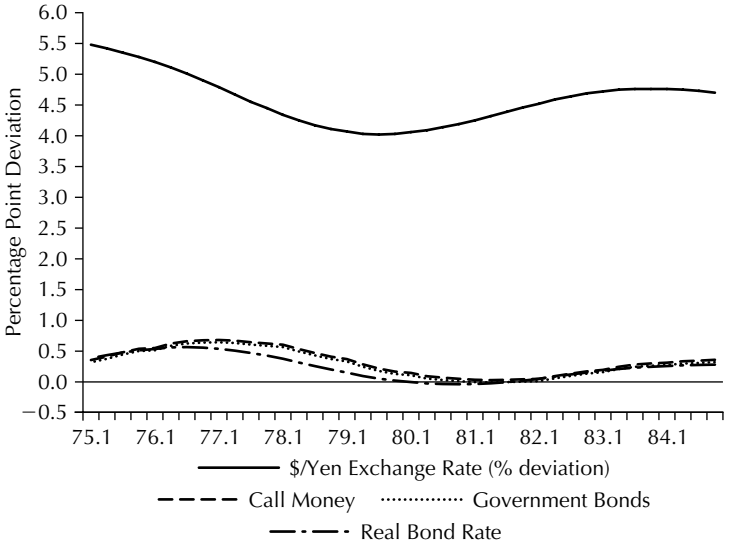


FIGURE 5-13C Japanese Fiscal Expansion
Effect on Japanese Net Export Ratios

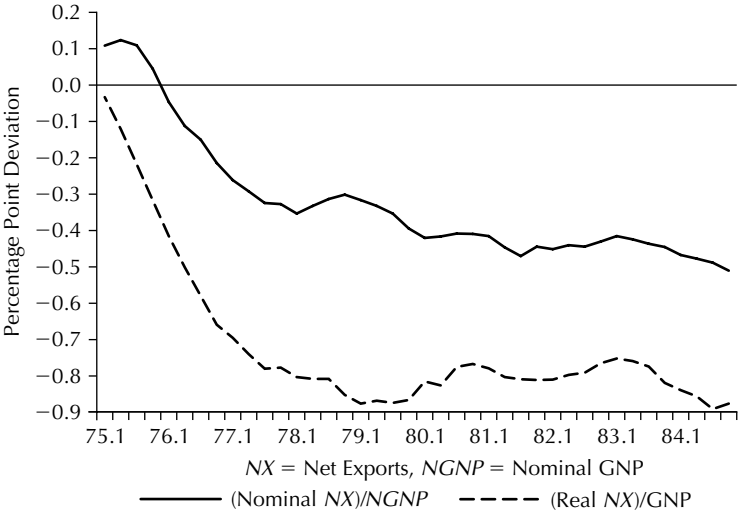


FIGURE 5-13D Japanese Fiscal Expansion
Effect on Japanese Wage, Import Prices

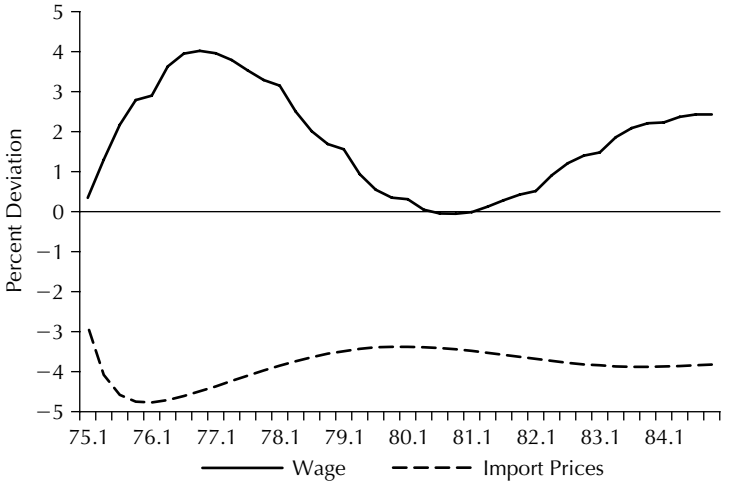


FIGURE 5-13E Japanese Fiscal Expansion
Effect on Japanese Demand Components

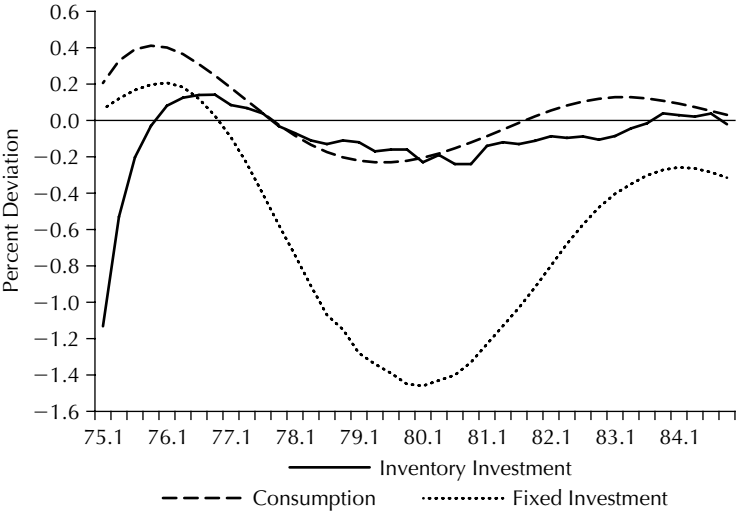


FIGURE 5-13F Japanese Fiscal Expansion
Effect on Japanese Exports, Imports

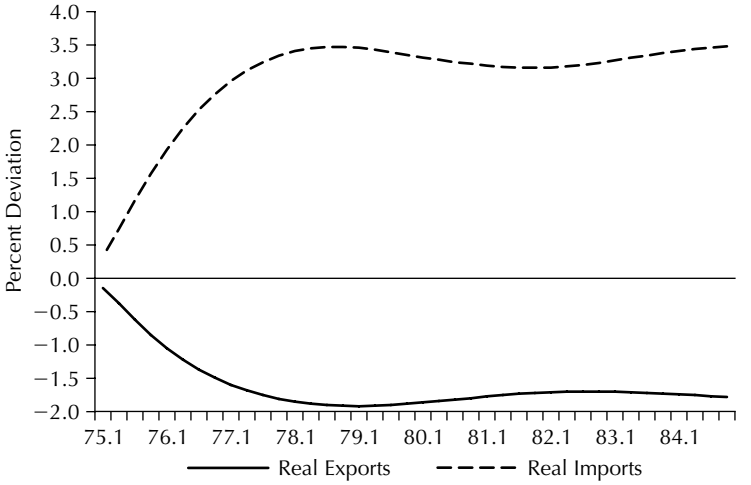


FIGURE 5-13G Japanese Fiscal Expansion
Effect on Output Abroad

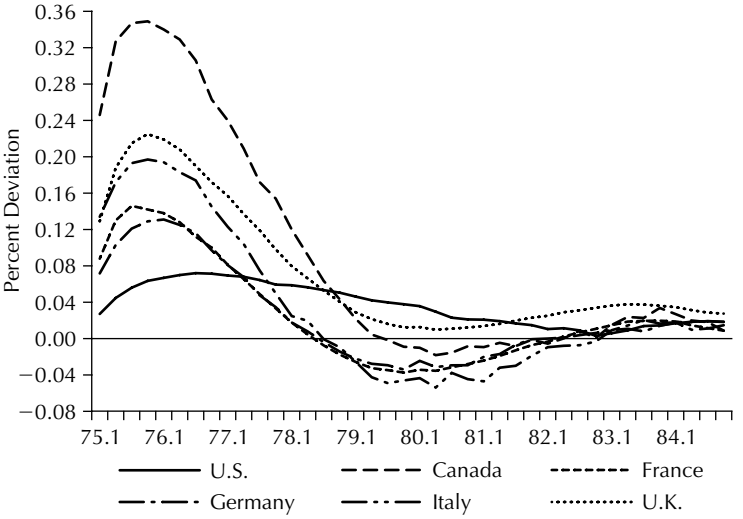


FIGURE 5-13H Japanese Fiscal Expansion
Effect on Prices Abroad

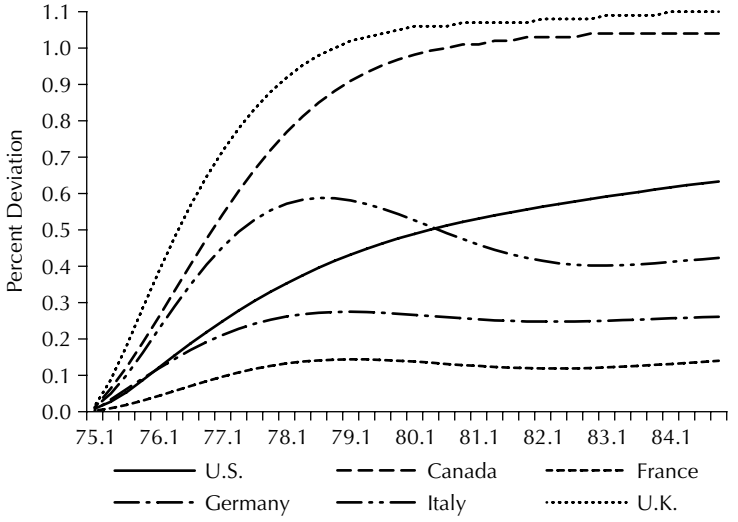


FIGURE 5-14A U.K. Fiscal Expansion
Effect on U.K. Output and Prices

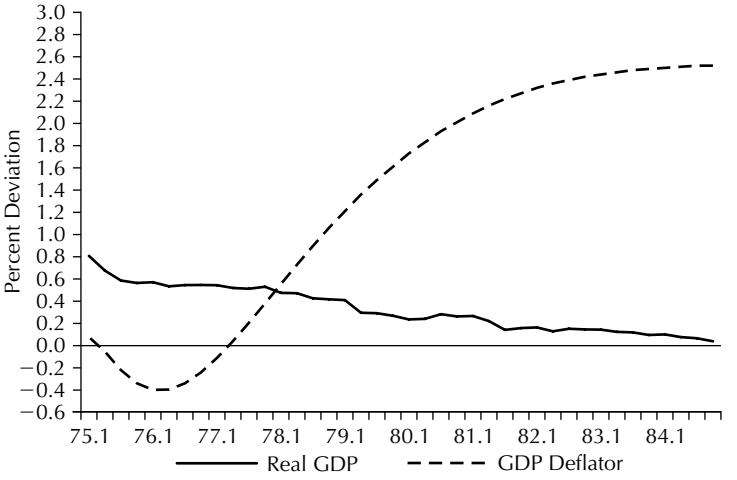


FIGURE 5-14B U.K. Fiscal Expansion
Effect on U.K. Interest Rates, Exchange Rate

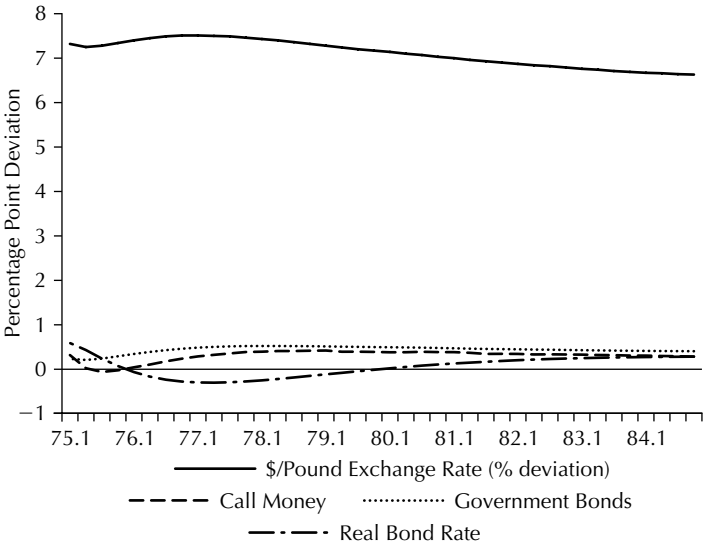


FIGURE 5-14C U.K. Fiscal Expansion
Effect on U.K. Net Export Ratios

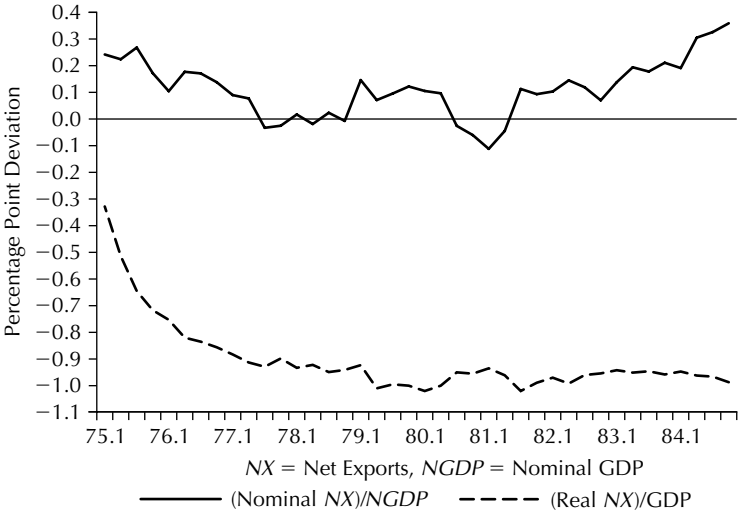


FIGURE 5-14D U.K. Fiscal Expansion
Effect on U.K. Wage, Import Prices

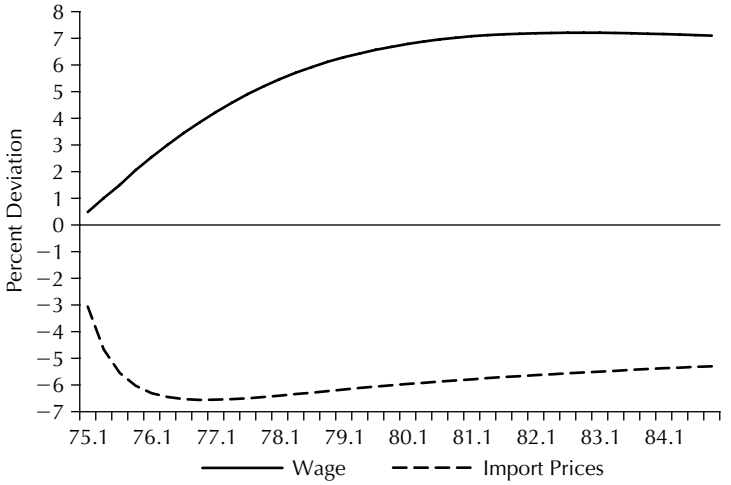


FIGURE 5-14E U.K. Fiscal Expansion
Effect on U.K. Demand Components

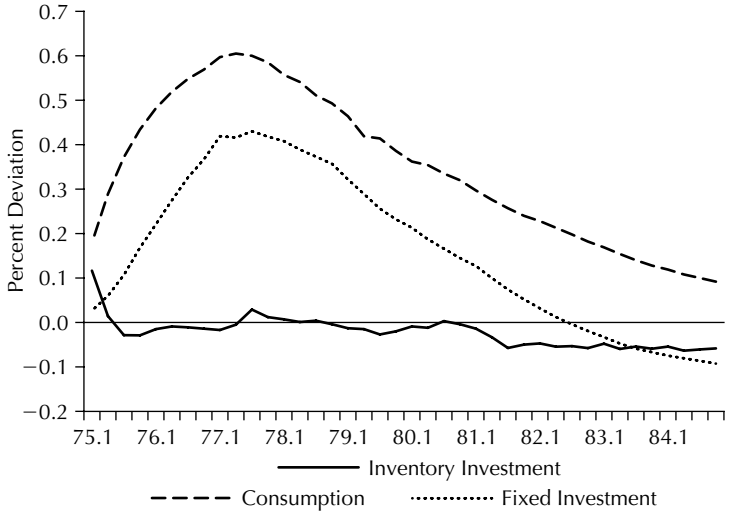


FIGURE 5-14F U.K. Fiscal Expansion
Effect on U.K. Exports, Imports

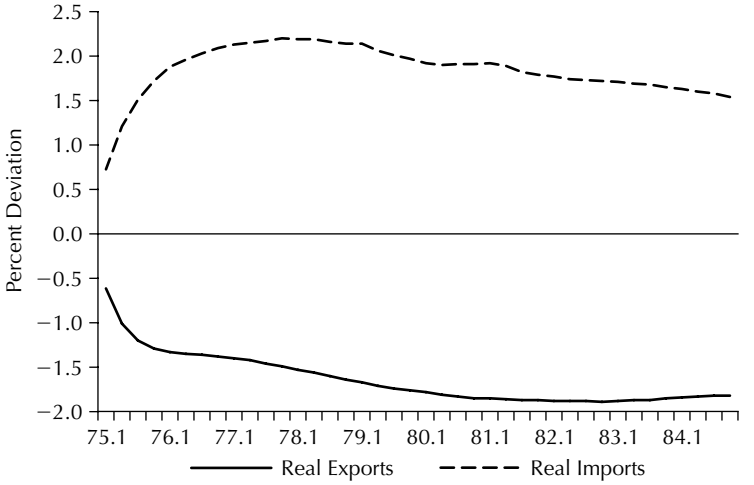


FIGURE 5-14G U.K. Fiscal Expansion
Effect on Output Abroad

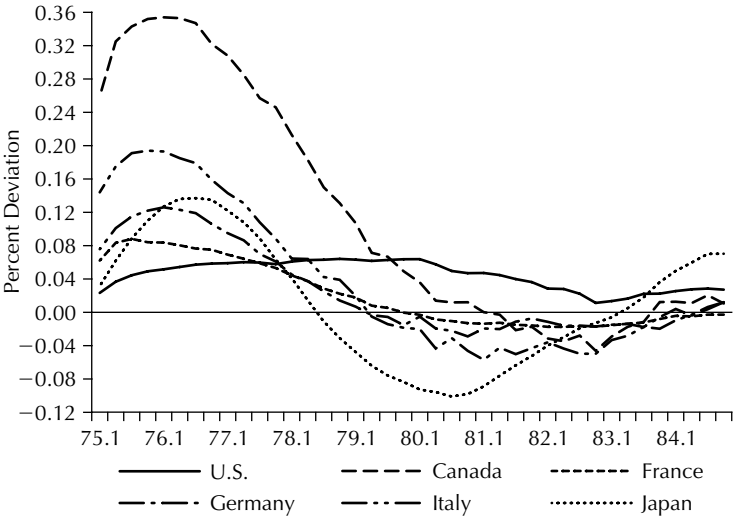


FIGURE 5-14H U.K. Fiscal Expansion
Effect on Prices Abroad

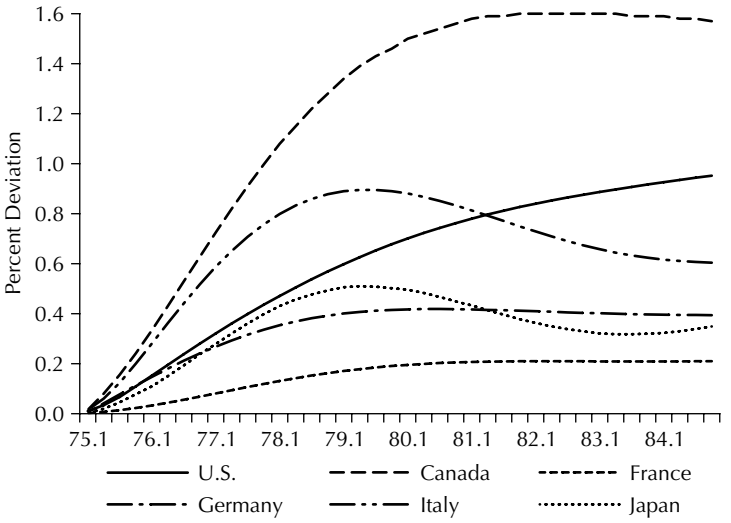


FIGURE 5-15A Japanese Monetary Expansion
Under Fixed Exchange Rate System

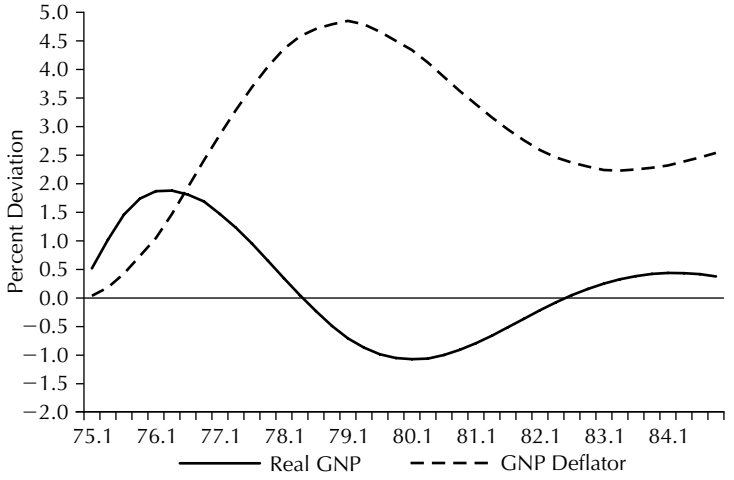


FIGURE 5-15B Japanese Monetary Expansion
Under Fixed Exchange Rate System

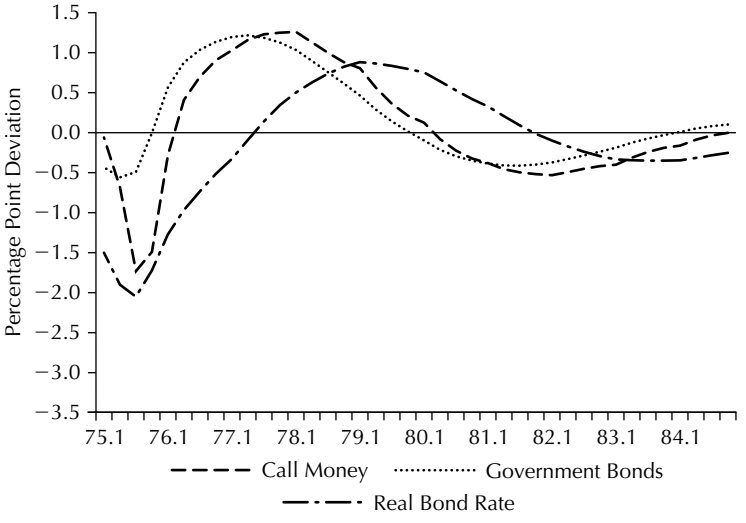


FIGURE 5-15C Japanese Monetary Expansion
Under Fixed Exchange Rate System

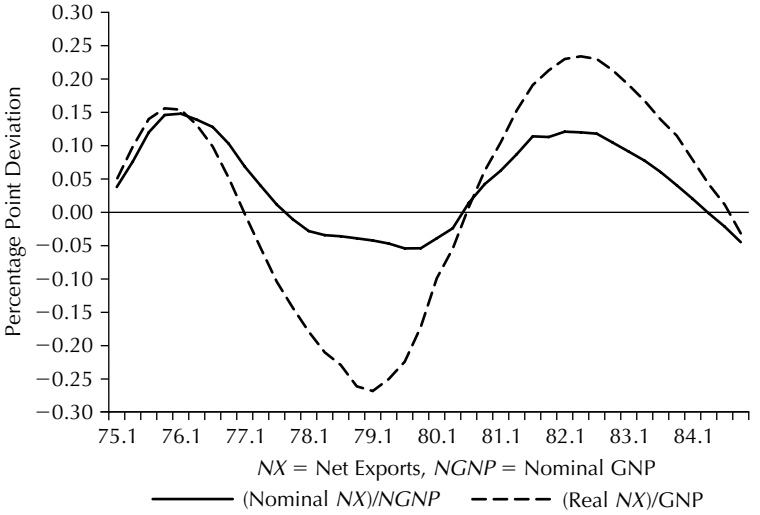


FIGURE 5-15D Japanese Monetary Expansion
Under Fixed Exchange Rate System

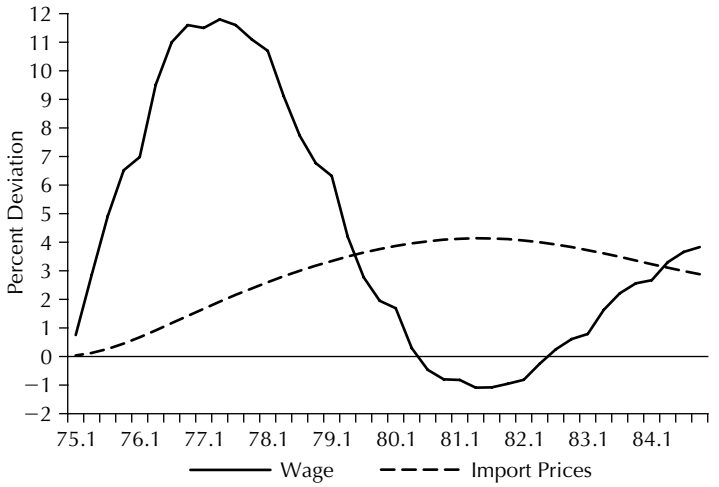


FIGURE 5-15E Japanese Monetary Expansion
Under Fixed Exchange Rate System

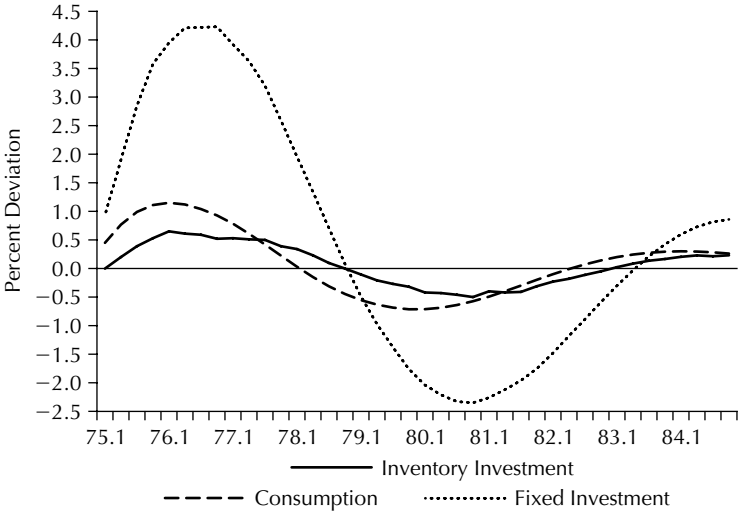


FIGURE 5-15F Japanese Monetary Expansion
Under Fixed Exchange Rate System

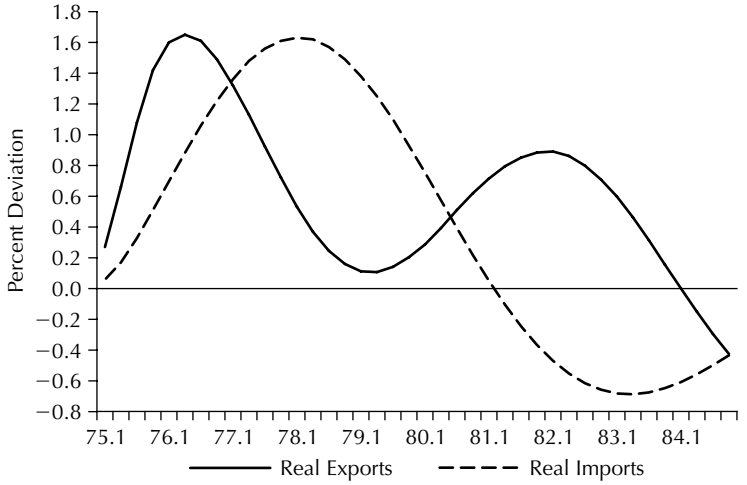


FIGURE 5-15G Japanese Monetary Expansion
Under Fixed Exchange Rate System

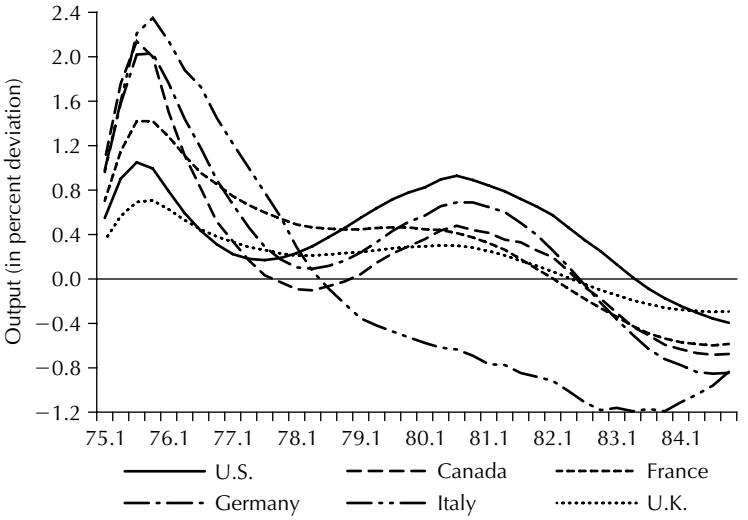


FIGURE 5-15H Japanese Monetary Expansion
Under Fixed Exchange Rate System

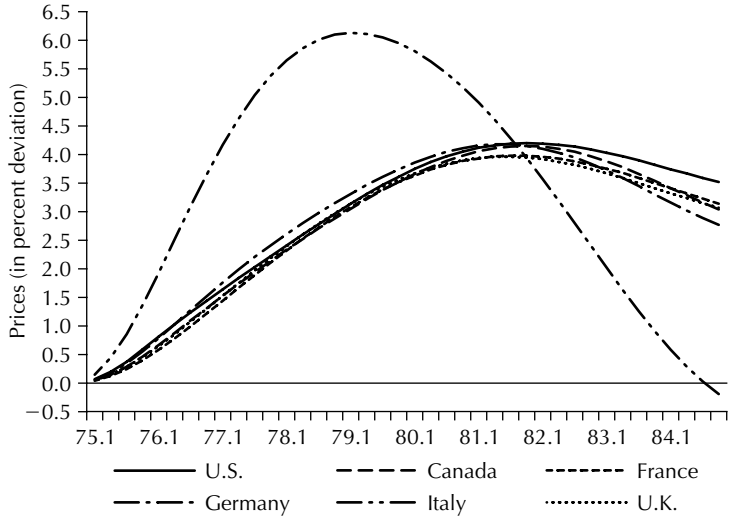


FIGURE 5-16A Anticipated U.S. Monetary Expansion
Effect on U.S. Output and Prices

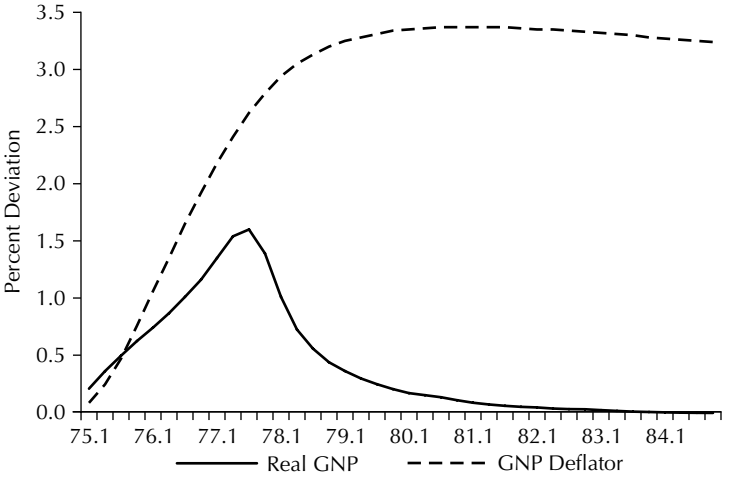


FIGURE 5-16B Anticipated U.S. Monetary Expansion
Effect on U.S. Interest Rates, Exchange Rate

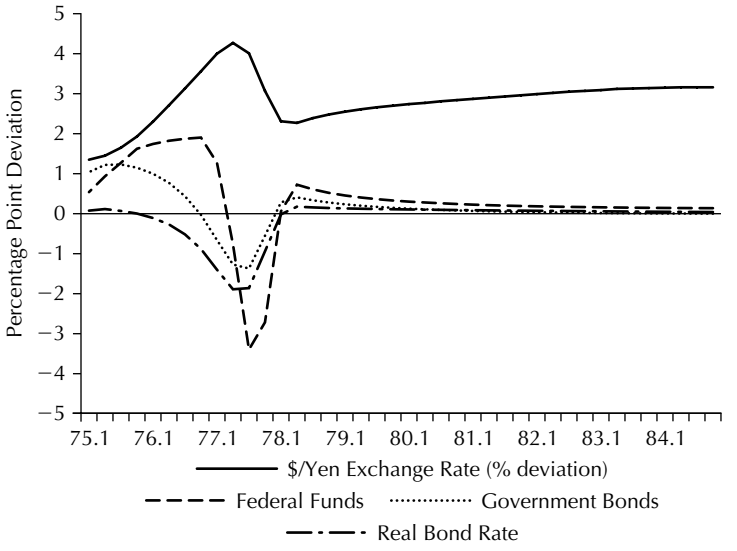


FIGURE 5-16C Anticipated U.S. Monetary Expansion
Effect on U.S. Net Export Ratios

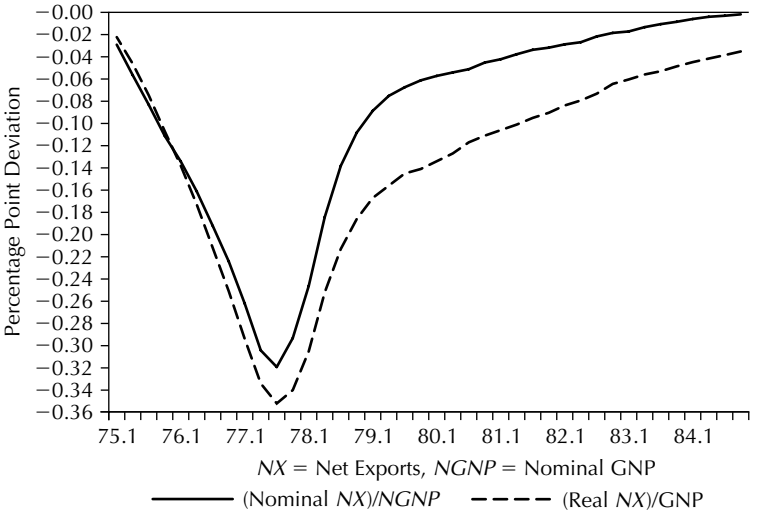


FIGURE 5-16D Anticipated U.S. Monetary Expansion
Effect on U.S. Wage, Import Prices

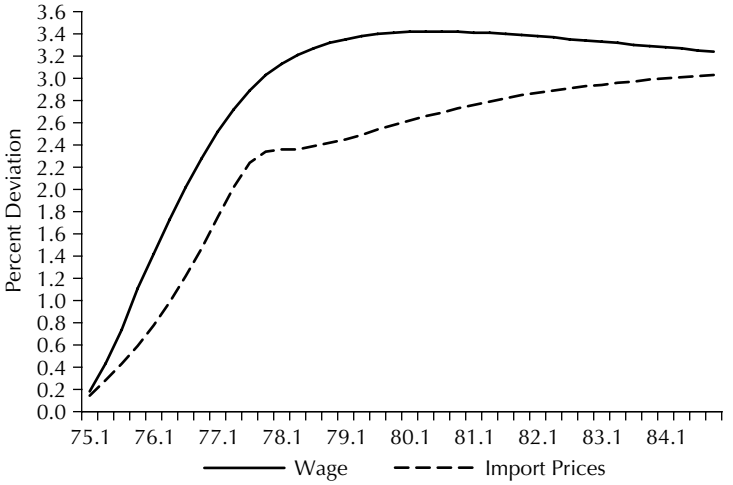


FIGURE 5-16E Anticipated U.S. Monetary Expansion
Effect on U.S. Demand Components

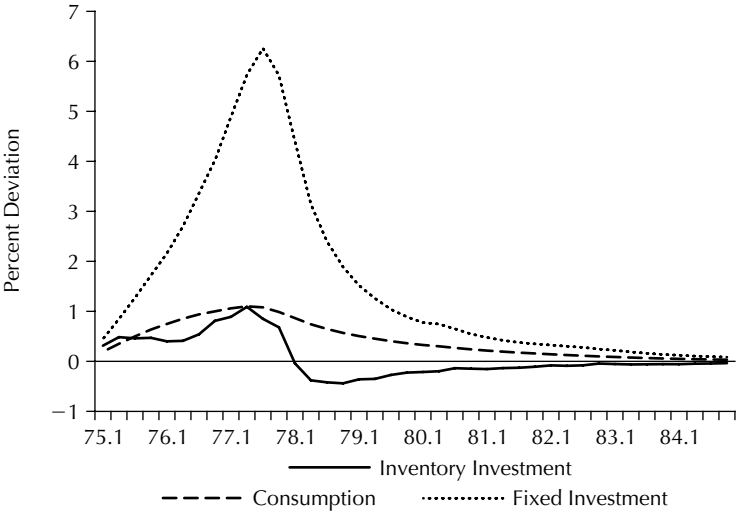


FIGURE 5-16F Anticipated U.S. Monetary Expansion
Effect on U.S. Exports, Imports

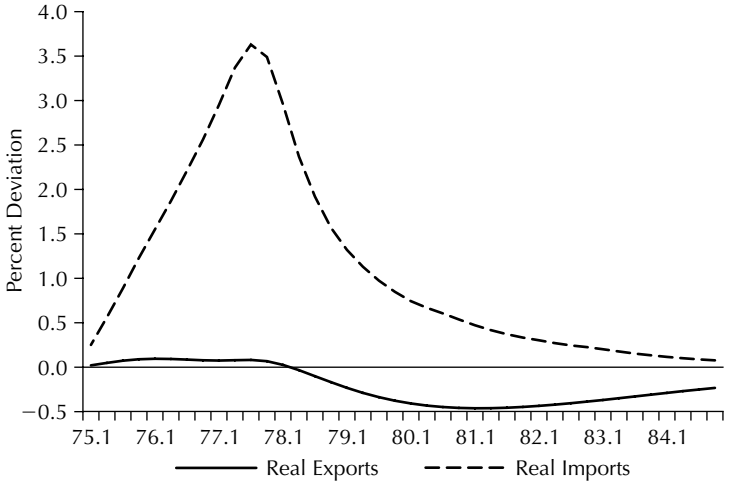


FIGURE 5-16G Anticipated U.S. Monetary Expansion
Effect on Output Abroad

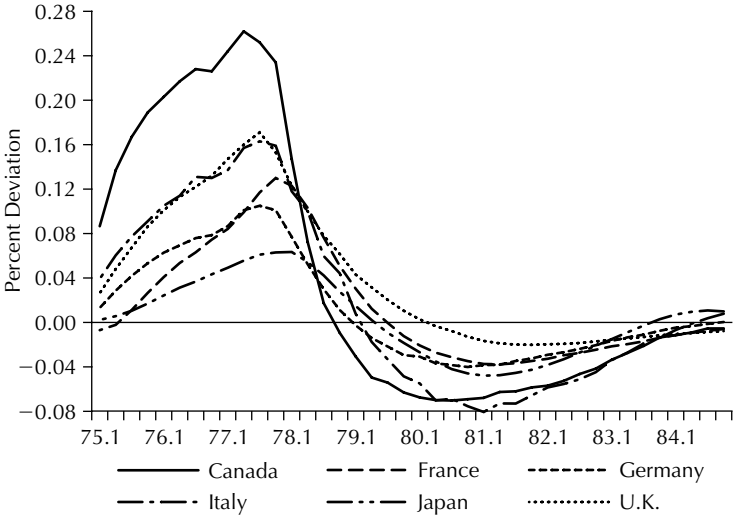


FIGURE 5-16H Anticipated U.S. Monetary Expansion
Effect on Prices Abroad

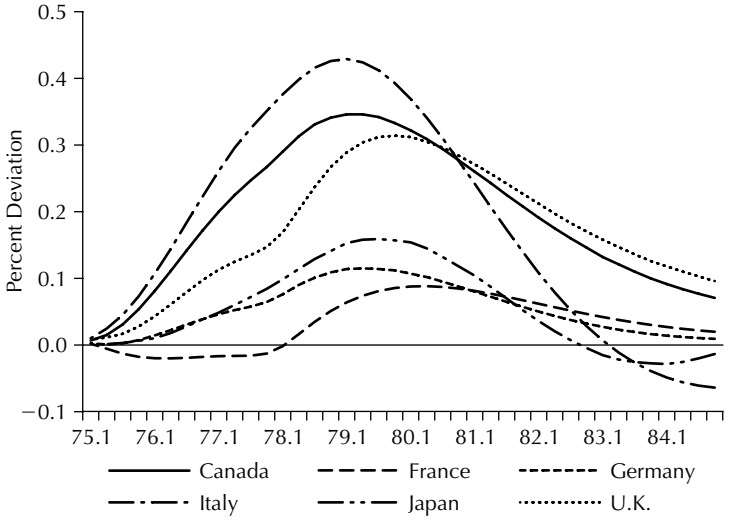


FIGURE 5-17A Anticipated U.S. Fiscal Expansion
Effect on U.S. Output and Prices

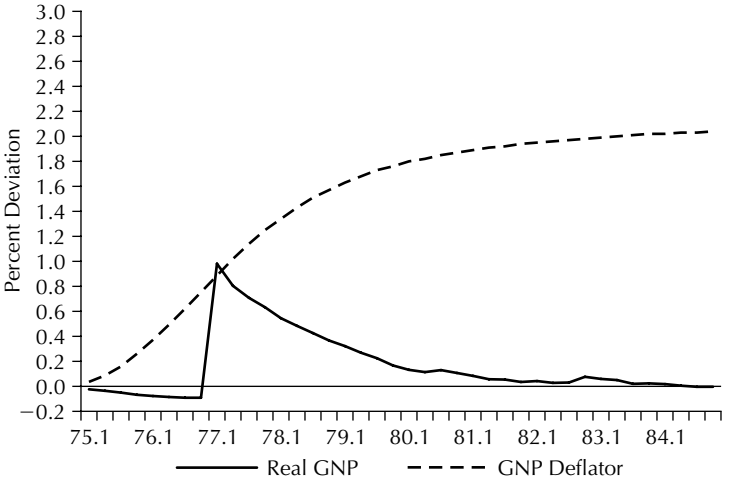


FIGURE 5-17B Anticipated U.S. Fiscal Expansion
Effect on U.S. Interest Rates, Exchange Rate

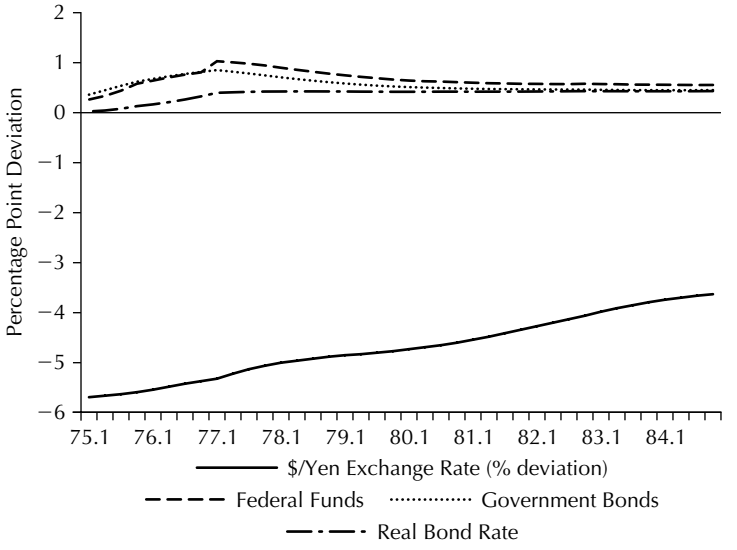


FIGURE 5-17C Anticipated U.S. Fiscal Expansion
Effect on U.S. Net Export Ratios

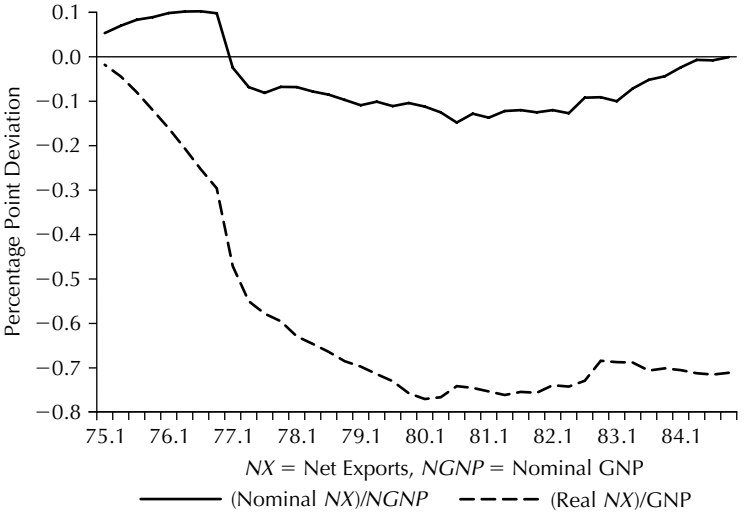


FIGURE 5-17D Anticipated U.S. Fiscal Expansion
Effect on U.S. Wage, Import Prices

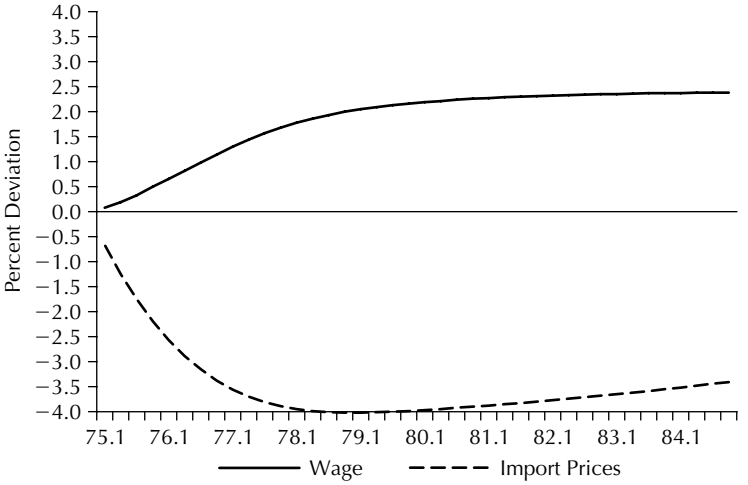


FIGURE 5-17E Anticipated U.S. Fiscal Expansion
Effect on U.S. Demand Components

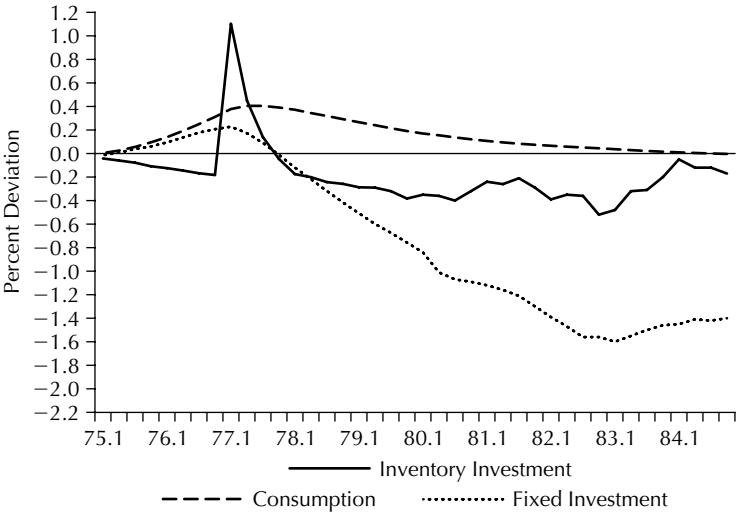


FIGURE 5-17F Anticipated U.S. Fiscal Expansion
Effect on U.S. Exports, Imports

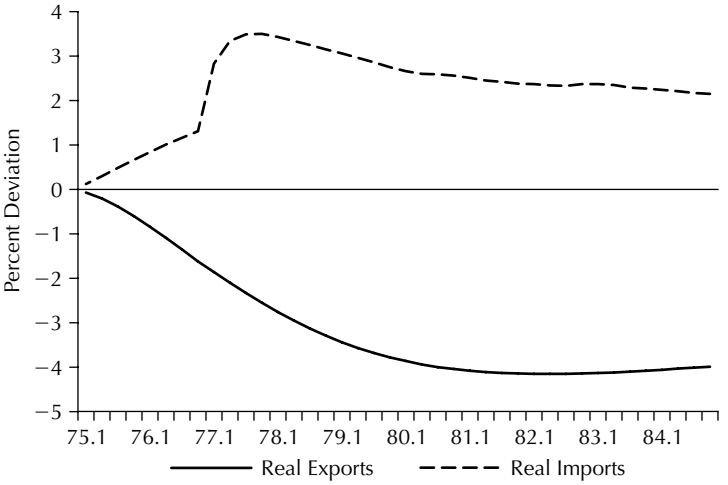


FIGURE 5-17G Anticipated U.S. Fiscal Expansion
Effect on Output Abroad

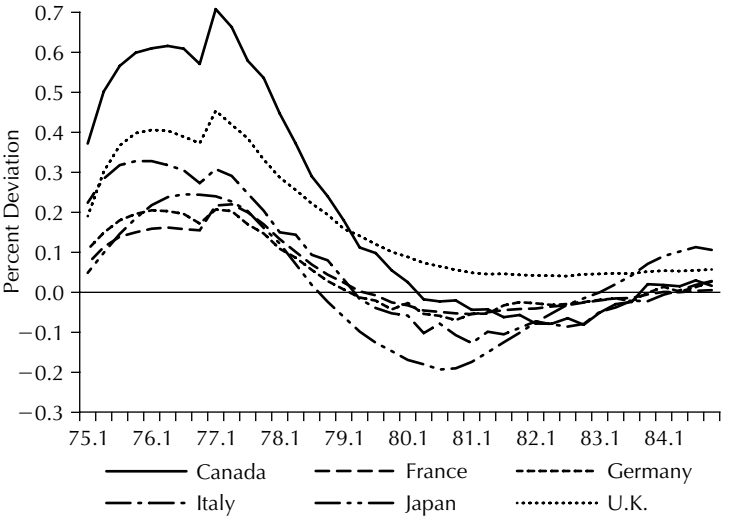
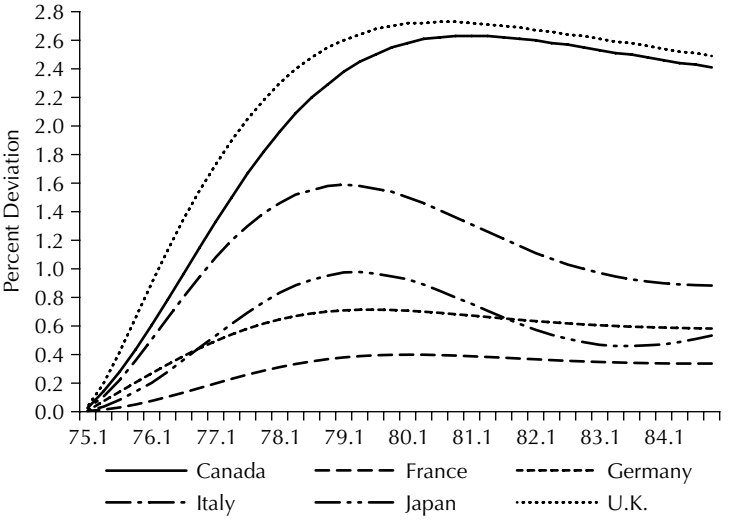


FIGURE 5-17H Anticipated U.S. Fiscal Expansion
Effect on Prices Abroad



The difficult questions concern what happens in the short and medium runs. As described in Chapter 1, the Mundell-Fleming fixed-price models, which ignore exchange-rate expectations, predict an expansion of output in the home country and a contraction of output in the rest of the world. The Dornbusch model, which incorporates rational exchange-rate expectations in a small open economy, predicts that the exchange rate will depreciate in the short run by more than it does in the long run. How large are the short-run effects in this empirical multicountry model?

Monetary Expansion in the United States

The predictions of the model for the case of an increase in the money supply in the United States are shown in Figures 5-1A through 5-1H. The impact on the major variables are reported in the following order for every country: real output, the output deflator, interest rates, exchange rates, net exports, wages, import prices, the components of spending, exports, imports, and finally, real output and prices in the other countries. This same order is maintained in the other experiments.

There is a sharp expansion in U.S. output in the first year as real long-term interest rates fall, stimulating residential and business investment as well as consumer durables. Displaying a hump-shaped pattern over time, output reaches a peak of 1.8 percent above the baseline after two quarters and then returns monotonically to the baseline over the next several years. With the increase in demand, the U.S. price level rises gradually as does the nominal wage level; the gradual movement is due to the staggered wage-setting assumptions.

Short-term interest rates drop sharply and then bounce back before gradually returning to normal. Because of the *ex ante* interest-rate parity conditions, this fluctuation in short-term interest rates requires a parallel fluctuation in the expected exchange rate, as described below. (This sharp initial fall in interest rates is probably due to the very low short-run elasticity of money demand. As already discussed, the interest-rate targeting rules I explore in Chapter 6 are not affected by this elasticity.) The long-term interest rate fluctuates with a similar time pattern but is naturally attenuated relative to the short-term rate. The real interest rate falls below the nominal rate because of the increase in the expected rate of inflation.

Fixed investment rises more than consumption in percentage terms (7 percent compared to 1 percent). The rise of durable consumption (not shown in the figures) is larger than that of nondurable consumption because of the larger interest-rate elasticity for durables. Of the components of investment, producers equipment rises by most in percentage terms, and structures (with a relatively low interest-rate elasticity) have the smallest response.

The pattern of the exchange rate is consistent with the fluctuations in short-term interest rates (only the dollar/yen exchange rate is shown, but the other exchange rates display a similar pattern). Because foreign interest

rates do not change by much, U.S. interest rates fall below foreign interest rates for several quarters but then rise above foreign interest rates. The dollar quickly depreciates by about 3 1/2 percent and then is expected to appreciate for about three quarters while the U.S. interest rate is below interest rates in the rest of the world. The appreciation takes the dollar above the long-run equilibrium, however, and the dollar then begins to gradually depreciate, eventually converging at 3 percent below normal. During this depreciation, the U.S. short-term interest rate is above foreign interest rates.

The monetary expansion causes a large decrease in net exports that is due almost entirely to a large increase in imports as the economy expands. Exports fluctuate by a relatively small amount. Both price and income elasticities are smaller in the export equation than in the import equation for the United States. Moreover, demand in the other economies does not fluctuate by much. Hence, the favorable effects on net exports of the dollar depreciation are overwhelmed by the increase in import demand brought about by the expansion in the U.S. economy.

The effects of the U.S. monetary expansion on output and prices in the other countries are small. The largest impact on output is in Canada, but it is still only about 20 percent of the expansion in the United States. The impact on output in the other countries is less than 10 percent of the United States. (Note that the scale is much larger for these figures.) In all cases, however, the short-term effects on output are positive, unlike with the simple Mundell-Fleming model but like with the model of Chapter 1. It appears that most of the positive effect on output in the other countries is due to the increased demand for their products brought on by the expansion of income in the U.S. economy.

For all countries except Italy, the price level initially declines relative to the baseline path. The appreciation of the currencies has a short-term negative effect on inflation. Eventually, this is offset by the expansion in demand for domestically produced goods, which drives up wages and prices. However, prices rise by less than 10 percent of the increase in the United States and eventually return to the baseline.

Monetary Expansion in Other Countries

Figures 5-2A through 5-7H show the effects of the same type of monetary expansion in each of the other G-7 countries, again holding money growth to the baseline path in the countries not experiencing a monetary expansion. The order of the figures is the same as in the U.S. presentation, and the countries are in alphabetical order. As with the United States, for each of the other countries, there is an initial increase in real output, which builds up for several quarters before gradually returning to the baseline. In other words, there is the same "hump-shape" pattern as that observed for the United States. The impact on output is largest for France and smallest for the United Kingdom. As in the United States, a monetary expansion

causes a decline in the real long-term interest rate and this temporarily stimulates the demand for investment and consumer durables.

Unlike in the United States, there is overshooting of the price level in some of the countries, especially Japan. The overshooting of the price level is associated with damped cycles in real output that are most prominent in Japan. After eventually rising, real output drops below the baseline by about 1 percent in Japan before rising again. It appears that the different wage dynamics in Japan are the source of these swings. To test this, the model was simulated with the wage coefficients in Japan set equal to those of the United States. This change resulted in wage-price dynamics as well as output dynamics that are much closer to those in the United States and that did not show the large cyclical swings.[2]

The general time pattern of short-term interest rates is similar to that of the United States, but the magnitudes are different. Short-term interest rates fall less in the other countries than in the United States, reflecting the larger short-run interest-rate elasticity of money demand in these countries. In every country the real long-term interest rate falls more than the nominal long-term interest rate because of the increase in the expected rate of inflation that results from the monetary expansion.

Exchange rates sharply depreciate in every country when there is a domestic monetary expansion. The initial depreciation is smaller in Germany and Japan than was observed for the United States. Surprisingly, the initial impact in these two countries is less than the long-run impact, so that there is no overshooting of the type observed in the other countries.

It was noted above that net exports decline in the United States when there is monetary expansion, despite the depreciation of the dollar. The same is generally true for each of the other countries; an easier monetary policy tends to make the trade deficit larger (or the surplus smaller) because of the short-run stimulus to domestic demand. Imports eventually rise more than exports in each of the countries. However, in the short run, exports rise more than imports in France, Japan, and the United Kingdom, so there is some transitory improvement of the trade account before deterioration takes place.

There are positive effects of monetary expansion on all the components of domestic aggregate demand, but the size of these effects vary widely from country to country. In percentage terms, fixed investment increases more than consumption in all countries except France. Although inventory investment moves by a relatively large amount in the United States, only a relatively small movement occurs in Japan.

Finally, consider the transmission of the monetary shocks abroad. Recall that the U.S. monetary expansion led to positive impacts on real output in the other countries, contrary to the predictions of a simple Mundell-

[2]More sensitive wages will tend to be stabilizing if the shocks to the economy come from the supply side. These demand-side disturbances are magnified by the very sensitive wage equations.

Fleming model. For the U.S. expansion, the transmission effect was very small in all countries except Canada where it was about 20 percent of the impact in the United States. Although the size of the transmission effects vary for the other countries, they are positive in the first few years for all countries except the United Kingdom. Perhaps this is due to the fact that the expansion of demand in the United Kingdom itself is small. But in any case, the most important feature of these transmissions is that they are very small. Not surprisingly, a monetary expansion in Canada has the smallest effects on the other countries. The impacts on prices abroad are also small. Monetary expansion in any of these countries—under a flexible exchange rate—has very small effects on inflation in the other countries, compared with the effects on domestic inflation.

5.3 Unanticipated Increase in Government Purchases

Consider next an unanticipated increase in government spending above the baseline by 1 percent of real output. The increase occurs in the first year and government spending remains at 1 percent of real output above baseline in all following years. This represents a permanent fiscal shock with a magnitude fixed in terms of the growing trend in real output.

Theoretical Insights

Some of the long-run effects of the fiscal shock can be assessed theoretically. Such a fiscal shock is assumed to have no long-run demand effects on real output. Of course, if the share of investment declines, then a slower growth of the capital stock will reduce potential output. But the economy will still return to potential output. The model is designed this way. Hence, in the country where the fiscal shock takes place, the share of the non-government components of real spending (consumption, investment, and net exports) should decline in the long run by the amount of the increase in the government share. Prices rise by enough to reduce real-money balances to the point where higher interest rates crowd out investment and a stronger home currency reduces net exports. Because the real wage does not change, wages rise by as much as prices. Hence, prices, wages, interest rates, and the real exchange rate all permanently rise. In the other countries, prices and interest rates also permanently rise in the long run in order to offset the positive net export effects of the depreciated currencies in those countries. The magnitudes of all these long-run effects must be estimated empirically since they depend on the elasticities of the model.

Fiscal Expansion in the United States

Figures 5-8A through 5-8H describe what would happen during the ten years following such a fiscal shock in the United States. Real output in the

United States increases quite sharply during the first year, and then gradually returns to the baseline path. The large real output increase during the first year is due to increases in consumption, fixed investment, and inventory investment as well as government purchases. Consumption and investment rise because the increase in expected income and sales outweighs the negative effect from the real interest-rate increase.

The real interest-rate increase is small, however, because of changes in inflation expectations. The fiscal expansion implies that prices must rise in the future. People realize this and raise their inflationary expectations. By definition, this reduces the real interest rate relative to what it otherwise would be. In fact, prices do increase in the simulations and this reduces crowding out of durable consumption and investment. Eventually, however, the expected rate of inflation returns to the baseline value, the real interest rate increases further, and the investment components of demand are entirely crowded out.

In the long run, the simulations indicate that prices rise by about 3 percent. This reduces real-money balances by a sufficient amount to increase interest rates, so that investment and durable consumption fall as a share of output to make room for more government purchases. The interest-rate rise is less than 1 percent in the long run.

The fiscal expansion causes the trade deficit to increase as imports rise and exports fall. The transmission channel is through the appreciation of the dollar that raises the price of exports and lowers the price of imports. The decline in net exports is a type of crowding out and occurs both in the short run and in the long run.

Fiscal expansion in the United States induces a positive effect on output in all the other countries, with Japan and Germany experiencing the smallest impact and Canada the largest. The effects are smaller than in the United States but are slightly larger than those abroad in the case of a monetary expansion. Prices rise in all other countries, but by less than in the United States.

Net exports increase in all the other countries (not shown in the figures) because of the depreciation of their currencies. This increase in net exports must eventually be offset by a decline in investment and durable consumption since real GNP is to remain unaffected. Hence, interest rates rise in the rest of the world. As exchange rates settle down to the baseline, this increase in world interest rates matches that in the United States.

Fiscal Expansion in Other Countries

Now consider a fiscal expansion in each of the other six countries. The results are shown in Figures 5-9A through 5-14G. A permanent increase in real government purchases causes output to expand in each of the other countries. With the exception of Japan, the largest effect occurs in the first quarter. In Japan, there is a cyclical swing much like the one observed for

the money shock. Eventually, prices rise in all countries, and real output returns to the baseline.

The fiscal expansion causes a large exchange-rate appreciation and a rise in interest rates in each country that experiences a fiscal expansion. The real net exports decline in each country as imports rise and exports fall due to the appreciation of the exchange rate. Hence, the fiscal deficit leads to a worsened trade account.

The transmission effects of the fiscal expansion in the other countries are of the same qualitative form as for the United States. A domestic fiscal expansion causes output to expand in the other countries; the lower exchange rate in those countries, as well as the expansion of output abroad, cause net exports to rise. This in turn stimulates production abroad. The transmission effects are, however, smaller for the other countries than what was observed for the United States.

5.4 Fixed Exchange Rates

Thus far all of the experiments have assumed flexible exchange rates with the money supplies in all countries being exogenous. Now consider the polar opposite case; money supplies are manipulated to keep the exchange rate pegged. Although one could consider changes in the policy instrument in every country, only Japan is considered here. In particular, consider a 3-percent increase in the Japanese money supply with a fixed exchange-rate system. The other six countries adjust their money supplies endogenously to keep exchange rates pegged.

Technically, the model is changed in two ways. First, the short-term interest-rate equations in all countries except Japan are rearranged with money on the left-hand side. This makes money in each of the countries an endogenous variable. Second, the interest rates in all countries are made endogenous by placing them on the left-hand side of the interest-rate parity equations. Interest-rate changes in the other countries then match movements in the U.S. interest rate because the expected change in the exchange rate relative to the U.S. dollar is assumed to be zero in the interest-rate parity equations.

Theoretical Considerations

Since money is neutral in the long run, prices and wages in Japan will eventually increase by 3 percent, and output and the components of demand will return to their baseline values. With exchange rates fixed, prices and wages in all the other countries must also eventually increase by 3 percent. The money supplies in all the other countries will eventually increase by 3 percent to bring about the required inflation. In this sense it doesn't matter which country started the money expansion, as all will follow suit in

any case. In the long run, output and the components of demand in the other countries also return to the baseline path.

Simulation Results

In the short run, there will be effects on output, the components of demand, and the trade balance from an increase in the money supply in Japan. Figures 5-15A through 5-15H show the results. They are strikingly different from those obtained in the flexible exchange-rate case. In that case, Japanese output expanded by a significant amount, and there was almost no effect on output in the United States, Germany, and the other countries. With fixed exchange rates, there is a big effect of the Japanese monetary expansion on both the United States and Germany. The impact on Japanese output is still about the same, but Germany's output expands by almost the same amount, and U.S. output expands by almost half as much as in Japan.

The reason for these changes is clear. In order to keep the exchange rates on target, the other central banks must expand their money supplies and reduce their interest rates when the Bank of Japan's monetary expansion puts downward pressure on short-term interest rates. The monetary expansion in the other countries in turn stimulates demand in these countries because wages and prices adjust slowly. Real-money balances rise, and this causes nominal interest rates to fall along with Japan's interest rates. Real interest rates in the other countries drop by a different amount from that in Japan because wages and prices rise (and are expected to rise) at different rates from those in Japan. The drop in real interest rates affects investment and durable consumption by amounts that depend on the size of real interest-rate elasticities. As the simulations show, the effect in some of the other countries of the Japanese monetary expansion is even larger than in Japan.[3]

5.5 An Anticipated Increase in the Money Supply

To examine the effects of anticipated changes in the instruments, we return to the world of flexible exchange rates. We focus our discussion on the United States. The qualitative differences between anticipated and unanticipated shocks are similar in the other countries.

Consider an increase in the money supply of 3 percent, just as in Section 5.2, except that the increase is anticipated eight quarters in advance.

[3]Note that this particular fixed exchange-rate system imposed on the model is not the only possibility. This system leads to a situation where all countries must match the increase in money growth undertaken by Japan. An alternative fixed exchange-rate arrangement would be to make world money exogenous. However, if the simulation was for the world money supply to increase by 3 percent, then the results would be similar since the money supply would increase by 3 percent in every country.

Because of the expectations effects, the anticipation of this change in policy will lead to immediate impacts. Additional impacts will occur at the time of the actual policy change. In the long run, however, the money increase will be neutral with the same effects studied as those in Section 5.2.

The effects on U.S. variables are shown in Figures 5-16A through 5-16H. There is a small expansionary effect on real output at the time of announcement. The stimulative effect occurs largely because investment and consumption depend on expectations of future sales and income, both of which rise as soon as the monetary expansion is expected to occur. In addition, there is a small decline in the real long-term interest rate in the first few quarters following the announcement. The effect on real output gradually builds up and reaches a maximum during the year in which the money supply is increased. The maximum increase at the time of impact is smaller than the initial impact in the unanticipated case (compare Figure 5-1A with Figure 5-16A). However, the speed of decline in output after the maximum effect is very similar to the unanticipated case.

Prices and wages rise gradually from the date of announcement. Because the money supply has not yet risen, this inflation reduces real-money balances and causes interest rates to rise in the first few quarters before they decline at the time of impact. This rise in nominal interest rates is more than offset by the increase in the expected rate of inflation, so that real interest rates fall slightly and stimulate investment and the purchase of durables.

Very little stimulus to demand is coming from exports in the initial quarters. The dollar depreciates starting in the period of the announcement, but this is not large enough to stimulate exports by more than a small amount. The depreciation starts with a 1-percent downward jump. This is followed by a more gradual fall to about 4.5 percent below the baseline—an overshoot of the final 3 percent. Then there is an appreciation back to a level 3 percent below the baseline in the first few quarters after the money supply increase.

The output effects in the other countries are even smaller than in the unanticipated case. The overall effect of the anticipated monetary change compared to the unanticipated change is to smooth out the effects on output and the components of demand in the United States and other countries. The impacts are smaller, but they last longer.

5.6 Anticipated Increase in Government Spending

Suppose now that the unanticipated expansion in government spending described in Section 5.3 is anticipated two years in advance. In the long run the effects will be identical to those in the unanticipated case, but in the short run the effects are much different. Again we focus on the United States. The effects are shown in Figures 5-17A through 5-17H.

At the time of the announcement there is a small decline in output relative to the baseline. By the seventh quarter after the announcement—but still before the fiscal shock occurs—output is still slightly below baseline. In

a growing economy this decline would not be large enough to be registered as a recession, but a slowdown in economic growth might be observed. When the increase in government spending actually takes place, the economy goes into a boom as output rises about 1 percent above normal. Hence, the size of the expansion, once it occurs, is about 70 percent as large as in the unanticipated case.

The cause of the decline in output at the time of the fiscal announcement is primarily the increase in interest rates and an appreciation of the dollar. Long-term interest rates rise because people expect short-term interest rates to rise in the future when the fiscal expansion actually occurs. The rise in long-term interest rates chokes off investment well before the increase in government spending occurs.

The sharp appreciation of the dollar occurs for similar reasons. People realize at the time of announcement that the dollar will appreciate in the future. If interest rates did not change, then the dollar would have to jump up immediately in order to keep interest-rate parity. In this case, U.S. interest rates rise above foreign interest rates at the time of announcement. Hence, the dollar must appreciate even further so that it can be expected to depreciate while the spread between U.S. interest rates and world interest rates is greater than normal.

The appreciation of the dollar has a positive impact on imports and has a negative impact on exports. The trade deficit gradually grows until the time of the fiscal shock when it increases sharply. The sharp increase in the trade deficit is due to the large increase in domestic demand at the time government spending increases. The decline in net exports is more than offset by an increase in consumption and investment, and the economy goes into a boom as described before.

5.7 Empirical Overview

This chapter began by emphasizing the importance of obtaining empirical information about the impact of the policy instruments. The many charts presented here provide that information and form the basis of the policy analysis that follows in the last three chapters of the book. In this section, I attempt to glean several key empirical rules of thumb about the overall effects on real output and prices from the simulations.

Monetary Policy Effects on Real Output and Prices

Short Run. An unanticipated increase in the money supply has significant short-run impact on real output in all seven countries. A *3-percent increase in the money supply* temporarily reduces the short-term interest rate by about 2 percentage points on the average and *raises real output* by an average maximum of *about* 1½ *percent* above the baseline. The maximum effect usually occurs about two quarters after the monetary shock. At this point

prices are about 1/2 percent above baseline. Anticipated increases in the money supply also have a significant effect on real output. The impact starts before the increase, and the maximum is slightly less than the unanticipated increase.

Medium to Long Run. The impact on real output dies out slowly. After three years, real output is still above baseline in all the countries, having returned about 75 percent of the distance back to the baseline. At this three-year point, prices, on average, are still less than 3 percent above baseline. In the long run, of course, effects on real output disappear, and prices rise by 3 percent.

Monetary Policy Effects on the Trade Balance and on Other Countries

In every country net exports decline in response to a monetary expansion. The maximum short-run decline is slightly less than 1/2 percentage points of GNP on average for the 3-percent money expansion. Of course, this effect is short-lived; eventually net exports return to the baseline.

With flexible exchange rates, monetary policy has a small but positive short-run effect on real output in other countries. The average impact is about one-tenth of a percent increase.

With fixed exchange rates, however, a monetary expansion has huge effects abroad. The impact in foreign countries averages to about the same as in the country expanding the money supply.

Fiscal Policy Effects on Real Output and Prices

Short Run. An unanticipated change in government purchases also has a significant effect on real output in the short run. An increase in real government purchases by 1 percent above the baseline raises real output by an average maximum of 1 1/4 percent. Hence, the multiplier is about 1 1/4 on average. The maximum effect occurs in the first quarter during which government spending increases. Prices rise by only a small amount in this first quarter.

Medium to Long Run. The impact on real output dissipates slowly as other components of spending decline. After three years, real output is still about one-third of a percentage point above the baseline. In the long run, of course, there is complete crowding out, and real output returns to the baseline.

Fiscal Policy Effects on the Trade Balance and on Other Countries

The expansionary fiscal policy reduces real net exports in every country. The long-run impact is larger than the short-run impact. In the long run the increase in government spending by 1 percent of real output reduces net

exports by an average of about .8 percent of real output. Thus, most of the long-run crowding out caused by the fiscal expansion occurs in net exports. However, even the short-run crowding out is significant. Real net exports decline by about .3 percent of real output on average in the quarter in which government spending increases. This is caused by a large appreciation of the currency that occurs just as the fiscal expansion occurs.

Assessing the Magnitude of the Impact in the 1980s

Finally, to give some sense of the magnitude of these effects, consider some well-publicized events of the 1980s. An important public policy issue in the 1980s was whether the U.S. budget deficit and expected future budget deficits were the cause of the large dollar appreciation—about 60 percent from 1980 to 1985 on a trade-weighted basis. As the simulations in this chapter make clear, both current and expected future budget deficits—caused, for example, by an increase in government spending—make the dollar appreciate.

Is the size of the effect large enough to explain the appreciation of the dollar observed in the early 1980s? The simulation results suggest that an unanticipated permanent increase in the budget deficit by 1 percent of GNP causes the dollar to appreciate by about 6 percent (the impact effect). The budget deficit in the United States during the 1980s reached a peak of about 5 percent of GNP, indicating that a 30-percent dollar appreciation in the early 1980s could be attributed to the budget deficits. This is only the impact effect. Over time, the size of effect on the exchange rate diminishes.

Anticipated budget deficits also affect the exchange rate. An increase in the budget deficit of 1 percent of GNP (anticipated two years in advance) causes the dollar to appreciate by about another 6 percent. Hence, it is possible that projections of large future deficits that had not yet occurred would have raised the exchange rate even further. But projections of deficits of over 10 percent of GNP would have been necessary to explain the dollar appreciation observed at that time. It appears that other factors, perhaps monetary policy, also had a role to play in the dollar's high value. The simulations in this chapter imply that a tighter monetary policy would temporarily appreciate the dollar.

Reference Notes

Starting in the mid-1980s, several research efforts have been devoted to comparing deterministic simulations, like those in this chapter, from different econometric models. This multicountry model was a participant in most of these comparison projects, so it is possible to compare the policy impacts with conventional models or with other rational expectations models. My assessment is that there are large differences between the simulations with rational expectations models and those with conventional models. However,

since most of the comparisons are for simulations of unanticipated changes in the policy instruments—where expectations effects play a smaller role—there is less difference between conventional and rational expectations models than a casual observer might expect.

The first set of comparisons—in which an early version of this multicountry model participated—is reported in the two-volume work by Bryant et al. (1988a). The paper by Hickman (1988) in the first of these volumes summarizes the different simulations by using stanadard textbook graphs and is a very useful way for the uninitiated to assess the results. The results of a second comparison, focusing on the trade deficit effects, were published by Bryant, Holtham, and Hooper (1988b). In addition, a model comparison project focusing mostly on quarterly econometric models of the U.S. economy was organized by Lawrence Klein and has met regularly since 1986. The results of a comparison of the deterministic simulations for this group of models is reported in Klein (1991). The comment by Shiller (1991) in the later volume points to some of the fundamental differences between simulations of conventional models and rational expectations models.