International Finance Discussion Papers

Number 344

March 1989

DOMESTIC AND CROSS-BORDER CONSEQUENCES OF U.S. MACROECONOMIC POLICIES

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ABSTRACT

This paper reviews empirical evidence about the effects of changes in U.S. monetary policy and fiscal policy that has been accumulated during recent years in a series of collaborative research projects involving a variety of global macroeconometric models. The paper also considers, in particular, the consequences over the next five to six years for key U.S. and foreign economic variables of a significant U.S. fiscal contraction. The quantitative implications of both alternative fiscal spending and tax actions, and alternative treatments of expectations (adaptive versus rational) are analyzed.

The results suggest that a phased-in fiscal contraction could reduce the level of output for up to several years, as well as the levels of interest rates, the dollar and the U.S. external deficit. The decline in the external deficit would be significantly smaller than the decline in the budget deficit, however. The negative effects on output would be mitigated to the extent that the phased-in contraction were anticipated (i.e., announced credibly in advance), to the extent that monetary policy were eased, or to the extent that the fiscal package emphasized spending cuts and personal taxes rather than corporate and excise taxes.

DOMESTIC AND CROSS-BORDER CONSEQUENCES OF U.S. MACROECONOMIC POLICIES

Ralph C. Bryant, John F. Helliwell, and Peter Hooper[1]

1. Introduction

Sound decisions about economic policies by national governments -- and, even more so, efforts to coordinate policies internationally -- must rest on a foundation of empirical knowledge about the macroeconomic behavior of the world economy. It is important to provide better quantitative estimates of interactions among the

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[1] This paper was prepared for the conference on "Macroeconomic Policies in an Interdependent World" jointly sponsored by the International Monetary Fund, the Centre for Economic Policy Research, and the Brookings Institution, Washington, DC, December 12-13, 1988. Bryant is Senior Fellow in Economic Studies at the Brookings Institution. Helliwell is Professor of Economics at the University of British Columbia and Clifford Clark Visiting Economist in the Canadian Department of Finance, Ottawa. Hooper is Assistant Director, Division of International Finance, Federal Reserve Board and Guest Scholar at the Brookings Institution.

Our biggest debt is to the numerous modeling groups that have collaborated in this research to provide results for a consistently defined set of experiments. We also wish to thank in particular those who have generously given of their time to conduct new experiments for inclusion in this paper, especially Flint Brayton of the MPS modeling group at the Federal Reserve Board, Nigel Gault of the DRI modeling group, Jaime Marquez of the MCM group at the Federal Reserve Board, and Guy Meredith and Phil Bagnoli of the INTERMOD group. Gary Burtless, Robert Lafrance, Paul Masson, Guy Meredith, and Ted Truman gave us helpful suggestions on early drafts. Kathy Larin, Carolyn Litynski, Boban Mathew, and Alan Chung have provided able research assistance. The views expressed in this paper are the authors' alone, and should not be taken as representing the views of the Federal Reserve Board, of the other institutions with which the authors are associated, or of the authors' many collaborators in the construction and evaluation of multicountry empirical models.

An abridged version of this paper will be published in a conference volume, to appear later in 1989. The main difference between this and the abridged version is the exclusion from the latter of most of the appendix material.

largest national economies and to facilitate a better use of those estimates in national policy-making. This is especially so at present, as the new U.S. Administration and Congress are facing significant choices about the future course of U.S. fiscal policy.

Our paper, motivated by these needs, has two purposes. One is to review empirical evidence about the effects of changes in U.S. fiscal and monetary policies that has been accumulated during recent years in a series of collaborative research projects. This research effort, which we describe further below, has focused primarily on comparative policy simulations generated by a variety of global macroeconometric models. Our second purpose is to use the accumulated evidence, plus some new empirical estimates prepared for this paper, to illuminate the macroeconomic policy choices now facing the U.S. government. We analyze, in particular, the likely consequences for key U.S. and foreign economic variables of a significant U.S. fiscal contraction. Our time horizon is the next five to six years, a period lengthy enough to capture medium- as well as shorter-run effects (but not effects that manifest themselves only over a very long run). We pay special attention to the consequences of alternative types of fiscal action on the "twin" deficits -- the U.S. government's budget deficit and the external (current-account) deficit of the American economy.

In the remainder of this introduction, we outline the ground covered by our analysis and briefly describe the research from which most of our empirical estimates have been obtained. In section 2, we then summarize the available evidence on the domestic and international effects of U.S. fiscal policy, typified by reductions

in U.S. government purchases of goods and services. Section 3 reviews the evidence on the effects of changes in U.S. monetary policy, calibrated as expansions in the U.S. money supply.

In section 4, we focus attention on the ways in which the estimated results of policy actions are influenced by a model's treatment of expectations. In particular, we distinguish between adaptive and rational (or model-consistent) expectations. Most of the simulations reviewed in sections 2 and 3 were generated by models that treat expectations adaptively. Under model-consistent expectations, it can make a substantial difference whether policy actions are a surprise when they occur or, alternatively, are anticipated prior to implementation. We accordingly also report some evidence bearing on this distinction between unanticipated and anticipated policy actions.

Section 5 presents another type of additional evidence, prepared for this conference by modeling groups responsible for three well-known macroeconometric models, contrasting the macroeconomic effects of cuts in government purchases with the effects of changes in various taxes or transfer payments. These estimates of alternative types of fiscal actions are preliminary and need to be corroborated by further research. Nevertheless, they suggest that different fiscal actions may imply significantly different trade-offs between the gains from reductions in U.S. budget and external deficits and the losses from reduced output at home and abroad.

Our analysis in section 6 illustrates how the empirical evidence reviewed in sections 2 through 5 can be used to assess the consequences of alternative U.S. macroeconomic policies in the

circumstances currently facing the newly elected President and Congress. Our examples focus on fiscal contractions that are phased in over a four-year period. We consider alternative assumptions about the specific spending, tax, and transfer actions that might be involved. We also illustrate the possible consequences of forward-looking expectations and of combining some monetary expansion with the fiscal retrenchment.

Section 7 completes the paper with concluding remarks, including our summary assessment of the empirical evidence.

The bulk of the empirical research we review in this study stems from a series of projects initiated in 1983. This research gathered momentum in succeeding years and, through the cooperation of numerous institutions and individuals in a variety of countries, has evolved into an international collaborative effort.[2]

Planning among modeling groups for the first of a series of workshops and conferences began in the fall of 1984. Preliminary results of commonly specified simulations for U.S. monetary and fiscal policy actions, and for alternative policy responses abroad, were compared and evaluated at a workshop held at Brookings in October 1985. Revised simulations were then prepared for a two-day conference at Brookings during March 1986. After further revisions and preparation of supplementary material, a two-volume publication

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[2] The organising initiative for the series of projects was taken by a group of researchers sponsored by the Brookings Institution, in cooperation with the Centre for Economic Policy Research in London, with subsequent organizing support from a variety of other institutions, in particular the staffs of the Japanese Economic Planning Agency and the Federal Reserve Board. Generous support for the research effort has been provided by the Ford Foundation and, beginning in 1987, the Tokyo Club Foundation for Global Studies.

about the project -- Empirical Macroeconomics for Interdependent Economies, referred to here as EMIE -- appeared in early 1988.[3]

The EMIE evidence pertained to full-model simulations. In January 1987, another workshop was held at Brookings that focused on the U.S. current-account imbalance, using primarily partial-model simulations that disengaged the U.S. current-account sectors from the rest of the models. Results from this project were published in External Deficits and the Dollar: The Pit and the Pendulum.[4]

Further joint efforts to generate empirical evidence from multicountry models were planned during 1987 and implemented in the first half of 1988. The Japanese Economic Planning Agency devoted a substantial part of its biennial symposium to evaluation of new simulations from three large multicountry models (EPA, MCM, and OECD). These simulations focused on the Japanese and U.S. economies and the global and domestic policy implications of correcting the

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[3] Bryant, Henderson, Holtham and others (1988). The models participating in the EMIE project included: the international model developed by Data Resources, Inc. (DRI), the COMPACT model of the staff of the Commission of the European Communities (EEC), the world econometric model of the Japanese Economic Planning Agency (EPA), the Project LINK system of linked individual country models (LINK), the model developed by Patrick Minford and associates at the University of Liverpool (LIVERPOOL), the Multi-Country Model developed by the staff of the Federal Reserve Board (MCM), a simulation model developed by Richard Haas and Paul Masson at the International Monetary Fund (MINIMOD), the global simulation model of Warwick McKibbin and Jeffrey Sachs (MSG), the INTERLINK model of the Organization for Economic Cooperation and Development (OECD), the multicountry model developed by John Taylor and associates (TAYLOR), a world vector autoregression model developed by Christopher Sims and Robert Litterman (VAR), and the world model of Wharton Econometric Forecasting Associates (WHARTON).

[4] Bryant, Holtham, and Hooper (1988). For subsequent updates and elaborations, see Hooper and Mann (1989a and 1989b), Bryant (1988), and Hooper (1988).

large external imbalances of those two countries.[5]

In May 1988, the Federal Reserve Board sponsored a conference on monetary aggregates and financial-sector behavior in interdependent economies. The papers at that conference focused on financial modeling for the United States and other major countries, with one session devoted to new simulation evidence paying particular attention to Japan, Germany, and the United States. Models for which simulations were prepared included several -- EPA, LINK, MCM, OECD, TAYLOR -- that had participated in earlier projects plus the global economic model of the National Institute of Economic and Social Research in London (GEM) and the MPS model of the Federal Reserve Board staff.[6]

Finally, an additional source of evidence has become available in 1988 as a result of modeling efforts at the International Monetary Fund and the Canadian Department of Finance. Members of the IMF staff, extending earlier work with the two-region MINIMOD, have constructed a seven-region rational expectations model of the world economy known as MULTIMOD. The focus of that model is on the transmission of policy effects. In its summer 1988 version, MULTIMOD contained separate sub-models for the United States, Japan, and Germany but treated the remaining four members of the Group of

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[5] The volume of papers prepared for this symposium includes, among others, Helliwell (1988c) and Edison, Helkie, Marquez, and Tryon (1988).

[6] A volume based on the papers and discussion at the May 1988 conference is in preparation. See in particular the contributions of Brayton and Marquez (1988) and Helliwell, Cockerline, and Lafrance (1988), which deal especially with the features and properties of the linkage models participating in that conference.

Seven (G-7) as a single aggregated region. A team of researchers at the Canadian Department of Finance, collaborating with the IMF modeling group, has disaggregated that 4-country region into four additional sub-models, one each for Canada, France, Italy, and the United Kingdom. Their resulting multicountry model is known as INTERMOD. A significant feature of INTERMOD, and of the predecessor MINIMOD, is the ability to treat expectations either adaptively or in a forward-looking, model-consistent manner. MULTIMOD and INTERMOD share a common modeling strategy and have similar properties.[7]

Our objective in sections 2 and 3 of the paper is to summarize, for U.S. fiscal and monetary policies, the main generalizations that can be extracted from the recently available empirical evidence outlined above. To put the evidence in accessible form, we have prepared averages and standard deviations for two substantial samples of the model simulations. Our full sample includes an almost complete set of model results -- typically 20 simulated time series per variable. The smaller sample, a subset of the full sample, typically contains 12 simulated series per variable. The two samples of results are similar for most variables. The biggest differences are the smaller standard deviations for the 12-series sample. We put more emphasis on the partial sample than on the full sample; the former eliminates some of the model results that seem to

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[7] MULTIMOD is described in Masson, Symansky, Haas, and Dooley (1988). For the earlier modeling effort by the IMF staff, see Haas and Masson (1986). For a description of INTERMOD and examples of its simulation properties, including a comparison with the properties of MULTIMOD, see Helliwell, Meredith, Bagnoli and Durand (1988).

us most problematic.

The appendix gives details of the model simulations included in the two samples, identifies some adjustments we made to the original simulations, and provides brief descriptions and bibliographic references for the individual models (including a few charts showing the diversity of results across the individual models). The appendix also contains tables supplying the underlying data shown in the text charts that follow.

2. Effects of Changes in U.S. Government Spending

The standardized change in fiscal policy considered here is a reduction in real U.S. government purchases of goods and services equal to 1 percent of baseline U.S. real GNP, maintained throughout a six-year simulation period.[8] For the accompanying monetary policy, the modeling groups held the level of a key monetary aggregate unchanged along its baseline path.[9]

Figure 2-1 summarizes the macroeconomic consequences of this reduction of government spending. All results are reported as deviations of the "shock" simulation from a "baseline" simulation.[10]

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[8] Those models incorporating forward-looking, model-consistent expectations assumed that the change in government purchases (from baseline) was gradually phased out after the completion of the six-year simulation period, or else altered tax rates (sometime after the end of the six-year period) so as to restore long-term fiscal balance.

[9] See the appendix for further details. The simulation results contain elements of non-comparability in the models' treatments of monetary policy.

[10] The baseline (sometimes referred to as "control") simulation is a benchmark set of commonly defined paths for important macroeconomic variables appearing in the model. The shock simulations are prepared by changing an exogenous fiscal (in section

The panels for most variables, here and later, show results as percent deviations from baseline. Variables such as interest rates are reported as absolute deviations from baseline in percentage points, while deviations in current accounts and government deficits are measured as percents of baseline nominal GNP.

The six panels on the first page of Figure 2-1 show domestic and external-sector effects. The top pair of panels plots the responses of real GNP and the price level.[11] The middle panels show the changes in the U.S. budget position and in the U.S. current-account balance. The bottom panels report the effects on the U.S. short-term interest rate and the exchange value of the U.S. dollar.[12] Each panel in Figure 2-1 (and in the analogous figure in section 3) plots two averages: the 12-series average with a heavy solid line and the 20-series average with a less prominent solid line. As a rough measure of the variability of the models' responses, each panel also shows with dashed lines the interval defined by plus and minus one standard deviation around the mean. The interval around the 12-series mean is shown with the heavy dashed lines, the 20-series interval less prominently.

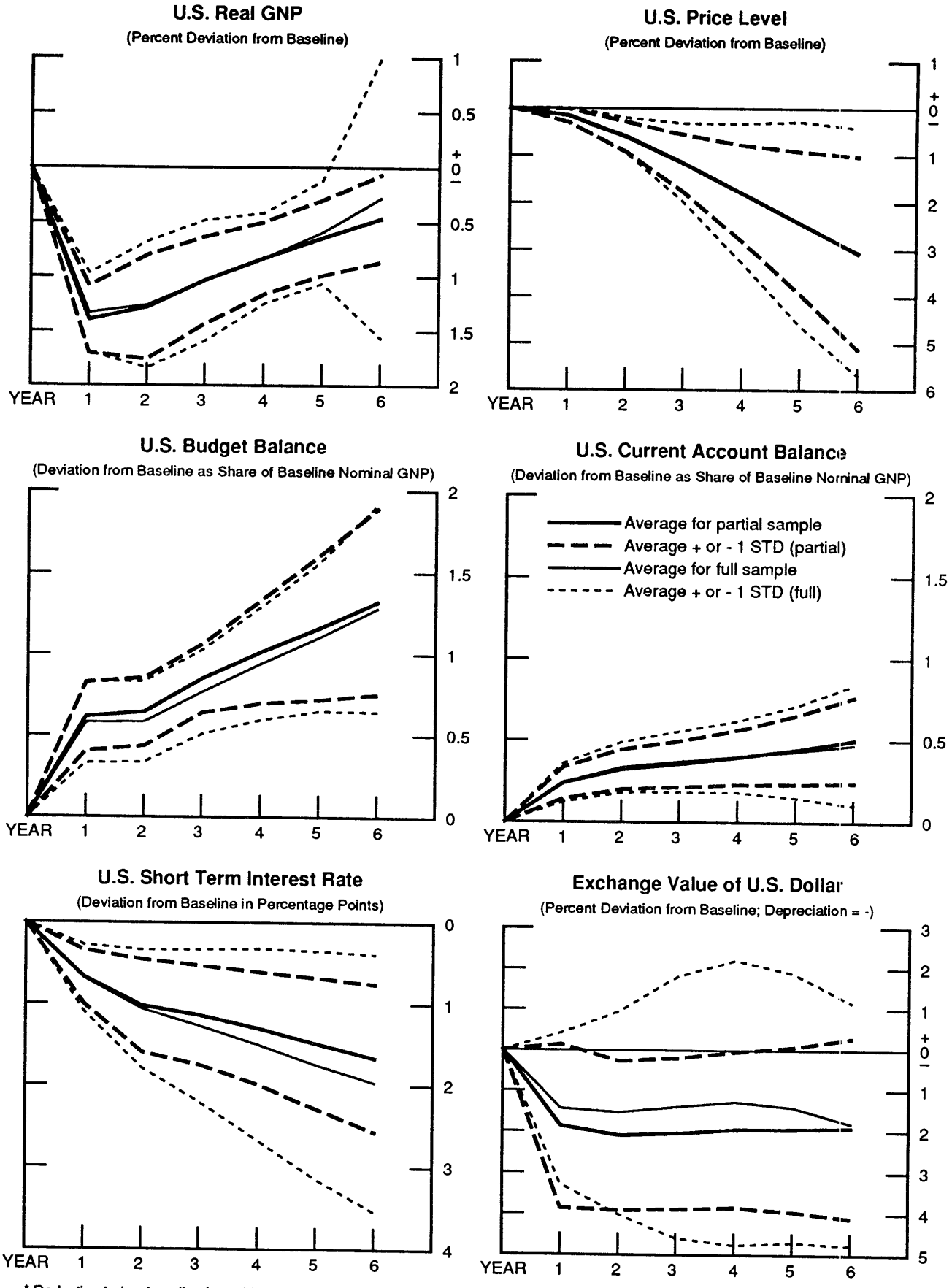
3, an exogenous monetary) variable by a specified amount from its baseline path and using the models to calculate the alterations in the paths of endogenous variables caused by the shock.

[11] Where available, the index of consumer prices is used to represent the price level. If the consumer price index is not available, a general index for absorption prices is used. In the absence of either index for spending prices, the GNP deflator is used instead.

[12] A minus value for the exchange value indicates a depreciation of the U.S. dollar against a trade-weighted average of foreign currencies, measured as a percent of the baseline value.

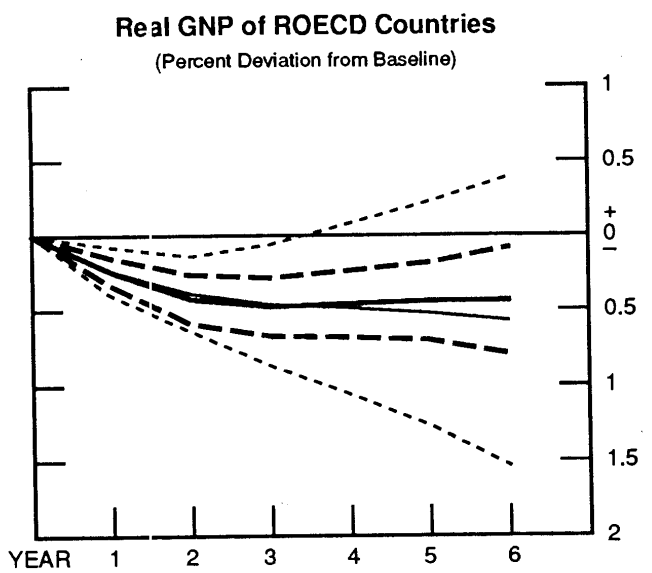
Figure 2-1

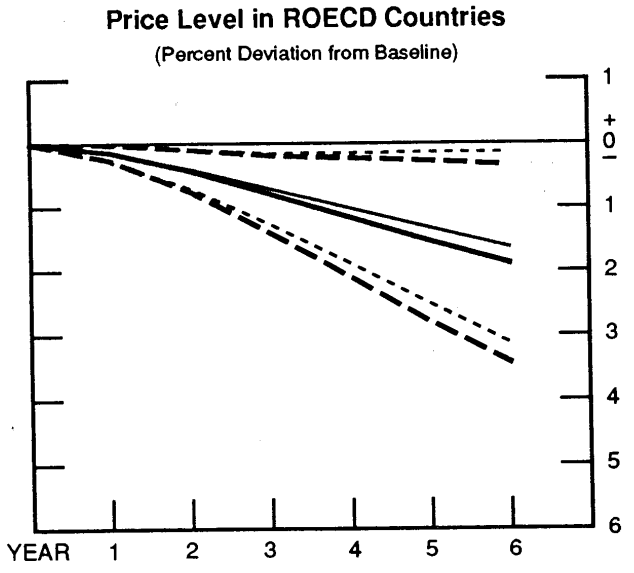
Averages of Simulated Effects for a U.S. Fiscal Contraction*

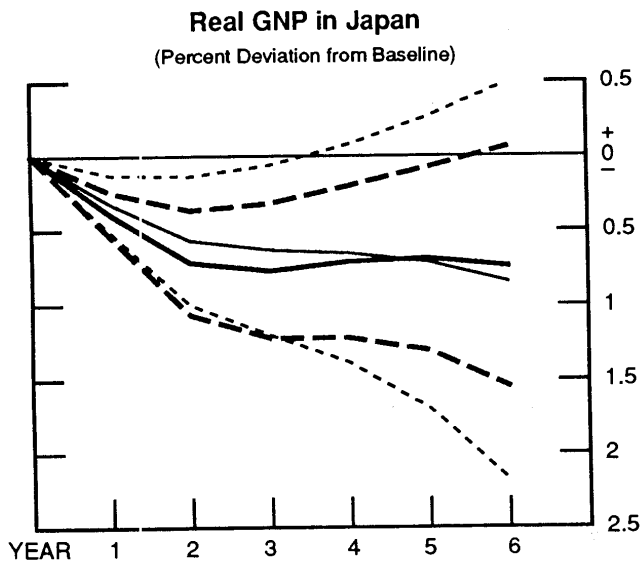


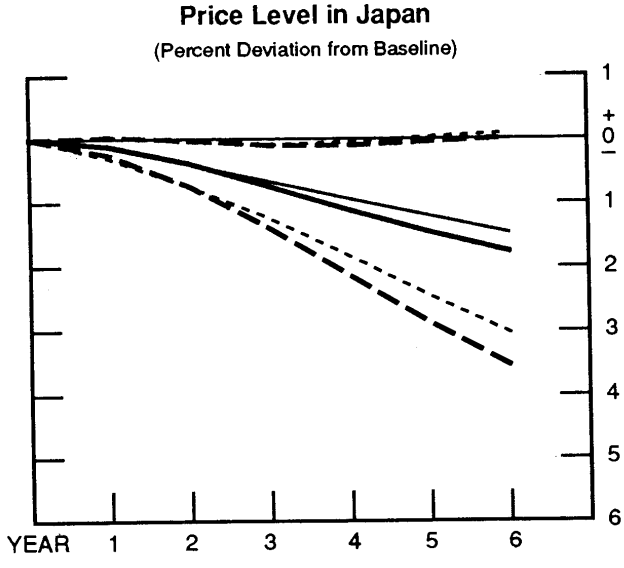
* Reduction below baseline in real U.S. government purchases of goods and services equal to 1 percent of baseline real GNP, maintained throughout the six years of simulation period.

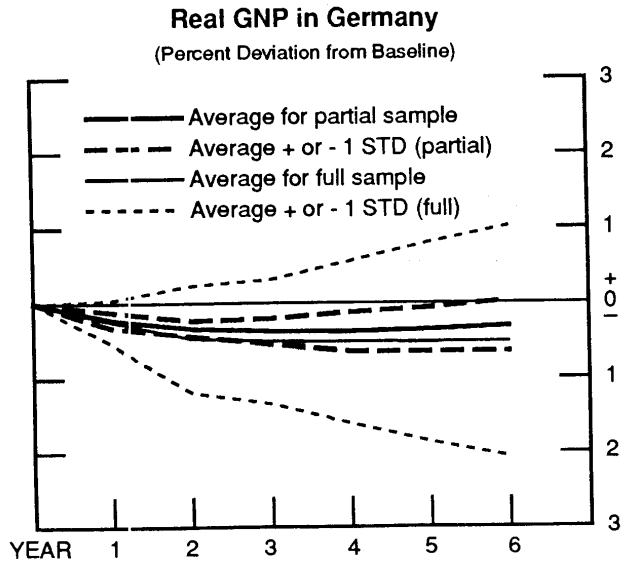
Figure 2-1 (continued)

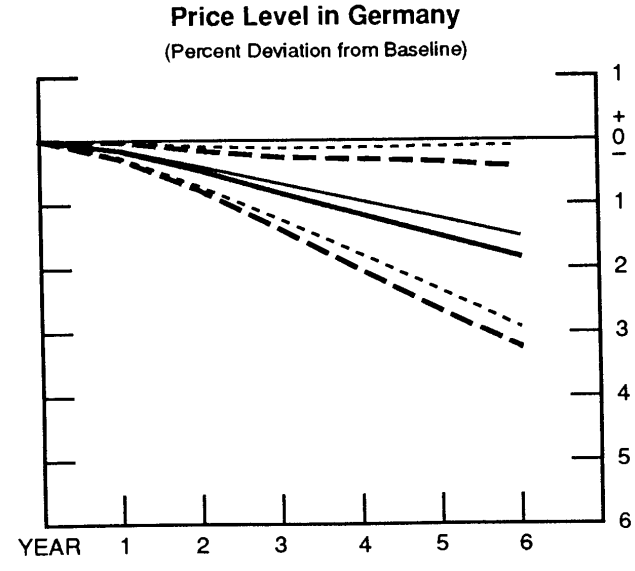












* Reduction below baseline in real U.S. government purchases of goods and services equal to 1 percent of baseline real GNP, maintained throughout the six years of simulation period.

In the initial year of the simulations, U.S. output falls relative to baseline by somewhat more than the decrease in government spending. After the second year, the models exhibit "crowding-in" behavior, as the negative income effects of the government-spending reduction begin to be offset by increases in other spending on domestic output induced by lower interest rates, lower prices, and a depreciation of the dollar.[13] The amount and timing of these offsetting effects vary across the models, as is evident from the standard-deviation intervals. Nevertheless, by the sixth year of the simulation, both the smaller and larger sample averages suggest that output will have returned most of the way back to its baseline path. The effects on the U.S. price level tend to cumulate throughout the six-year simulation period.

The models all predict reductions in the U.S. government budget deficit stemming from the fiscal contraction, but with sizable differences across the models in the amounts. In the third year, the average reduction in the fiscal deficit is about 85 percent as large as the initial reduction in spending (with a standard deviation equal to about one fifth of the initial change in spending).

The direction of movement of the exchange value of a country's currency after a fiscal action is ambiguous in expository theoretical models. Among other things, it depends on the assumed degree of substitutability between assets denominated in the home currency and in foreign currencies. In simplified expositions of the theory, the direction of movement of the exchange rate depends

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[13] This crowding-in behavior is discussed in more detail in section 5.

on the relative slopes of the "BP" and "LM" curves (representing, respectively, equilibrium in the external sector and the money market). The greater the degree of substitutability between home-currency and foreign-currency assets, the flatter will be the slope of the BP curve. A flatter (steeper) slope for the BP curve than for the LM curve implies that a contractionary fiscal action will depreciate (appreciate) the home currency.[14]

The ambiguity in theoretical models is largely absent in the simulations discussed here. The prevailing result in multicountry empirical models is that the home currency depreciates in the initial years following a fiscal contraction. The empirical models tend to embody either perfect or near-perfect substitutability of assets denominated in different currencies (relatively flat BP curves). Exchange rates are determined for the most part in asset-market equations, either in the form of real interest-parity conditions or in portfolio-balance sectors in which asset demands are interest elastic and exchange-rate expectations are directly affected by relative price movements (or purchasing-power-parity

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[14] In the textbook theoretical framework, the exchange rate responds to interest rates (via capital flows) and to income/absorption (via the effects through imports on the trade balance). A fiscal contraction tends to lower the home interest rate (putting pressure on the home currency to depreciate) and to reduce home income (putting pressure on the currency to appreciate by improving the trade balance). The flatter the BP curve relative to the LM curve, the more the interest-rate effects on the exchange rate dominate the effects working through income and the trade balance. See, for example, Ethier (1983, pp. 338-42, 390-92). In more complicated theoretical models, the home currency's exchange value may follow a complex dynamic pattern -- for example, depreciating temporarily after a fiscal contraction but then eventually appreciating to an inflation-adjusted value significantly above its original level.

considerations). Hence nominal exchange rates move in response to changes in nominal interest-rate differentials, expected inflation differentials, current and expected relative price levels (and, in a few cases, factors that may influence equilibrium real exchange rates in the long run such as the wealth of national residents and the stocks of governments' debts).

Under the 1 percent U.S. fiscal contraction, the average decrease in the nominal value of the U.S. dollar is about 2 percent. There is substantial variation among the models in their estimates of the size and persistence of the extent of the depreciation, as evidenced by a standard deviation almost as large as the mean estimate of the change.[15]

With the domestic economy weaker and the dollar tending to depreciate, the U.S. current account improves. Expenditure-reducing and expenditure-switching effects both work in the same direction to contribute to this improvement. The size of the effects varies considerably across the models, especially in later years of the simulation. Measured in current dollars, the range of sixth-year improvements in the U.S. current account runs from close to zero to more than $70 billion. For the 12-series average, each $100 billion reduction in U.S. government spending would lead, in the third year, to a reduction of $35 billion (with a standard deviation of $15 billion) in the current account deficit, some two-fifths as large as the average net reduction of $85 billion in the fiscal deficit.

To what extent is the improvement in the current account due to

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[15] Figure A-2 and Table A-2 in the appendix show the underlying data for the individual model simulations.

the induced change in the nominal exchange rate? Experiments conducted for the 1988 symposium of the Japanese Economic Planning Agency, discussed in Helliwell (1988c), ran government expenditure changes (assuming unchanged money growth) under both fixed and flexible exchange rates to permit this question to be answered. The results suggested that by far the largest part of the net improvement in the current account comes from the changes in domestic spending, prices and interest rates, and relatively little from the small change in the nominal exchange rate. Of course, changes in the nominal exchange rate would play a greater role in the net effects on the current account if the fiscal contraction took place in the context of an easier U.S. monetary policy, in which case the dollar would fall more and domestic demand less, as we will discuss further in section 6.

It is noteworthy that the "full-model" effects on the external deficit of an exogenous nominal depreciation of the dollar are considerably smaller than the effects that are predicted by partial-equilibrium models of the current account. For the three models assessed in the 1988 EPA symposium, a 10 percent exogenous depreciation of the dollar improved the U.S. current account by about $35 billion in the third year, according to the partial simulations, compared to only about $10 billion in the full-model simulations.[16] This evidence indicates how important it is, when evaluating the effects of exchange-rate changes, to take account of the induced changes in domestic incomes and prices, as is done in

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[16] See Helliwell (1988c), especially Figure 12.

the full-model but not the partial simulations.

What about the spillover effects of the U.S. fiscal contraction on other countries? Changes in actual and expected exchange rates, and in the prices and volumes of trade flows, are the main channels through which fiscal actions are transmitted to the rest of the world. The second page of Figure 2-1 shows the estimated effects of the U.S. expenditure reduction on the real output and the domestic price level of the aggregate region of the rest of the OECD (ROECD), of Japan, and of Germany. All of the models show reductions in foreign real GDP, although there is substantial diversity in the estimates, especially for later years. The reductions in foreign GDP lag behind those in the United States, and show, on average, their largest magnitude in the third year of the U.S. fiscal contraction (0.4 percent of GDP), while the U.S. real GDP effects peak in the second year. On average, the foreign GDP effects are about one-quarter as large as those in the United States, where both effects are measured as percentages of that country's or region's GDP. The effects on Japan are estimated to be, on average across the models, about twice as large as those in Germany and the aggregate of ROECD countries, reflecting Japan's proportionately greater reliance on export sales to U.S. markets.

All of the models predict that a U.S. fiscal contraction will lower the price level abroad relative to baseline -- and by growing amounts over the first four years.[17] Interest rates abroad tend to

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[17] The size of this price transmission is small in models such as GEM and OECD, and only modest in models such as MCM and TAYLOR. Much the largest effects, as for the own-country price effects in the United States, are predicted by MULTIMOD and INTERMOD.

fall, but by only a fraction of the fall in interest rates in the United States. In keeping with the overall depreciation in the dollar's exchange value, currencies such as the yen and DM strengthen against the dollar.

3. Effects of Changes in U.S. Monetary Policy

For the fiscal-policy simulations discussed in the preceding section, the models assumed that a key U.S. monetary aggregate (either M1 or M2) was held unchanged from its baseline path. In this section we review the evidence on the effects of raising the U.S. monetary aggregate above baseline by 1 percent throughout the simulation period. Targeted monetary aggregates in other countries were assumed to be held unchanged from baseline in the face of the U.S. monetary expansion.[18]

The own-country effects of the U.S. monetary expansion are summarized on the first page of Figure 3-1. The induced effects on real output and prices in the ROECD, Japan, and Germany are shown on the second page.

Theoretical models predict that a home-country monetary expansion will result, at least over the short run, in a fall in home interest rates and increases in both home output and the home price level. The own-country simulated effects of a U.S. monetary expansion in these empirical models accord with theoretical presumptions.

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[18] See the appendix for further discussion. In section 5 below we consider the differing implications of holding either M1 or M2 exogenous for simulations of monetary shocks, based on experiments with two of the three models used to prepare the simulations reported in that section.

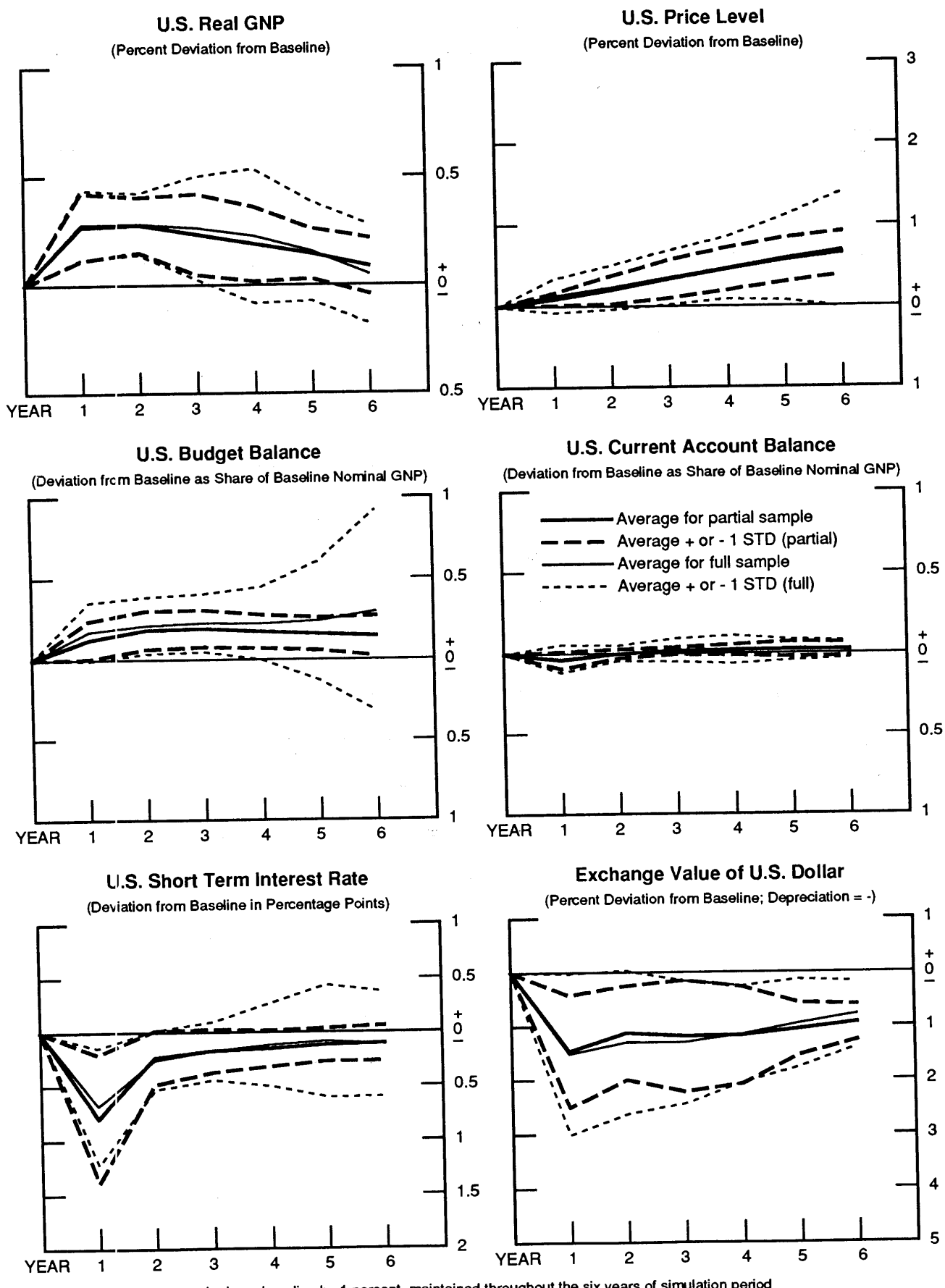
Interest rates tend to fall sharply immediately after the monetary expansion. The decline during the first year averages some 80 basis points, with a considerable range across models, generally reflecting differences in their estimates of the interest elasticity of money demand. On average, the nominal interest rates then gradually rise back towards their baseline values over the six-year simulation horizon.

In the first year U.S. real GNP rises above baseline by an average of 1/4 percent. This average increases slightly in the second year, and then gradually tends back toward zero over the following four years. The reversal starts earlier (after the first year) for models such as OECD, TAYLOR, and GEM, and later for the MCM (in the fourth year). The return of real GNP toward baseline in later years generally accords with the "long-run neutrality of money" assumption of many theoretical models. Most models have U.S. prices rising continuously through the simulation period. All of the models, as expected, simulate a depreciation in the nominal exchange value of the dollar in response to U.S. monetary expansion. They tend to exhibit overshooting, with the dollar dropping by an average of about 1.5 percent in the first year, and then climbing back up towards the expected long-run value about 1 percent below the baseline value, commensurate with the 1 percent increase in the money stock.

Expository theoretical models cannot predict unambiguously the effects on the own country's current balance. The higher home incomes and output tend to pull in more imports; thus the income-absorption effects of the monetary expansion work to worsen the

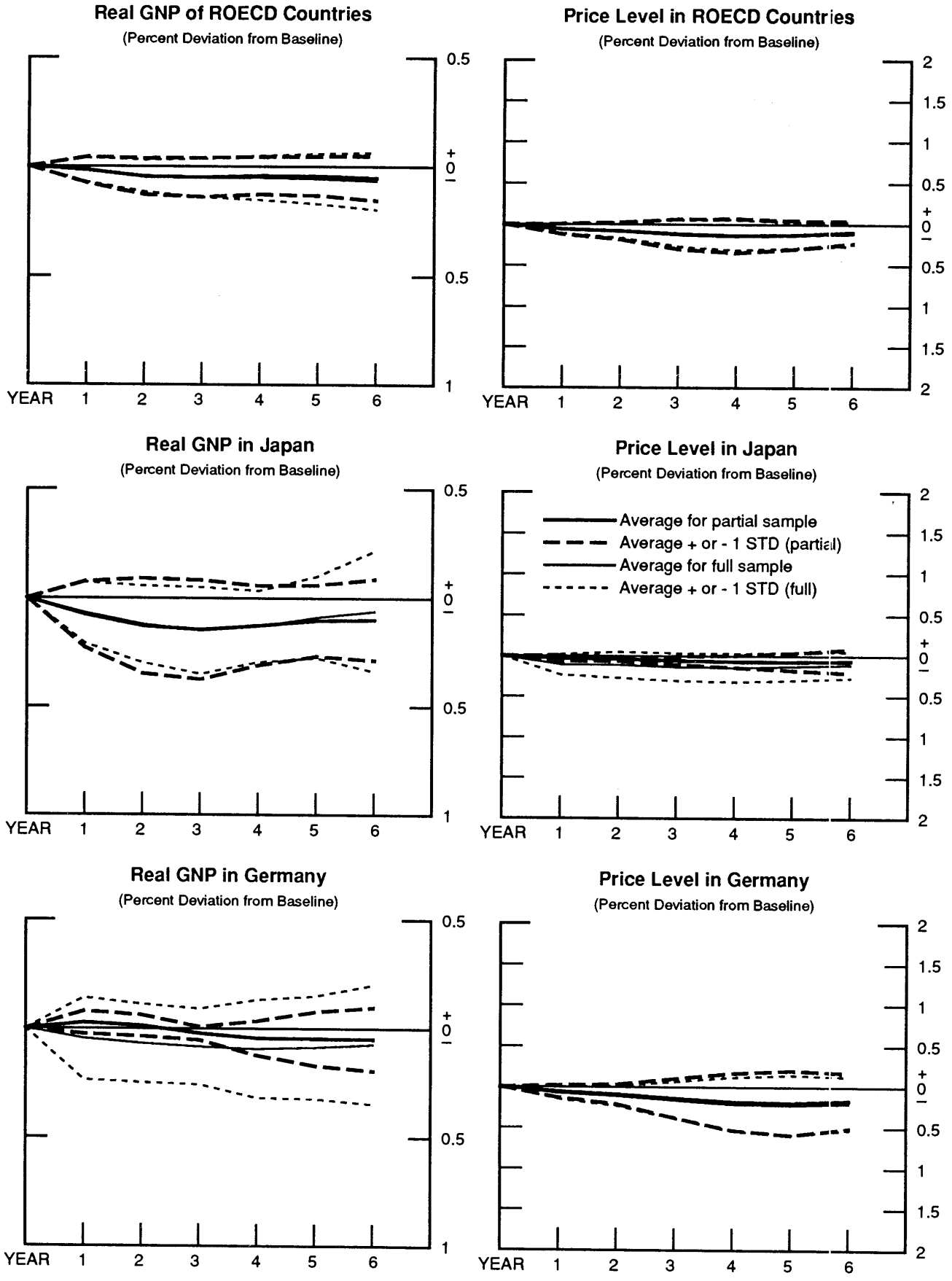
Figure 3-1

Averages of Simulated Effects for a U.S. Monetary Expansion*



* Increase of money stock above baseline by 1 percent, maintained throughout the six years of simulation period

Figure 3-1 (continued)



* Increase of money stock above baseline by 1 percent, maintained throughout the six years of simulation period.

trade and current balances. The expenditure-switching effects associated with the depreciation of the currency, in contrast, tend to improve the trade and current balances.[19] The empirical results in Figure 3-1 broadly confirm that the net effects of a U.S. monetary expansion on the U.S. nominal current account are small.

Spillover effects on foreign output also tend to be small. In about half the models the foreign real income effects are negative, exhibiting the 'beggar-thy-neighbour' property of monetary expansion in the Mundell-Fleming model with perfect capital mobility and static exchange-rate expectations. Other models show some small positive effects, which can arise in more general models. Averaged across the models, the effects on foreign income are slightly negative.[20]

An unexpected U.S. monetary expansion would have adverse effects on the long-run value of foreigners' wealth. The long-run increase in the U.S. price level and the long-run drop in the nominal foreign

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[19] In the initial versions of the standard Mundell-Fleming theoretical model, the second of these effects necessarily had to dominate the first, leading to an improvement of the current balance. When expository theoretical models are enriched with additional behavioral assumptions (for example, allowing for non-static expectations of exchange rates), however, the models can generate either a net capital inflow or outflow (and hence either an improvement or deterioration in the current balance). For further discussion, see Frankel (1988).

[20] Jeffrey Frankel has cited (in, e.g., Frankel and Rockett 1988) the uncertain sign of the effects of monetary policy on the current account, and on foreign output, to buttress his view that model uncertainty is a major obstacle to international policy coordination. As can be seen in Figure 3-1, and in Figure A-4 and Table A-4 in the appendix, the variation in sign of the net effects is less noteworthy than the fact that the absolute sizes of the net effects, whatever the sign, tend to be small.

exchange value of the dollar would combine to impose a capital loss (valued in foreign currencies) on that portion of foreigners' net wealth held in the form of dollar-denominated bonds. The offsetting gains would accrue to those who are net debtors in U.S. dollars.[21]

4. Alternative Treatments of Expectations

In the preceding sections, we did not distinguish results from models with adaptive and model-consistent expectations. In this section, we include some evidence about the extent to which alternative ways of modelling expectations influence the size and timing of the estimated responses to changes in fiscal and monetary policies. Two issues are of primary concern: the extent to which model results are influenced by the use of model-consistent rather than adaptive expectations, and the extent to which the consequences of future policy actions are altered when the policy changes are credibly announced and correctly anticipated.

Expectations that are forward-looking and model-consistent, in contrast to adaptive expectations, take into account the future effects of policy changes. Forward-looking expectations thereby tend to reduce the impacts of temporary policies and to accelerate the responses to sustained policy changes. If policy changes are announced in advance, and if the announcements are treated as firm commitments, then anticipated future policies can influence current

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[21] Such valuation effects are absent in most of the existing empirical models. In the shorter run, foreign holders of dollar-denominated bonds could experience capital gains resulting from lower interest rates on dollar assets. The net short-run effects on the foreign-currency valuation of foreigners' wealth are uncertain.

market prices and current spending, in a way not captured by models without explicit forward-looking expectations. Such anticipatory effects may have the opposite sign to the direct effects of the policy when it is finally implemented. For example, the multiplier effects of tax increases or cuts in government spending do not generally happen until the expenditure change is actually implemented; in contrast, the expenditure-increasing effects of exchange-rate depreciation, lower interest rates, and anticipated lower prices, which occur immediately after a credible announcement, feed back to induce some additional expenditures before the tax or government spending changes are implemented.

To illustrate the nature and possible size of these effects, Figure 4-1 shows the consequences of a reduction in U.S. government purchases of goods and services of the same size as that analysed in section 2. Each panel of Figure 4-1 shows three simulated results, based on three different runs of INTERMOD. By means of these experiments, which corroborate the earlier MINIMOD results of Haas and Masson (1986), we can illustrate (in the context of this specific model) the differences between adaptive and model-consistent treatments of expectations. To show the potential importance of anticipatory effects, we use two different expectational assumptions in the consistent-expectations version of the model. These alternative assumptions relate to whether the policy change is anticipated before the spending change actually takes place. In all cases, the spending cut, once implemented, is taken to be permanent, and to influence private-sector expectations about the long-run share of government spending in the economy, and

Figure 4-1

Simulated Effects for a U.S. Fiscal Contraction with Alternative Treatments of Expectations

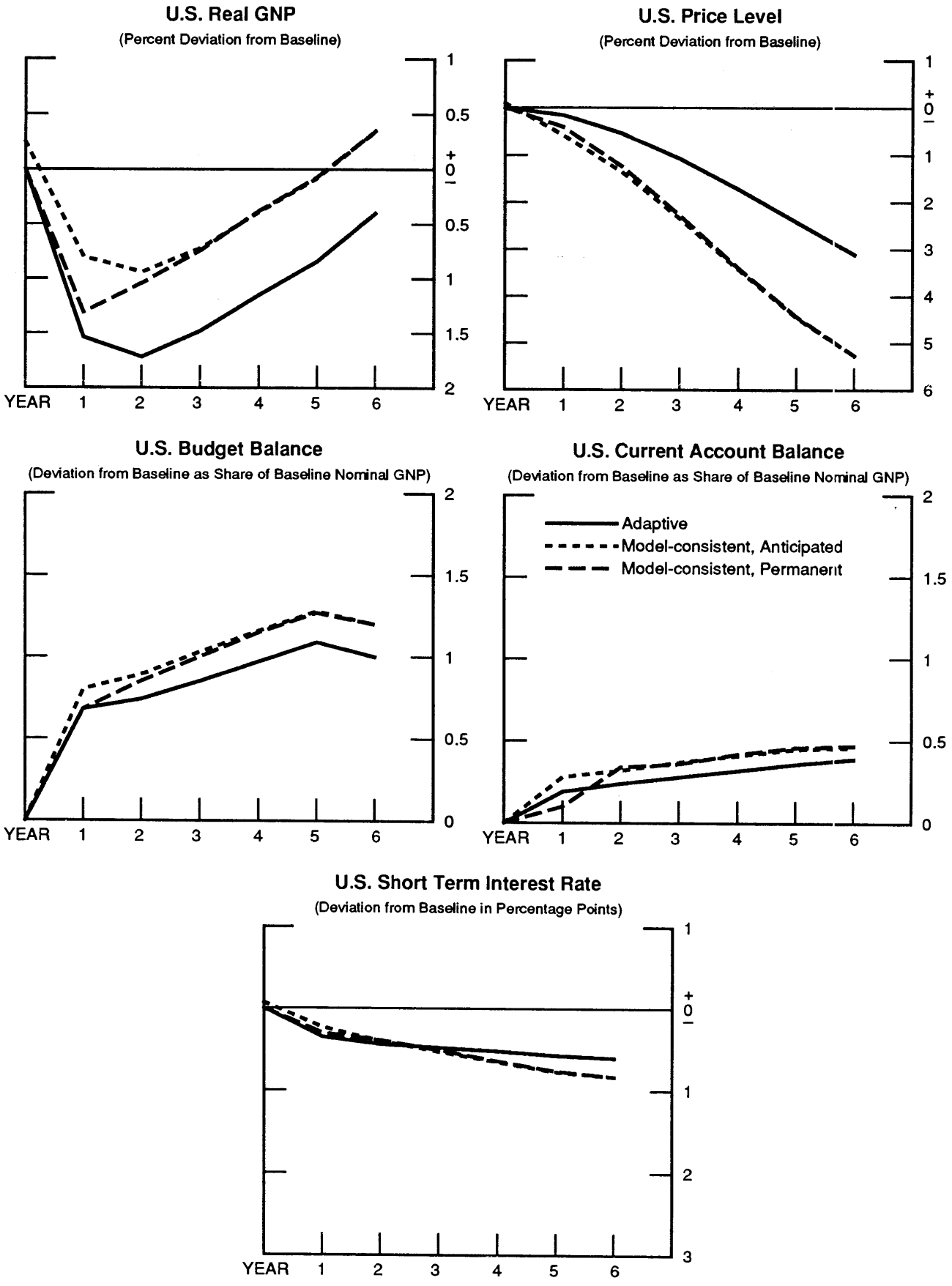
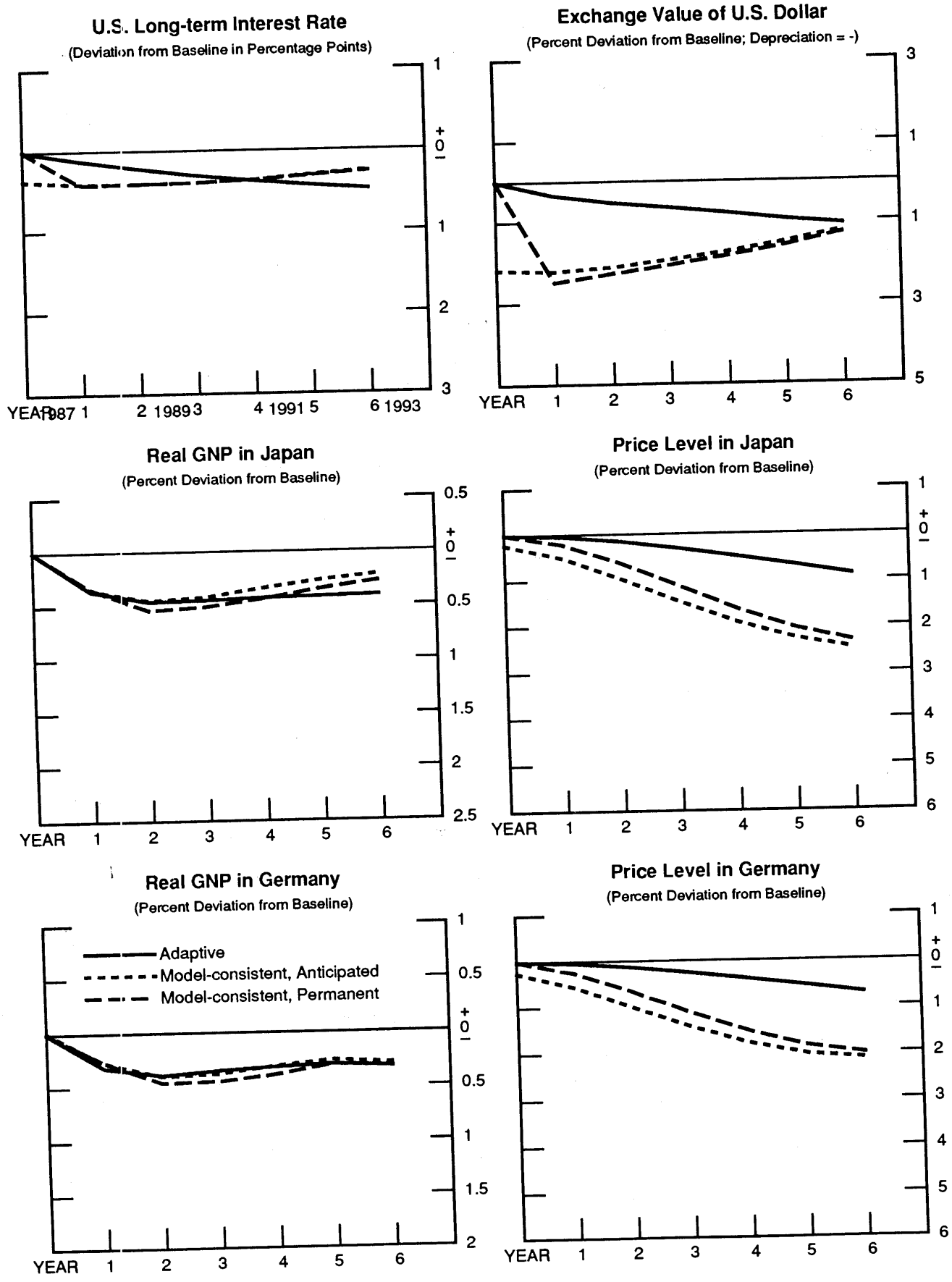


Figure 4-1 (continued)



hence the long-run expected tax rate.[22]

In all three simulations, U.S. government spending is reduced (by an amount equal to 1 percent of real GNP) in year 1, and maintained lower on a permanent basis. In the adaptive-expectations simulation (shown in the figure with a solid line), no change is made to the long-run expected share of government spending as a share of GNP. In the other two cases this ratio is reduced by 1 percent. In one of the consistent-expectations cases (shown with a dashed line and labelled 'permanent'), the spending change is announced and implemented in year 1 (1989 in the simulations). In the other consistent-expectations case (shown with a dotted line and labelled 'anticipated'), the change is implemented in year 1, but announced a year earlier, and thus can influence year 0 prices, interest rates, exchange rates, and activity levels.

As with most other consistent-expectations models with high international mobility of capital, INTERMOD shows an immediate "jump" depreciation of the dollar in response to a government expenditure cut, as soon as the cut is announced. The adaptive-expectations simulation also shows depreciation, but the process is slow-starting and gradual. The consistent-expectations simulations, by contrast, show sharp movements that are subsequently reversed to ensure expected future maintenance of the interest parity condition.

There is a parallel difference between the adaptive and consistent-expectations simulations with respect to long-term

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[22] In INTERMOD, tax rates are endogenous in the long run, moving so as to achieve an exogenously determined target ratio of nominal government debt to nominal GNP.

interest rates. In the adaptive simulation, changes in long-term interest rates, which provide the key link between monetary conditions and real spending, lag behind changes in short-term interest rates. In the consistent-expectations simulations, by contrast, long-term rates move down immediately, falling in the first year by several times as much as in the adaptive-expectations version, thus accelerating the crowding in of private investment and consumption spending.

The sharp jumps in long-term interest rates and exchange rates in the consistent-expectations simulations stimulate real demand for domestic output, and hence lower the fiscal multiplier. The peak multiplier appears in the second year in the adaptive results, and is about 30 percent greater than the earlier-appearing peak multiplier for the unanticipated permanent expenditure cut with consistent expectations.

Another important feature of these INTERMOD simulations, which confirm the earlier work of Masson and Blundell-Wignall (1985) and of Haas and Masson (1986), relates to the difference between the consistent-expectations results for anticipated and unanticipated expenditure changes. In year 0, before the policy action is implemented, the anticipated future spending cut lowers the value of the dollar, and leads to an increase in real GNP. Lagged effects of the anticipatory crowding-in of spending spill over into years 1 and 2. Thus the peak multiplier effect is one year later (appearing in year 2) and one-third smaller in the anticipated case than in the unanticipated case.

The importance of this result is that a series of credibly

announced fiscal actions can achieve reductions in the budget deficit with a considerably smaller loss of real output than would be estimated with adaptive expectations, or even with consistent expectations in the absence of the anticipatory effects. For example, under adaptive expectations, the spending cut is estimated to reduce real GNP by an average of 1 percent over the seven years (year 0 through year 6), three times the average reduction in GNP (1/3 of 1 percent) when the cut is announced in year zero and correctly anticipated to be permanent. The cumulative reduction in U.S. government debt, at the end of year 6, is some $320 billion under adaptive expectations and $375 billion in the anticipated case. In terms of cumulative output loss per dollar of debt reduction, over the period 1989-1994, the anticipated case is thus less than one-third as painful as the adaptive case.[23]

These INTERMOD results for the adaptive and permanent cases support the conjecture made on the basis of the earlier EMIE comparisons, where models with consistent expectations on average

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[23] The simulation results summarized in the text were prepared with the same version of INTERMOD for which results were reported in sections 2 and 3. The use of monetary-policy reaction functions, combined with the high coefficients on the lagged dependent variables in the INTERMOD and MULTIMOD demand-for-money equations, gives those models unusually small interest-rate responses to expenditure shocks, as shown in the Appendix tables. The INTERMOD modeling group has since estimated a U.S. monetary sector with more conventional properties, having short-run and long-run increases of 72 and 53 basis points in response to a 1 percent increase in GNP, about the middle of the range of the LM curve properties surveyed by Helliwell, Cockerline and Lafrance (1988, Table 3.1). When this alternative version of the financial sector is incorporated in the U.S. block of INTERMOD, the simulated money supply is held very close to the baseline path, thereby leading to larger interest-rate decreases in response to cuts in expenditures. The alternative version of INTERMOD thus exhibits more crowding-in for both the adaptive and the model-consistent treatments of expectations.

had lower fiscal multipliers than did models with adaptive expectations.[24]

Consistent-expectations models differ with respect to which variables are treated as explicitly forward-looking in model simulations. In most of these models, economic agents are assumed to form explicit expectations about future values of inflation, the term structure of interest rates, and exchange rates. In addition, the TAYLOR model uses explicit forward-looking expectations of income in its investment, consumption, and wage equations. The MULTIMOD/INTERMOD consumption function is forward-looking, but permanent wealth is currently not varied when simulations are run.

Thus the INTERMOD results, shown in Figure 4-1, about the effects of different treatments of expectations would not necessarily be replicated by other models with consistent expectations, and should be subjected to further tests with alternative model structures.

There is evidence from a number of other models about the effects of anticipated future policy changes. Taylor (1988) reports the results of anticipated monetary expansions in four rational-

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[24] However, as Dungan and Wilson (1988) point out, the lower multipliers observed in these models may reflect other differences in model structure, and not just their treatment of expectations. Dungan and Wilson find higher fiscal multipliers under model-consistent than under adaptive expectations. The most likely reason for this finding lies in the fact that their FOCUS model shows an appreciation of the domestic currency in response to fiscal contraction, while the other models, with flatter BP curves, show depreciation. The application of consistent expectations brings forward the induced effects of these exchange rate changes, thus raising the multiplier effects for Dungan and Wilson and lowering them in other models. Most of the multicountry empirical models embody specifications or assumptions leading to relatively mobile capital, and are thus likely to fall into this latter category.

expectations models, all of which show positive income and price effects after the policy is announced but prior to its implementation. Anticipatory effects of fiscal policies, by contrast, tend to have income effects that are of opposite sign to the effects that arise when the actual policy change is implemented. Such effects can be substantial, as shown in Figure 4-1. Masson and Blundell-Wignall (1985, p. 23) also show own-country real GNP effects, in the anticipatory year 0, that are about one-third as large as, and of the opposite sign to, the effects in year 1. McKibbin (1988) reports recent experiments from the MSG2 model showing that real output effects in the year of expenditure-policy anticipation can be one-half or more as large as the effects in the first year when the spending change is implemented. These fiscal policy results suggest that the anticipation of future expenditure cuts helps to reduce the income losses that are entailed as the economy adjusts to a lower level of government spending.

5. Alternative U.S. Fiscal Actions

The simulations of fiscal actions analyzed in earlier model-comparison exercises and reviewed in sections 2 and 4 involve changes in government purchases. In this section we present some new evidence on a broader range of fiscal actions, including not only changes in federal purchases but also transfers, personal taxes, corporate taxes and federal sales (or excise) taxes.[25]

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[25] Surprisingly little empirical analysis of the comparative macroeconomic effects of these alternative fiscal actions exist in the literature. Coen and Hickman (1984) considered the effects of alternative tax policies in simulations with the Hickman-Coen model, Fair (1984) presents simulations of a number of different fiscal

Our analysis is based on simulations carried out with the DRI, MPS, and MCM models. These models contain sufficiently detailed specifications of the U.S. economy to permit them to distinguish, at least to some degree, among the alternative fiscal policy shocks.[26]

All three models have basic Keynesian (IS-LM) structures, and also contain significant supply-side linkages. Changes in taxes and transfers directly affect household and corporate incomes and spending. Shifts in corporate and personal tax rates also affect the user costs of capital for both business investment and housing. Labor supply is a function of the after-tax real wage in the DRI model (although with a very small coefficient), but not in the MPS or MCM models.[27] The DRI and MPS models distinguish between

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policy measures with the Fair model, Hickman, Huntington, and Sweeney (1987) surveyed a number of U.S. models to assess the effects of alternative tax policies in the face of an oil price shock, and both Christ (1974) and Fromm and Klein (1973) provided evidence on the comparative effects of change in government expenditures and personal taxes, based on simulations with a group of U.S. models. More recently, in a report to the National Economic Commission, CBO (1988) surveyed what three U.S. models (the DRI model, the Fair model, and the Washington University model) had to say about the effects of deficit reduction packages that contained different mixes of cuts in purchases and transfers and increases in taxes.

[26] The DRI and MPS models are large U.S. models that also contain reduced-form relationships for key foreign macro variables. (The DRI U.S. model used here is essentially the same as the U.S. sector in DRI's international model that was used in the EMIE exercises.) The MCM is a "global" model that contains medium-sized models of the U.S. economy and four other major countries, plus reduced-form relationships for the rest of the world. For bibliographic references on the models, see the appendix.

[27] This omission in the MCM and MPS models may not be significant, given that a reduction in after-tax wage rates and income associated with an increase in personal taxes will have offsetting effects on labor supply: on the one hand, a "substitution effect" -- reduced willingness to work for lower after-tax income -- and, on the other hand, an "income effect" -- an increase in work effort in order to maintain income levels. A substantial body of

households and corporations, and between federal and state and local governments. The MCM does not make these distinctions within the private and government sectors, treating each as a composite sector. All three models treat expectations adaptively.

The simulations of the five types of fiscal actions were run over a six-year horizon, beginning in 1988Q1 and ending in 1993Q4, and making use of reasonably comparable baseline assumptions.[28] The simulations were standardized to produce an initial impact on the budget deficit (i.e., before taking into account endogenous feedbacks to revenues, interest payments and other transfers) equal to 1 percent of baseline nominal GNP in 1988Q1, or $47 billion (at an annual rate). In each of the simulations the shock to expenditures or revenues was essentially tied to nominal GNP, so that the dollar amount of the shock increased gradually over time.[29]

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empirical evidence on this question suggests that while both effects may be significant, neither is dominant, and that the net effect is probably small; see Burtless (1987).

[28] The MPS simulations were run over the period from 1988Q1 to 1992Q4. The key features of the baseline solution are: (a) U.S. real GNP grows at an average annual rate of 2.5% during 1988-93, (b) unemployment stays about unchanged from its average level in the first half of 1988, (c) inflation remains in the neighborhood of 4%, (d) real federal expenditures grow at 1 to 2 percent per year, (e) interest rates remain about unchanged from their 1988H1 levels, and (f) the dollar remains little changed to down moderately over the baseline period.

[29] For the purchases and transfer shocks, the "exogenous" increase in constant-dollar expenditures over time was tied to the baseline level of constant-dollar GNP; in the tax-rate shocks, the "exogenous" increase in nominal revenues over time was tied to the simulated level of nominal GNP. While the shocks were designed to be equivalent in the absence of feedbacks to GNP (assuming that revenues and expenditures use the same price deflator), they are not strictly equivalent when simulated real GNP deviates from its baseline path. The magnitude of this discrepancy is small, however, as real GNP generally falls only temporarily, and at most by only about 2 percent below baseline (implying that the tax shocks are at

For each of the five simulations, the modeling groups kept the U.S. money supply (either M1 or M2) unchanged from its baseline path. The DRI results were reported with M1 held exogenous and the MCM and MPS results were reported with M2 exogenous. Alternative choices for the definition of unchanged monetary policy have important implications for the simulation results, as discussed in more detail at the end of this section. In the DRI and MPS models, changes in foreign interest rates were tied to changes in U.S. interest rates. In the MCM, key foreign monetary aggregates were held exogenous (except in the case of Canada, where interest rates were tied to U.S. interest rates).

The specific simulations were:

1. Real federal purchases of goods and services were reduced below their baseline path throughout the six-year simulation period by an amount equal to 1 percent of baseline real GNP (equivalent to a 12.0 percent reduction in real federal purchases of goods and services in 1988Q1).

2. Real federal transfer payments to persons (social security, etc.) were reduced below their baseline path for all six years by an amount equal to 1 percent of baseline real GNP, or 11.2 percent of real federal transfers to persons in 1988Q1.

3. The average federal personal income tax rate was raised by enough to increase revenues exogenously by 1 percent of baseline nominal GNP (or 11.9 percent of personal income tax revenues) in 1988Q1. The tax rate was then kept at that higher level for the entire simulation period.[30]

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most 2 percent "smaller" than the spending shocks). Some shocks were run on a smaller scale (to produce 0.5% of GNP), with the results doubled for reporting here.

[30] The DRI and MPS models include a total federal personal tax revenue equation, with an average personal tax rate that was shifted by enough to achieve the required increase in revenues at baseline levels of personal income. The MCM identifies total personal tax revenues (federal plus state and local) as a function of an average personal tax parameter times nominal GNP; that parameter was shifted

4. The average federal corporate profits tax rate was raised by enough to increase revenues by 1 percent of baseline nominal GNP (or 44 percent of corporate tax revenues) in 1988Q1, and then maintained unchanged thereafter.[31]

5. The federal sales tax rate (i.e., indirect business tax or excise tax on domestic consumption expenditures, including liquor, tobacco, etc.) was raised by enough to increase revenues exogenously by 1 percent of baseline nominal GNP (146 percent of excise tax revenues) in 1988Q1.[32]

Figure 5-1 shows the simulated impacts of the five types of fiscal actions on the levels of U.S. real GNP, consumer prices, personal consumption expenditures, business fixed investment, short-term interest rates and the budget balance as a share of baseline nominal GNP. Each panel of Figure 5-1 reports an average of the effects across the three models. Details of the individual models' simulated impacts on real GNP and consumer prices are shown in Figure 5-2. In both figures, all the results are presented in terms of deviations from baseline paths.

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by enough to achieve the requisite increase in baseline revenues.

[31] This tax refers to the tax on corporate profits excluding Federal Reserve banks. The shock was implemented by shifting average corporate tax rate parameters in the models, much the same as in the personal tax simulation. These parameters also enter directly into the determination of the user cost of capital in all three models.

[32] This shock was implemented in the DRI and MPS models by raising the indirect business tax (or excise tax) parameter in the federal revenue sector. In addition, in the DRI model the residuals in all personal consumption deflator equations were raised by 1 percent of the dependent variable times the ratio of baseline GNP to total personal consumption expenditures. (In the MPS model a shift in the federal excise tax rate is passed through directly into higher consumption deflators.) In the MCM, the tax was treated as a combination of a lump-sum increase in tax revenues equal to 1 percent of baseline GNP, and an increase in the residual in the equation for the total domestic expenditure deflator enough to raise the deflator by 1 percent. Thus, in all three cases, the tax was assumed to be passed through fully and immediately to consumers.

The three-model average results for real GNP (Figure 5-1) indicate that all of the fiscal actions produce the familiar pattern of initial decline for about 2 years, followed by a rebound as domestic expenditures and net exports are "crowded in", due to lower interest rates, domestic prices, and (in most cases) dollar depreciation. For each of these actions output returns towards, and in four out of five cases rises above, its baseline level, reflecting a tendency of the models to cycle about the baseline path in the longer run.[33] Nevertheless, significant differences in the effects of the various shocks are evident.

The shift in government purchases has a somewhat greater initial negative impact on real GNP than shifts in taxes and transfers, consistent with the predictions of standard textbook multiplier analysis. A change in corporate taxes has smaller initial impacts than a change in either personal income taxes or sales taxes, and about half the first-year impact of a comparably scaled shift in federal purchases. The marginal propensity of the private sector to spend corporate profits is smaller and has longer lags than the marginal propensity to spend labor income or transfers.

By major domestic expenditure category, personal disposable income and consumption are initially more than twice as sensitive to transfers and personal taxes as they are to federal purchases and

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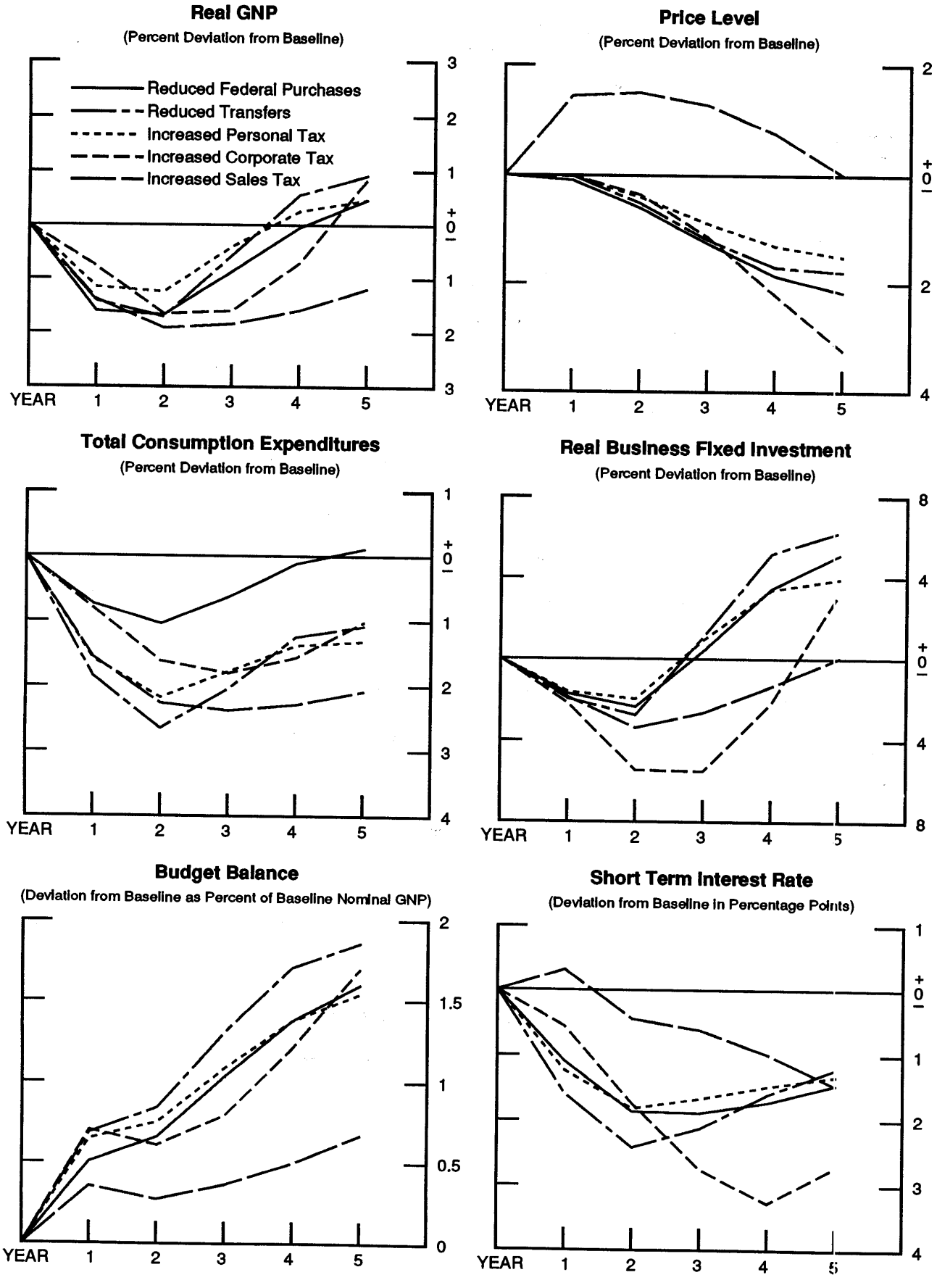
[33] Cycling of output arises because interest rates respond quickly to changes in money demand, whereas output (which, in turn, affects money demand) responds slowly to changes in interest rates. This cycling behavior is discussed in detail by Anderson and Enzler (1987), Brayton and Mauskopf (1985), and Enzler and Johnson (1981).

Figure 5-1

Effects of Alternative U.S. Fiscal Policies on Key U.S. Variables : Based on Averages of DRI, MCM and MPS Simulations



corporate taxes, while their sensitivity to a sales tax is intermediate. The range of initial impacts on business fixed investment is somewhat narrower in the near term, with corporate taxes having the largest negative impact and personal taxes the smallest.

Beyond the first year, the increases in sales taxes and corporate taxes result in larger average losses in output over the simulation period than the other fiscal actions. The increase in the sales tax results in much less crowding in of domestic expenditures and net exports than the other simulations in the longer run because it has direct positive impacts on the level of domestic prices and money demand, and, hence, on interest rates and the dollar's exchange rate.[34] The increase in the corporate income tax rate has a more prolonged negative impact on output (and especially on investment) than the personal tax increase or either of the expenditure cuts, because it raises the user cost of capital much more (or reduces it much less) than these other measures do. "Supply-side" effects are thus more significant in the corporate tax case; the greater reduction in business fixed investment results in greater reductions in the capital stock and potential output.[35]

The cut in transfers and the increase in personal taxes, both of

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[34] The CBO (1988) report also found that in two out of the three models they surveyed (including the DRI model) excise taxes had relatively strong contractionary effects.

[35] The finding that corporate taxes tend to depress output more than personal taxes (because of their relatively greater negative "supply-side" effects) is consistent with the results of Coen and Hickman (1984), as well as with the implications of a substantial body of empirical analysis in public finance. (See Boskin (1988) for a recent survey of some of this literature.)

which have relatively large negative effects on consumption and relatively small negative effects on investment, result in smaller average losses in total output than the other measures.[36] Negative supply-side effects are apparently less important in these cases. The cut in federal purchases results in a noticeably greater loss in output than the increase in personal taxes over much of the simulation period, consistent with the predictions of static multiplier analysis.[37]

These average results mask some significant differences among the individual models (see Figure 5-2). In general, the differences across policy actions tend to be greater in the DRI and MPS models, whose U.S. sectors are specified in more detail, than in the MCM. One notable point of disagreement about near-term (first-year) effects concerns the relative position of the cut in transfers. In the MPS model (unlike the other two models), the first-year impact on real GNP of the cut in transfers is somewhat greater than that of

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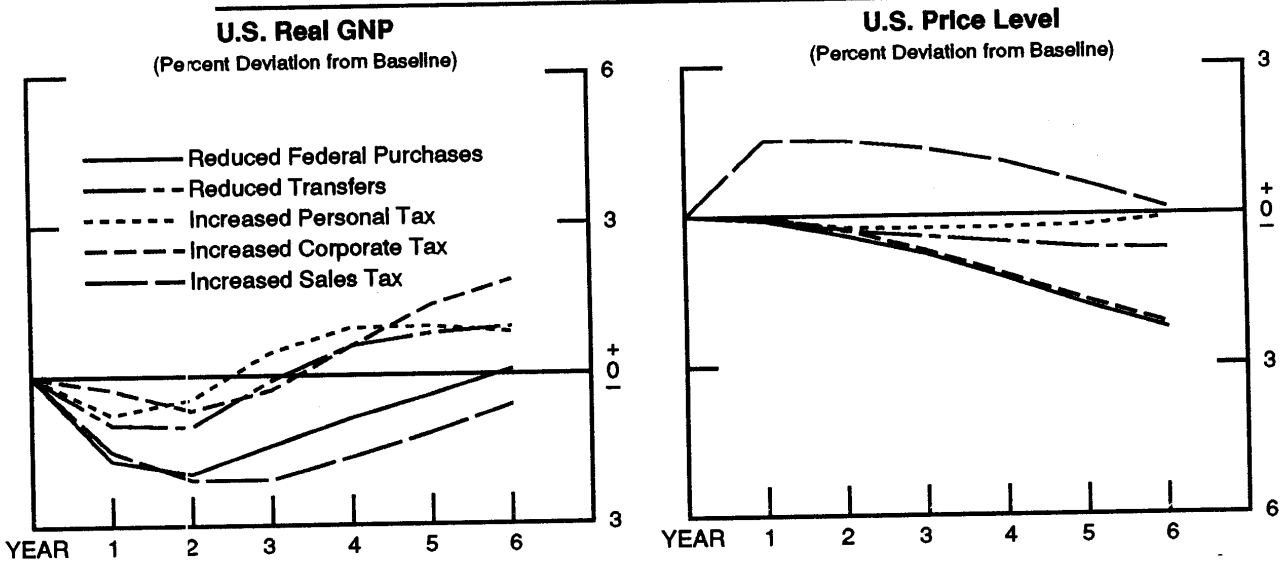
[36] The CBO (1988) report, too, found that cuts in transfers involved noticeably smaller negative impact on output than cuts in federal purchases.

[37] The comparison of the results for reduced purchases and increased personal taxes actually indicates a balanced-budget multiplier that is somewhat less than the 1.0 predicted by simple Keynesian multiplier analysis. (A balanced-budget multiplier of 1.0, at least in the near term, appears to have been supported by simulations with the DRI, MPS, and several other models, in an earlier model comparison exercise; see Fromm and Klein (1973).) The balanced-budget multiplier will be less than unity, and will decline over time, to the extent that the tax and spending shocks induce comparable crowding-in effects through lower interest rates, prices and exchange rates, as well as to the extent that the tax increase depresses labor participation rates (which it does to a small extent in the DRI results). The crowding-in effects of the DRI and MPS models appear to be more pronounced than they were in the earlier model-comparison exercises. See Fromm and Klein (1973), Christ (1975), Hickman and Huntington (1987), and Blinder (1984).

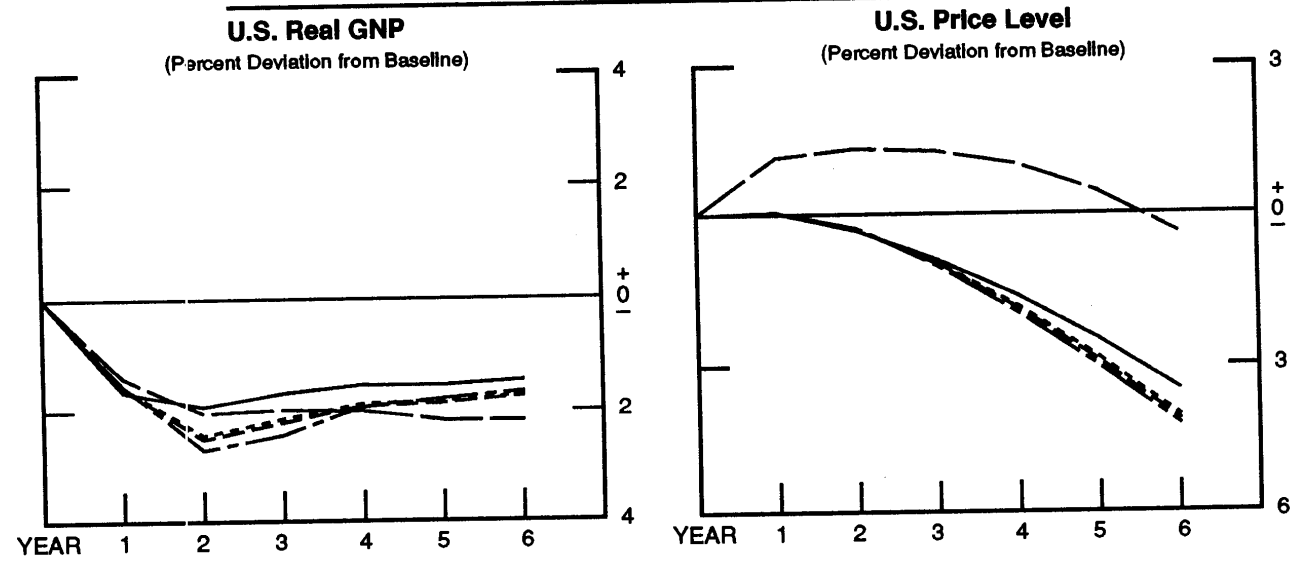
Figure 5-2

Effects of Alternative U.S. Fiscal Policies on U.S. GNP and Prices : Effects for the Individual Models

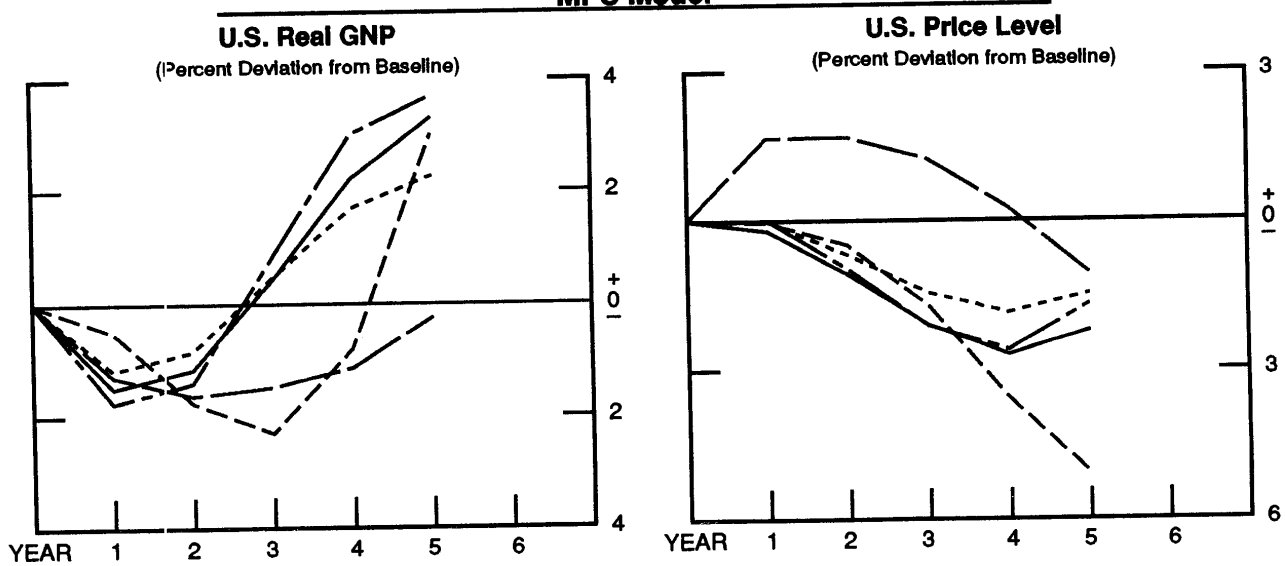
DRI Model



MCM Model



MPS Model



the cut in purchases. The MPS model expresses consumption as a function of different sources of personal income, and has a marginal propensity to consume out of transfer income that is close to one (0.94). The DRI model, which does not distinguish among alternative sources of income in determining consumption, finds reduced transfers to have a substantially smaller impact on GNP than reduced purchases.[38]

With respect to longer-term effects, all three models show relatively weak crowding-in effects for the sales tax, and the DRI and MPS models agree that the crowding-in effects of shifts in transfers and personal taxes are relatively strong. However, the MCM generally shows much weaker crowding in than the other two models for all types of fiscal action, due to a lower sensitivity of domestic expenditures to interest rates and an absence of most of the private wealth effects present in the other two models.[39] The MPS model shows stronger crowding in than the DRI model, partly because the level of prices, and therefore private wealth and consumption, appear to be more sensitive to changes in aggregate

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[38] Figure 5-2 shows annual averages of quarterly impacts; in the first quarter of the simulation, all three models show noticeably larger negative impacts resulting from the reduction in purchases than from the other shocks. Even in the MPS case there is some lag in the response of consumption to transfer income.

[39] In the MPS and DRI models, lower prices raise the real value of the private sector's net holdings of bonds, while lower interest rates also lead to higher corporate stock prices. (In the MPS model lower interest rates also raise the real value of net private bond holdings.) These effects on private wealth are largely missing in the MCM. As can be seen in appendix table A-1, the version of the MCM model used to prepare the EMIE simulations exhibited considerably stronger crowding-in behavior than the re-estimated version used for the new simulations reported here.

demand in the MPS model, and partly because of the difference in monetary assumptions under which the two models were run. Both models have a lower interest elasticity of demand for M2 than for M1, which means that interest rates fall more (and crowd in more) for a fiscal contraction with M2 exogenous.[40]

Even correcting for differences in monetary-policy assumptions, the DRI and MPS models appear to disagree about the effects of the corporate tax action on real GNP. Business fixed investment is apparently considerably more sensitive to shifts in the user cost of capital, and with a longer lag, in the MPS model than in the DRI model. Thus, the MPS model predicts a considerably lower path for output in the corporate-tax simulation than the DRI model over most of the period shown.

All three models agree that an increase in sales taxes would raise the U.S. price level above baseline for most of the simulation period, reflecting the assumption the models have in common that the tax would be passed on fully to consumers. The other four types of fiscal actions would reduce prices relative to baseline. The DRI and MPS models both suggest that an increase in personal taxes and cuts in transfers would have smaller negative effects on prices than an increase in corporate taxes and a reduction in purchases.

On a three-model average basis, the different fiscal measures show qualitatively similar patterns of change in the federal budget

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[40] The DRI model initially attempted to hold M2 growth exogenous for these shocks, but apparently found interest rates to be substantially more unstable and crowding in to be substantially more severe than even in the MPS results. The interest elasticity of demand for M2 is effectively very low in the DRI model.

over time (bottom left panel of Figure 5-1), but they have quite different implications for the absolute magnitude of reduction in the budget deficit. All of the simulations show an initial fall in the deficit in the first year, followed by a partial reversal in the second year as lower income temporarily reduces tax revenue and raises transfer payments; then the deficit falls further in the longer run, as income turns around and begins to rise.[41] Throughout the simulations, the ex-post effects on the budget of shifts in transfers are somewhat larger than for the other fiscal actions. The deficit-reducing effects of higher sales taxes are generally less than half as large as for the other actions.

The relative sizes of the effects of these actions on the budget balance can be traced to their impacts on real GNP, interest rates and prices. The sales tax reduces the budget deficit by a smaller amount than the other actions, for example, because it produces the largest decline in real income (which depresses revenues and raises transfer payments), the smallest decline in interest rates (which reduces interest payments on the national debt), and the largest increase in prices (which raises the absolute level of nominal expenditures more than it does the absolute level of revenues).[42]

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[41] In addition, because of the way the simulations were designed, the "exogenous" component of the improvement in the budget deficit increases over time, essentially in proportion to increases in the level of baseline nominal GNP.

[42] The effects of price increases follow from the fact that expenditures exceed revenues by a substantial margin in the baseline and from the assumption in the simulations that the exogenous component of expenditures is held fixed in real terms.

Two of the three models generating these simulations were not designed to focus on international effects in any detail. We nonetheless show in Figure 5-3 the three-model average effects for the U.S. current account balance, the exchange value of the U.S. dollar against the currencies of other industrial countries (in terms of foreign currency per dollar), and for the real output, consumer prices and interest rates of a weighted average of other industrial countries.

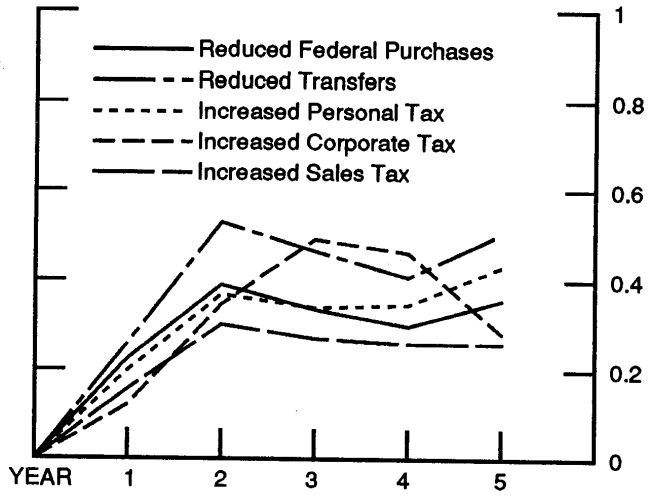
The U.S. current account improves in all cases, although the magnitude of improvement varies widely across the alternative fiscal actions, and is generally much smaller than the improvement in the federal budget balance. Factors tending to improve the current account balance include reduced income (hence lower demand for imports), reduced interest rates (hence lower investment income payments to foreigners), and, in several cases, a lower dollar and lower domestic prices (hence increased U.S. price competitiveness). The relative ordering of the current account effects across the fiscal actions can be traced primarily to movements in real exchange rates and interest rates. The personal tax and transfer shifts produce greater real depreciations of the dollar and greater improvements in the current account balance, while the sales tax results in a real appreciation of the dollar (for reasons discussed below), little decline in interest rates and a smaller improvement in the current account. The ordering of the current account impacts cannot be traced to movements in U.S. real GNP, which appear to be working in the opposite direction to what might be expected. (Relatively low output and import demand in the case

Figure 5-3

Effects of Alternative U.S. Fiscal Policies on Key International Variables : Based on Averages of DRI, MCM, and MPS Simulations

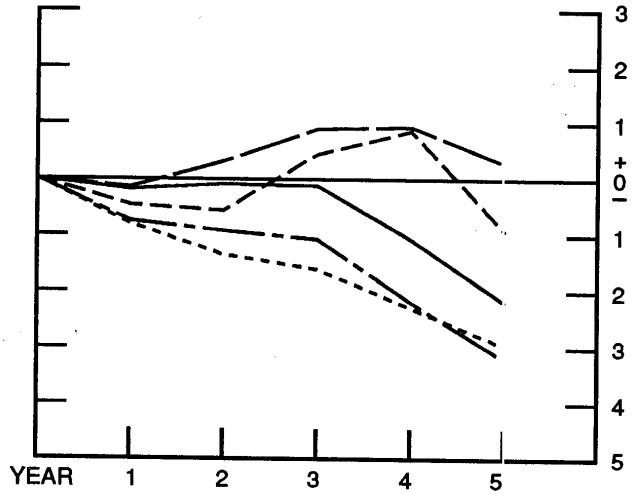
U.S. Current Account Balance

(Deviation from Baseline as Percent of Baseline Nominal GNP)



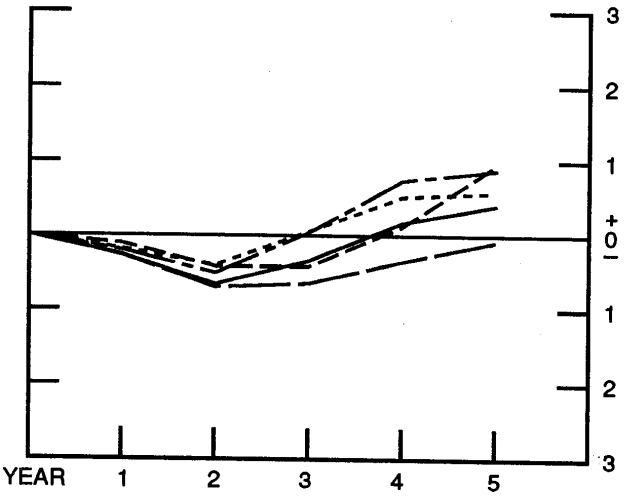
Exchange Value of U.S. Dollar [1]

(Percent Deviation from Baseline)



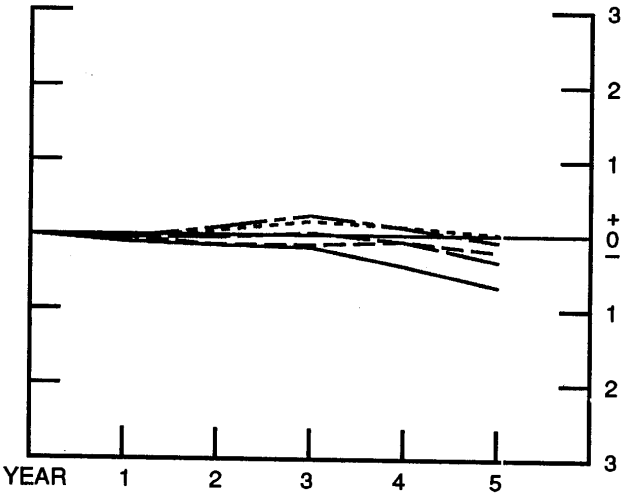
Foreign Real GNP [2]

(Percent Deviation from Baseline)



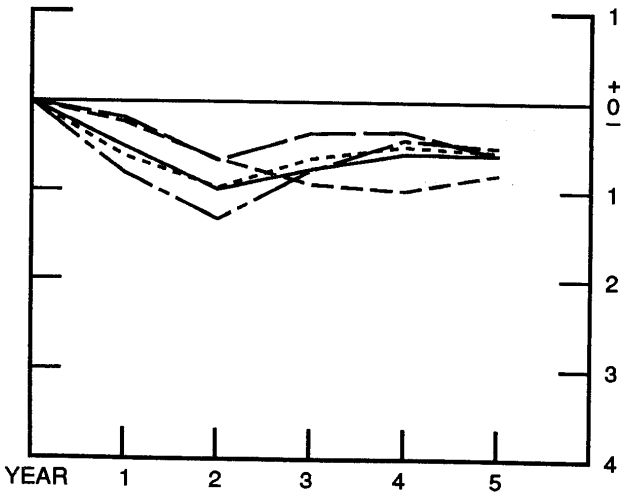
Foreign Price Level [2]

(Percent Deviation from Baseline)



Foreign Interest Rate [2,3]

(Deviation from Baseline in Percentage Points)



1. Foreign currency per dollar.
2. Weighted average for major industrial countries.
3. Based on short term interest rates for MCM and MPS and long term interest rates for DRI.

of the sales tax, for example, is associated with a smaller current account effect.) Apparently the effects of changes in U.S. income are being offset in part by similar movements in foreign income.

When the effects are averaged for these three models, the dollar depreciates in response to three out of the five fiscal actions (top-right panel, Figure 5-3). The actions that produce relatively larger declines in U.S. interest rates (purchases, transfers and corporate taxes) also show declines in the dollar. The magnitude of depreciation is fairly small, however, because declines in foreign interest rates offset much of the fall in U.S. rates.[43] In addition, in the MPS model, assets denominated in different currencies are assumed to be imperfect substitutes, so that an improvement in the U.S. current account (which reduces the rate of foreign accumulation of net claims on the United States) leads to a rise in the dollar as a result of portfolio rebalancing. For the DRI and MCM models (both of which assume perfect substitutability of assets denominated in different currencies), the dollar depreciates in response to all types of fiscal action. It is sizable appreciations of the dollar in the MPS model that cause the three-model average to show small appreciations for the cases of the sales-tax and the corporate-profits tax actions (although in the latter case the dollar depreciates in real terms).

The relative magnitudes of the effects of the fiscal actions on

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[43] Foreign interest rates fall by construction in the DRI and MPS models, because in those models they are tied directly to U.S. rates (with long-run coefficients of, respectively, 0.5 and 0.94). Nevertheless, foreign rates also fall by comparable amounts in the MCM (in those countries in which money is held exogenous), as reductions in own nominal GNP reduce money demand.

foreign output mirror their relative effects on U.S. output, although the sizes of the effects are smaller and less negative overall.[44] Foreign output falls initially in all cases as U.S. output declines and reduces demand for imports from abroad. Foreign output then returns to (and often rises above) baseline as U.S. output recovers, and as declines in foreign interest rates stimulate domestic expenditures abroad. Reduced aggregate demand and local-currency appreciations result in lower own prices and interest rates. For the three-model averages, output abroad shows the greatest net loss (or smallest net gain) for the U.S. fiscal contractions involving reduced purchases or increased sales taxes.

The simulated effects of the various fiscal actions on key macroeconomic variables depend crucially on the underlying assumption about the stance of U.S. monetary policy. As noted earlier, the crowding-in of domestic expenditures is largely a result of declines in interest rates when money demand falls in the face of unchanged money supply. The degree of crowding in depends on which monetary aggregate is being held exogenous and on the magnitudes of the income and interest-rate elasticities of demand for that aggregate.

As a first attempt to address this issue empirically, we report in Figure 5-4 the results of the simulated cut in purchases, run with the MCM and MPS models under three different U.S. monetary policy assumptions: holding M2 exogenous, holding M1 exogenous, and holding short-term interest rates exogenous.

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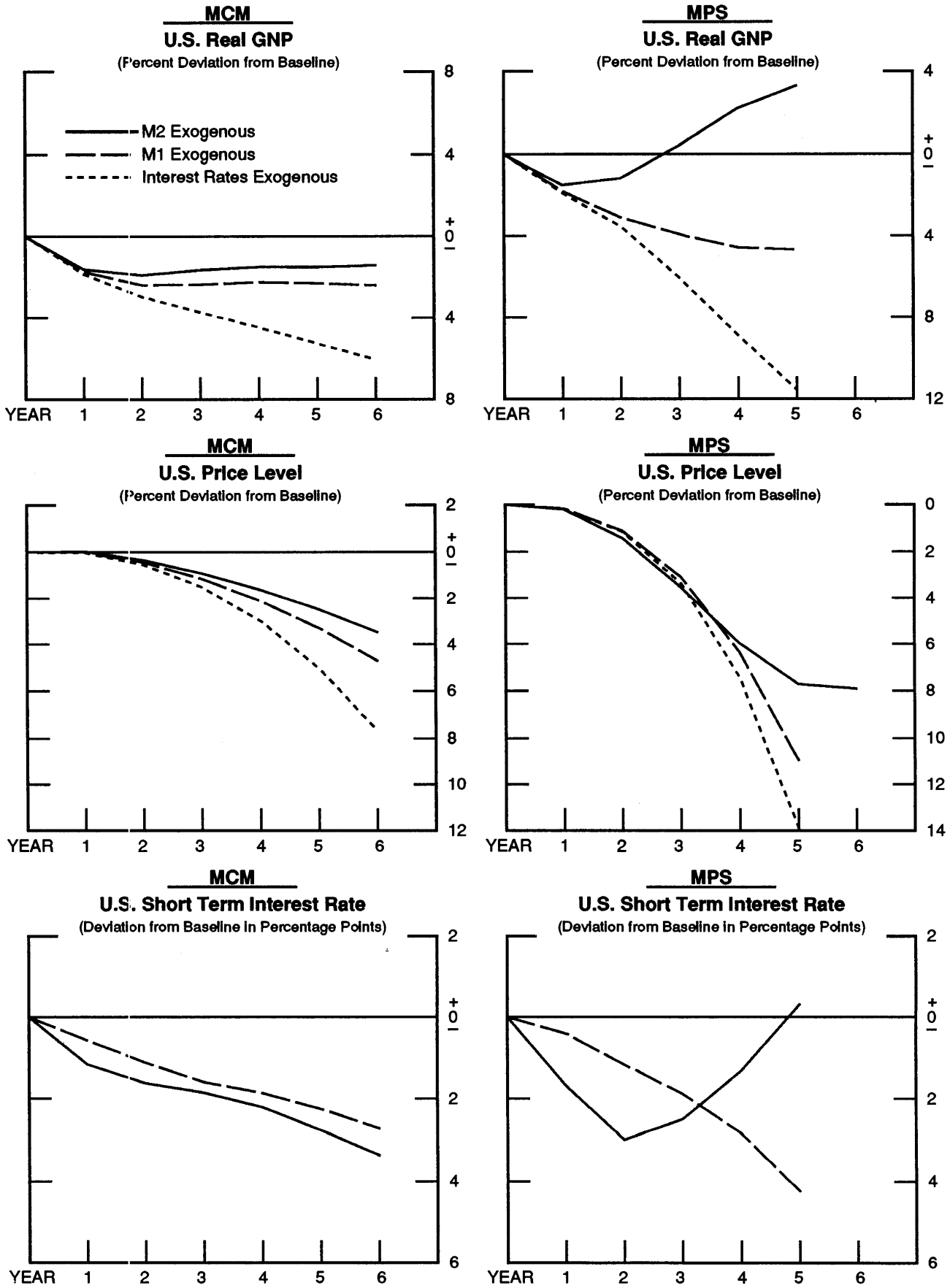
[44] In the DRI model, this outcome occurs largely because the model links foreign activity directly to U.S. real GNP.

Figure 5-4

Effects of Fiscal Contraction under Alternative U.S. Monetary Policies



In general, holding M2 exogenous in the models produces larger declines in interest rates than when M1 is held exogenous, and hence provides stronger crowding-in effects. The MCM shows only moderate differences in the effects on U.S. real GNP between the M1 and M2 simulations, and a substantially greater decline in real GNP when interest rates are held unchanged.[45] The MPS model shows considerably greater differences between the M1 and M2 cases, reflecting a greater difference in the interest elasticities of demand for those two aggregates, and that model's greater sensitivity of domestic expenditures to interest rates.[46]

The evidence presented in this section suggests several broader inferences. First, the effects on U.S. real GNP across the five types of fiscal actions differ quantitatively, but for the first two

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[45] Simulations of all five fiscal actions run with the MCM under the three monetary policy assumptions also suggested that changing the monetary policy assumption could shift the relative ordering of the effects of the fiscal actions on real GNP. Most notably, the sales tax action switches from having the largest negative impact on real GNP with M2 held unchanged, to the smallest negetive impact with interest rates held unchanged. This is because prices fall more in the case of other fiscal actions than they do for a sales tax. Thus, when nominal interest rates are held unchanged, real interest rates rise more, and depress investment more than in the case of the sales tax. (In the sales tax case, prices actually rise for a time, which reduces real interest rates and stimulates investment.)

[46] The MPS model specifies demand for money functions in somewhat more detail than the MCM. Demand for M2 is significantly less interest elastic than demand for M1 in the MPS model, largely because interest-bearing deposits account for a much larger share of M2 than M1. Demand for interest-bearing deposits varies positively with the rates on those deposits. To the extent that those deposit rates move with other interest rates, the negative interest elasticity of demand for money is reduced. The DRI model also specifies the monetary sector in some detail, and probably would show at least as great a difference as the MPS model between simulations holding M1 exogenous and those holding M2 exogenous.

to three years are generally within the range of estimates discussed in section 2. As a first approximation, therefore, analysts can probably infer at least the qualitative pattern of short-run effects of all types of fiscal actions by using the estimates for cuts in purchases summarized in section 2 above.

The differences among types of fiscal actions become more important over longer horizons. To judge from the average-model results presented here, two out of the three types of contractionary fiscal policies that would directly restrict private consumption (that is, increases in personal taxes and reductions in transfers) could have somewhat less negative implications for U.S. and foreign output and somewhat more positive implications for both the budget deficit and the current account deficit than a comparably-scaled cut in federal purchases. The other policy that would restrict private consumption directly -- increases in sales taxes -- would yield by far the worst trade-off of all the fiscal measures considered: it would register the largest losses in U.S. and foreign output, and yet would yield the smallest amounts of progress in reducing the U.S. budget and current account deficits.[47]

Finally, the corporate profits tax appears to be "second worst"

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[47] The adverse macroeconomic effects of increases in sales taxes may well depend on the assumption of unchanged money growth and hence considerable flexibility of interest rates. Under the unlikely possibility that interest rates were held unchanged, a sales-tax increase could well produce the smallest decline in GNP of all the policies considered. Moreover, the longer-run negative effects of a sales tax could be reduced somewhat if the tax were less than fully passed through to higher prices (contrary to the full pass-through assumptions used in preparing the simulations reported here). In this case, the results might look more like those of a corporate profits tax, since profits would be squeezed to the extent that businesses absorbed the sales tax.

in terms of the GNP/budget-current-account deficit trade-off, because of its supply-side effects (raising the cost of capital and depressing investment).

We conclude this section with three important caveats. First, some of the effects of the alternative fiscal policies on output could, in principle, be offset by a more or less expansionary monetary policy. In that case, the differences would show up as differences in impact on the price level. An excise tax would result in a significantly greater increase in prices, with output held unchanged, than the other policies. Second, the results for alternative types of fiscal actions reported here are from only three models. The simulated effects of fiscal actions differ in some major ways across those models, partly because of difficulties in conducting the simulations on a fully comparable basis, but also because of fundamental differences in model specification. We do not have space here to dwell on these differences. Third, the three models used in this section all treat expectations adaptively; models with forward-looking expectations could yield quite different results. In particular, to the extent that agents with forward-looking expectations "saw beyond" the transitory inflationary effects of a sales-tax increase, that policy change could yield a more favorable tradeoff between output loss and deficit reduction than the results described here.

Until further research can refine the new evidence reported in this section and place the preceding caveats in appropriate perspective, readers should use the results with caution.

6. Illustrative Use of Empirical Estimates in Policy Analysis

Although the evidence reviewed in preceding sections about the quantitative effects of U.S. fiscal and monetary actions is far from definitive, policy-makers and their analysts have, for the time being, little else to go on when choosing among alternative policies. In this section, therefore, we illustrate potential applications of the existing evidence to the current macroeconomic difficulties facing the newly elected U.S. President and Congress. Our limited purpose is to consider what the possible macroeconomic consequences would be if the United States succeeded in substantially reducing the federal budget deficit over the next four years; we do not try to deal with the political dimensions of this issue.

Baseline Economic Outlook. As an illustrative baseline for our analysis, we find it convenient to adopt the projections in the most recent IMF World Economic Outlook (IMF, 1988). As of October 1988, the IMF staff foresaw a continuation through 1989 of expansion in real activity for all the major industrial countries.[48] They noted concerns for some countries that output might be approaching capacity limits and that inflation could increase somewhat.

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[48] For example, output for the industrial countries as a whole was projected to increase 3.9 percent for calendar 1988 (year over year) and 2.8 percent in 1989. The corresponding figures for Japan were 5.8 percent and 4.2 percent, for Germany 2.9 percent and 1.9 percent, and for the United States 4.0 percent and 2.8 percent. (By the end of 1988 it appeared that these growth rates for 1988 were somewhat below the actual 1988 growth rates.)

For the United States, the budget deficit was expected to remain very high, with only modest further progress toward reduction; the Fund staff's "working assumption" was that the deficit would still remain above $120 billion in the years 1990-92.[49] Total domestic demand in the United States was expected to increase slightly less rapidly than growth in output, resulting in some slight further reduction in the U.S. current-account deficit. By 1989, however, this improvement in the external deficit was projected to be minor (virtually no change between the calendar 1988 and 1989 current-account deficits, each of which was projected at $129 billion).[50]

The IMF's baseline outlook thus has several unsettling features. While it does not entail a worldwide recession in real economic activity, nor a resumption of strong inflationary pressures, it projects external imbalances continuing at unacceptably high rates. Moreover, it points to risks that those imbalances could cause

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[49] World Economic Outlook, October 1988, p. 20. This projection of the budget deficit implies that the targets embodied in the Gramm-Rudman-Hollings legislation would not be met (and hence, implicitly, that the legislation as currently written would not be enforced).

[50] Other analysts have suggested that the short-run prospects for further reductions in the U.S. external deficit in 1989 and even 1990 could be somewhat brighter than envisaged by the IMF staff (see, for example, Hooper 1988). Nonetheless, given exchange rates similar to those prevailing in the fall of 1988 and given roughly similar rates of growth in the United States and other industrial countries, it is difficult to imagine enough improvement in the U.S. external imbalance to bring the deficit down to a range regarded as acceptable and indefinitely sustainable. For further discussion of the prospects for the U.S. external deficit, see Bryant, Holtham, and Hooper (1988); Hooper and Mann (1987, 1988); and Bryant (1988).

significant tensions among the major countries.[51]

What adjustments in macroeconomic policies could improve this outlook? Most analysts, inside and outside the United States, focus first on the large budgetary imbalance in the United States. A thorough treatment would have to discuss policies in all the industrial countries, not merely in the United States. But we too believe that U.S. fiscal retrenchment is a necessary condition for improvement in the U.S. and the world economic outlook. Our illustrations of policy modifications here therefore concentrate on U.S. fiscal policies.

A Phased-in Package of Expenditure Cuts. We focus mainly on expenditure reductions, because we have more model-based evidence on the effects of spending changes. We emphasize phased reductions in part because our results (from section 4 especially) suggest that a series of expenditure reductions implemented over several years is likely to be less economically painful than a single large unannounced reduction. Our illustrative package involves successive incremental expenditure reductions of 1/2 percent of GNP in each of the four years 1989 to 1992, with government spending in real terms in and after 1992 therefore below that in the baseline by an amount equal to 2 percent of real GNP. The ultimate size of the package of cuts is thus twice the size of the standardized expenditure

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[51] The World Economic Outlook of October 1988 does not make explicit projections for years beyond 1989. When thinking of an illustrative baseline against which to evaluate the calculations in this section, the reader could (for example) roughly extrapolate into 1990-94 the broad trends envisaged by the IMF for late 1988 and 1989.

reduction analyzed in section 2.

What macroeconomic consequences would ensue from this phased-in package of expenditure cuts ("package A")? Two illustrative projections are shown in each panel of Figure 6-1. The solid curves show estimated effects derived from the 12-series sample averages in section 2. The curves with long dashes, shown less prominently, plot the effects using the 3-model averages discussed in section 5. All panels of Figure 6-1 show effects measured as deviations from the baseline outlook. The baseline paths themselves are not plotted, but rather the changes resulting from the assumed modification in fiscal policy. (In effect, the baseline paths are the horizontal lines beginning at the zero points on the vertical scales.)[52]

These estimates suggest that the expenditure cuts would sharply diminish the twin-deficit problem. The package would produce a

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[52] Tables with the data plotted in the chart are in the appendix. Our approach in preparing the calculations in this section follows the analytical procedures explained in Bryant, Henderson, and Symansky (1988). The procedures use particular simulation results to derive standardized estimates of the consequences of policy actions (in effect, final-form coefficients from the relevant model), which can then be used as shortcut "ready reckoners" to assess hypothetical policy actions, including combinations of actions in policy "packages." In the calculations underlying the illustrations in Figure 6-1 and elsewhere in this section, we applied these procedures not only to the simulations from individual models but also to the model-average simulation results reported in sections 2 and 3. For reasons discussed in Bryant, Henderson, and Symansky (1988, pp. 69-71), the procedures for deriving and using final-form coefficients cannot legitimately be applied to simulation results from individual models with a rational, forward-looking treatment of expectations. For such a model, there seems to be no shortcut substitute for a hands-on use of the model itself. The results reported in Figure 6-3 below for the version of INTERMOD using forward-looking expectations were obtained from direct simulations of the PC version of that model.

Figure 6-1

Estimated Effects of a Phased-In Package of Expenditure Cuts

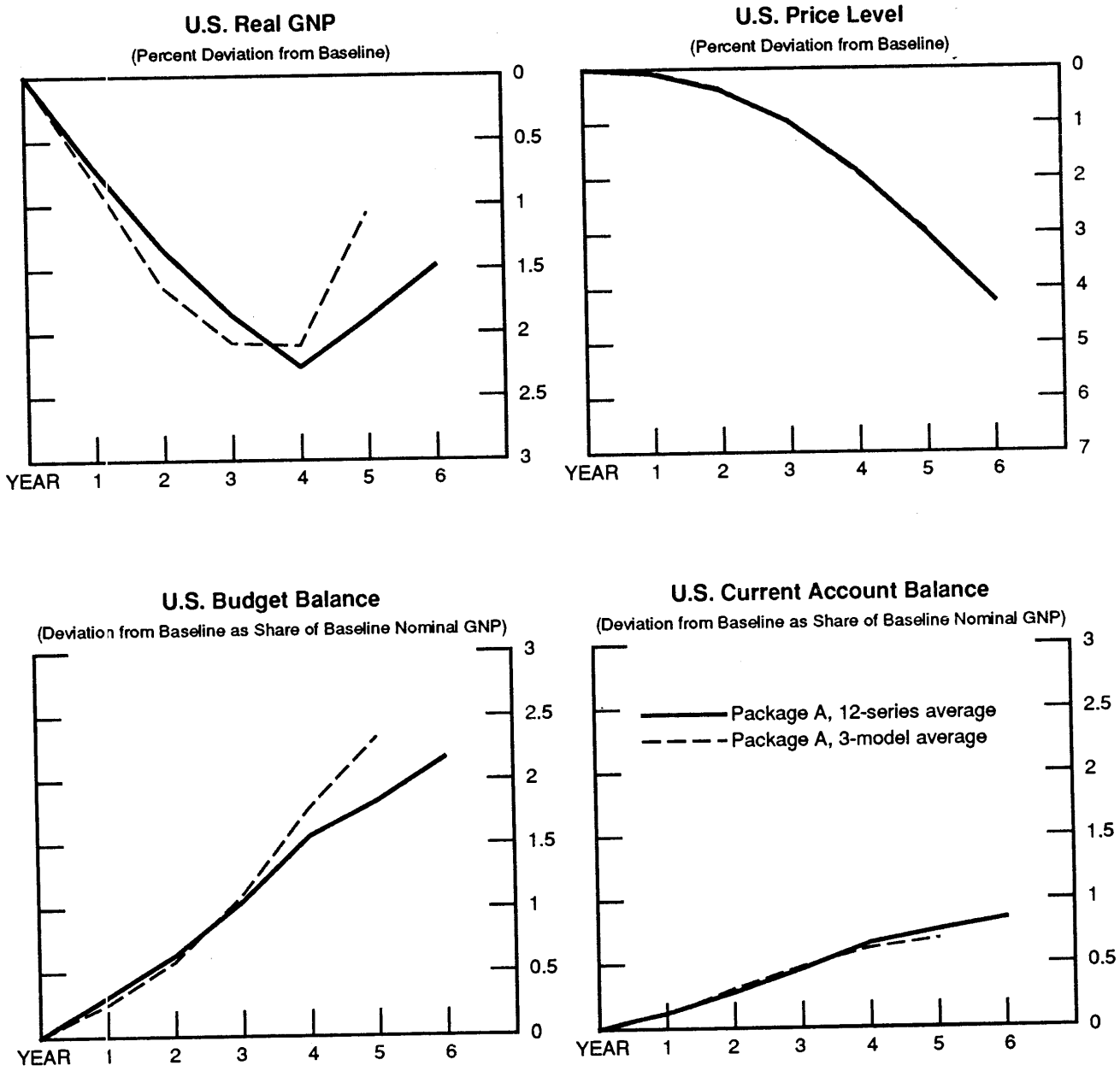
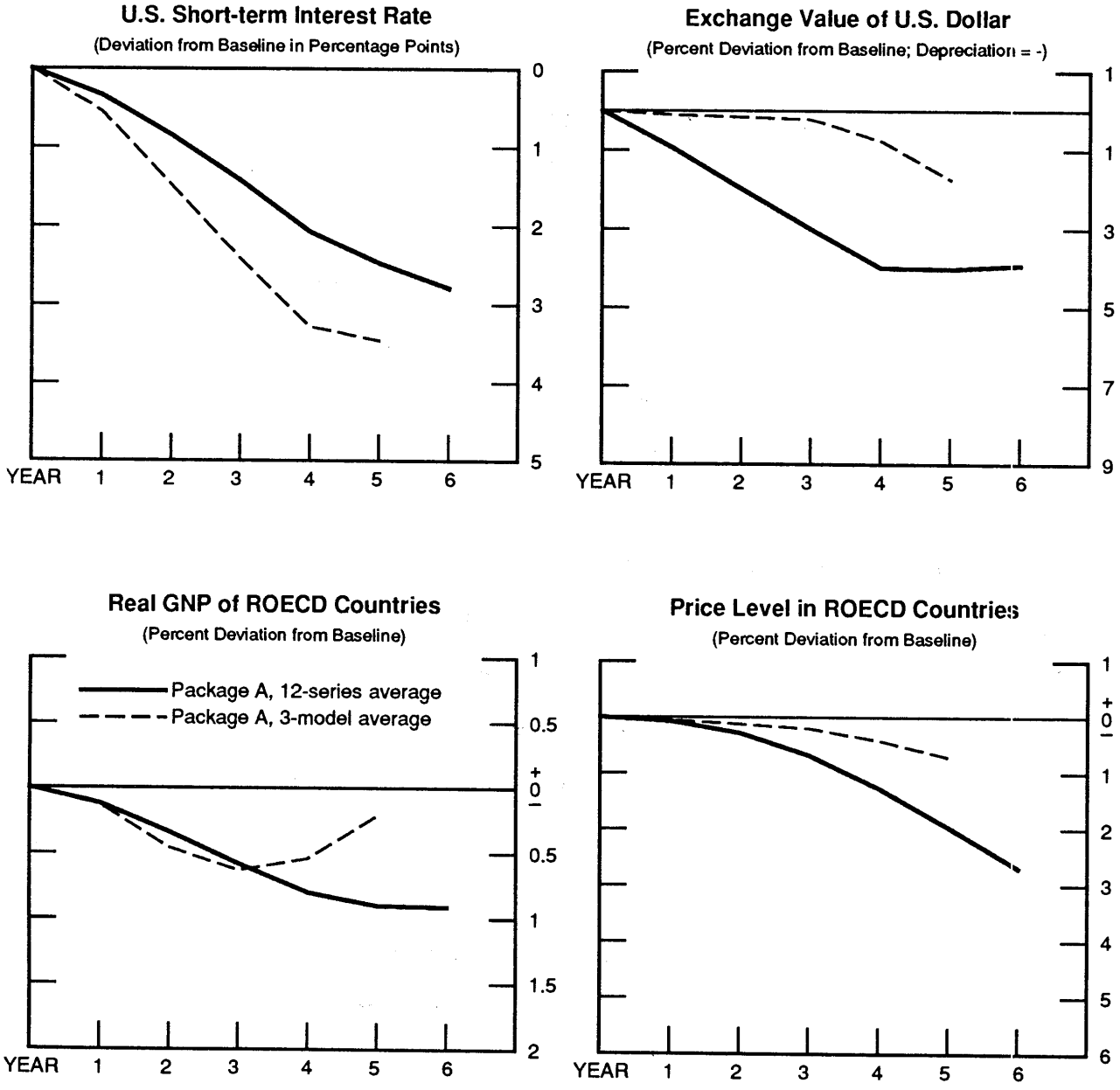


Figure 6-1 (continued)



large decline in the budget deficit, building up gradually over each of the six years 1989-94; by the fifth year, the deficit would fall by at least 1-3/4 percent, perhaps more than 2 percent, of baseline nominal GNP (some $120-150 billion). The package would also gradually reduce the external deficit, but by smaller amounts -- in the fifth year, for example, by about 3/4 percent of nominal baseline GNP (roughly $45-50 billion).

Output would fall substantially below baseline (top left panel in Figure 6-1) -- according to these estimates, more than 1-1/3 percent of real GNP by the second year and perhaps by some 2 percent by the third and fourth years. The U.S. price level would also fall below baseline, by increasing amounts with each year. Because the Federal Reserve is assumed to keep a key monetary aggregate unchanged from its baseline path, interest rates in the United States would fall below baseline by progressively larger amounts. And the dollar would depreciate modestly in exchange markets. These movements in prices, interest rates and exchange rates would induce, with a lag, a turnaround ("crowding in") of the deviations of output from baseline.[53]

Packages with Tax and Transfer Changes. A realistic budget compromise is unlikely to place the entire burden of fiscal contraction on reductions in government expenditures. "Revenue enhancements" of one sort or another, and perhaps reductions in transfer payments, will also have to play a role. It is therefore

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[53] The crowding-in effects here are delayed relative to those shown in sections 2 and 5 because the fiscal contraction is phased in over time. Crowding-in effects appear much sooner when allowance is made for forward-looking expectations, as we show below.

useful to illustrate how much difference it might make for the macroeconomic consequences if packages were structured in alternative ways.

For comparison with package A's exclusive use of expenditure cuts, consider two other polar cases, one composed entirely of reductions in transfer payments and increases in personal taxes ("package B"), the other composed entirely of increases in corporate taxes and in excise/sale taxes ("package C"). Packages dominated by reductions in transfer payments or personal tax increases initially would affect personal disposable income and private consumption especially strongly, but would have relatively little impact on investment and potential output. Packages dominated by corporate and excise taxes would curtail private capital formation more strongly than other actions.

We have designed packages B and C to have the same overall size as package A, namely a total of fiscal actions measured in constant dollars equivalent to 1/2, 1, 1-1/2, 2, 2, and 2 percent of baseline real GNP, respectively, in the six years beginning in 1989. Roughly one half of package B takes the form of cuts in transfer payments. The other half comes from increases in personal taxes.[54] Package C

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[54] For the cuts in transfer payments, the assumed amounts for the six years 1989-94 in constant dollars are, respectively, 1/4, 1/2, 3/4, 1, 1, and 1 percent of real baseline GNP. For the increases in personal taxes, the (average) personal tax rate is assumed to be raised in 1989 by an amount necessary to generate additional revenue equivalent to 1/4 percent of nominal baseline GNP; the rate is raised in each of the next three years by an additional step, each time so as to raise incremental revenue equivalent to another 1/4 percent of nominal baseline GNP in that year; from the fifth year (1993) on, the tax rate remains unchanged at the higher level attained in 1992.

is composed half of increases in corporate taxes and half of increases in sales or excise taxes.[55]

The effects of the three packages are compared in Figure 6-2. The three prominent curves plot the estimated effects using the three-model averages developed in section 5; package A is shown with long dashes (repeated from Figure 6-1), package B with dots, and package C with short dashes. For comparison, the panels also show in the background the effects from the 12-series sample average (repeated from Figure 6-1).[56]

The estimates in Figure 6-2 suggest that it could make a significant difference to key macroeconomic variables over the medium and long runs if tax increases and transfer payments were used in addition to expenditure reductions in a budget package. Packages including changes in personal taxes or transfers appear, from the three-model results, to offer more leverage on the twin deficits per dollar of cost paid in reduced output. The worst tradeoffs for macroeconomic variables per dollar of fiscal action would result from increases in sales taxes and, less clearly, from increases in corporate taxes.

For example, U.S. real GNP by the third and fourth years might fall below baseline by, respectively, as much as 2.3 and 2.9 percent

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[55] For each type of tax, as for the personal tax increase in package B, the (average) tax rate is assumed to rise in four annual increments during 1989-92, and to remain unchanged thereafter. Each annual increment in the rate, for corporate taxes and sales taxes, is calculated to raise additional revenues in that year by an amount equal to 1/4 percent of baseline nominal GNP.

[56] Figure 6-2 does not plot sixth-year (1994) estimates for the 3-model averages because here, as in section 5, we did not have the required sixth-year simulation results for all three models.

Figure 6-2

Estimated Effects of Alternative Packages of Phased-In Fiscal Contraction

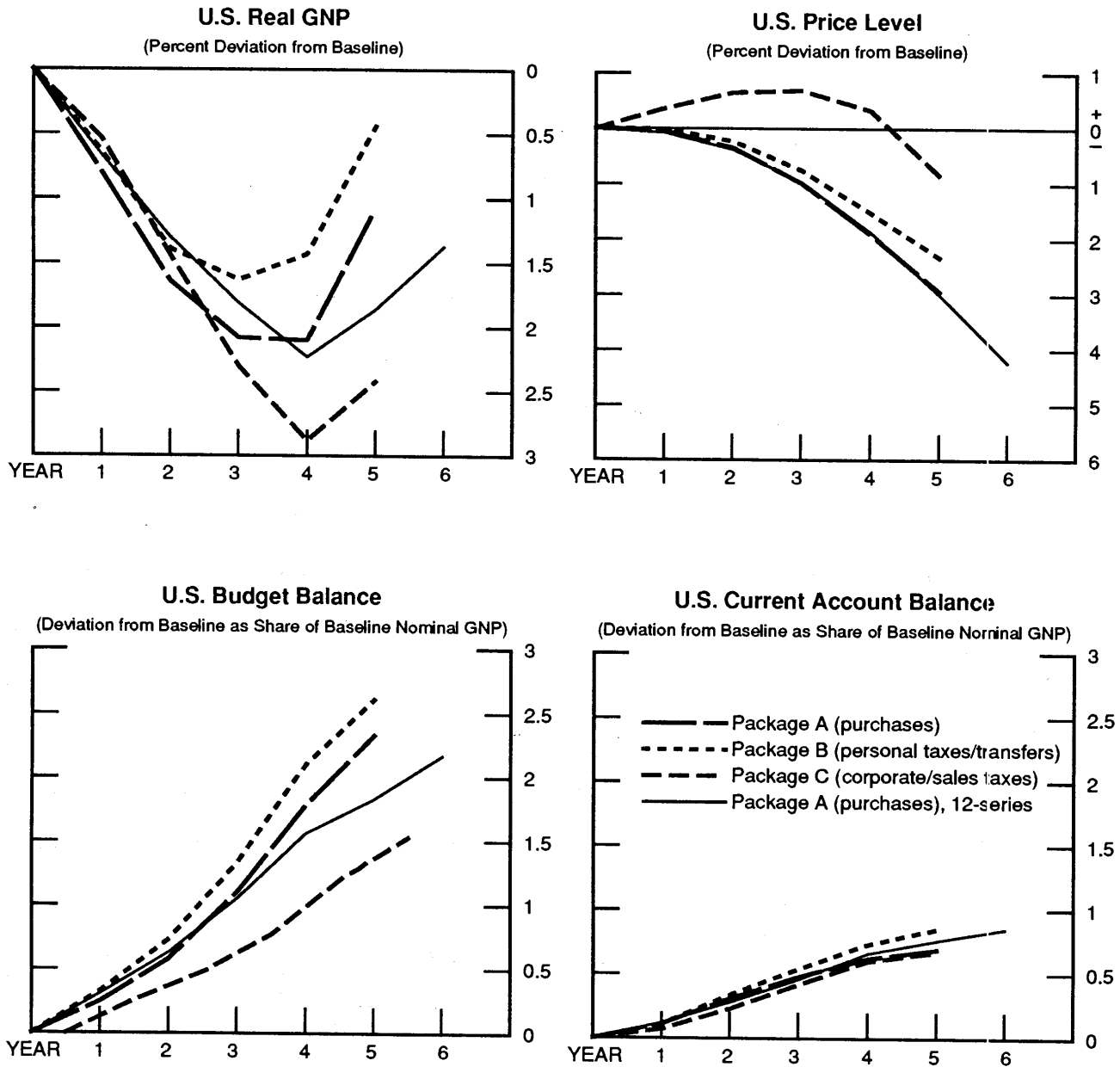
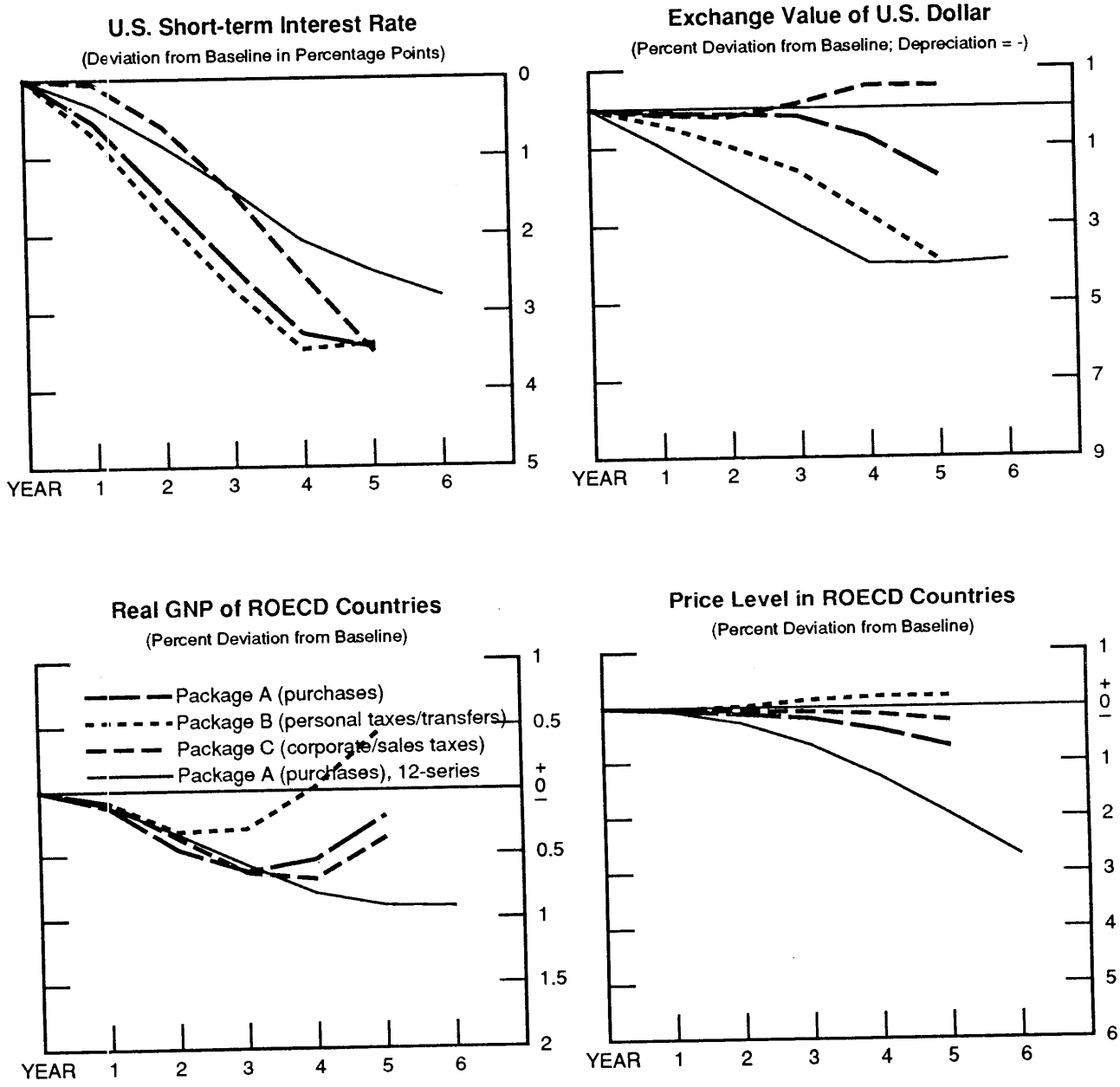


Figure 6-2 (continued)



for package C but only by some 1.6 and 1.4 percent for package B. Yet the medium-run reduction in the budget deficit in package C might be only half the reduction stemming from package B. The current-account deficit would also fall slightly less under package C than under B.

The politics of obtaining agreement on increased sales and excisetaxes -- for example, on gasoline, liquor, and tobacco ("promote energy conservation; reduce dependence on imported oil; discourage sin") -- and on raising the burden of corporate taxation ("the corporations are wealthy and can readily absorb increased taxes") might well be less difficult than the politics of obtaining agreement on personal tax increases or curtailments in entitlement programs. If so, however, it ought to be recognized that the easier political solution could be less efficient in redressing the macroeconomic problems that require a budget compromise in the first place.

Expectations of Phased-in Fiscal Packages. We emphasized in section 4 that a phased-in package of fiscal actions could have important anticipatory effects not captured in models that treat expectations adaptively. In principle, the more credible the initial announcement of a multi-year sequence of actions, the greater the degree to which favorable crowding-in effects would be accelerated, and the less would be the output loss throughout the adjustment process. The estimated consequences of U.S. fiscal packages shown in Figures 6-1 and 6-2 do not allow for such

expectational effects.[57]

To illustrate the potential importance of forward-looking expectations, Figure 6-3 reports some additional simulation results generated with INTERMOD. One of the two prominent curves in that figure shows the simulated results for package A (phased-in expenditure cuts) when INTERMOD treats expectations adaptively. The other prominent curve plots the estimated effects of package A when INTERMOD is in consistent-expectations mode; for the purpose of that simulation, it was assumed that none of the package was anticipated prior to its announcement and first-part implementation at the beginning of year 1 (1989), but that all subsequent changes were correctly anticipated. As a benchmark for comparison, Figure 6-3 also repeats, less prominently in the background, the estimated effects of package A using the 12-sample model average (which makes no allowance for anticipatory effects).

The differences between the adaptive and consistent-expectations simulations in Figure 6-3 are noteworthy. For the consistent-expectations simulation, anticipations in 1989 of the further phased-in cuts to be implemented in the subsequent years 1990-92 reduce interest rates and price expectations immediately, and thus lead to increases in private spending that cushion the output loss from the drop in public spending. As a consequence, U.S. real GNP falls significantly less when INTERMOD is simulated with model-

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[57] The DRI, MCM, and MPS models (used in the 3-model averages of section 5) all treat expectations adaptively. The procedures used for extracting final-form coefficients from the 12-series sample of sections 2 and 3 implicitly assume that the "composite model" treats expectations adaptively.

Figure 6-3

Estimated Effects of Phased-In Expenditure Cuts under Alternative Expectations Assumptions

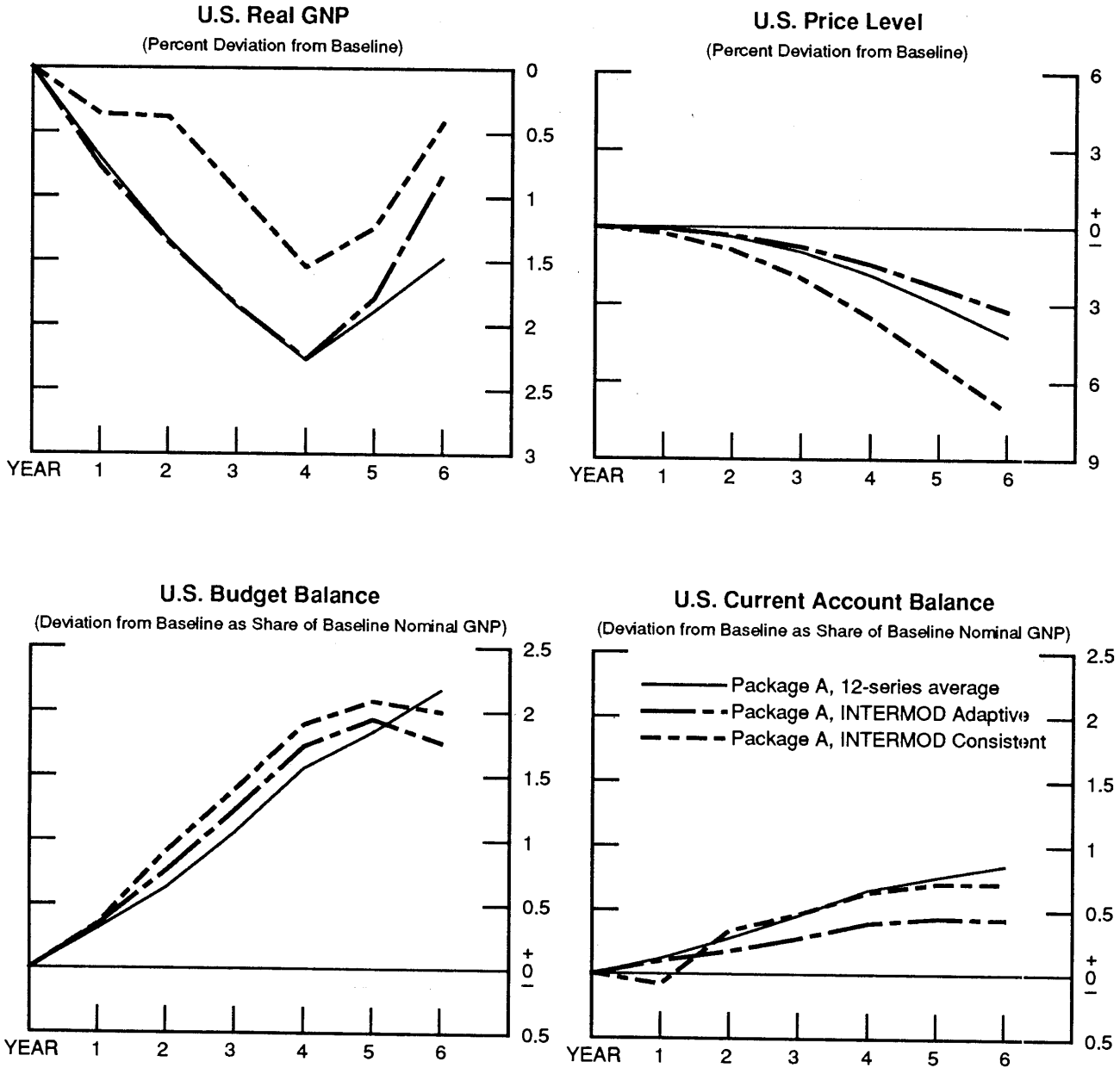
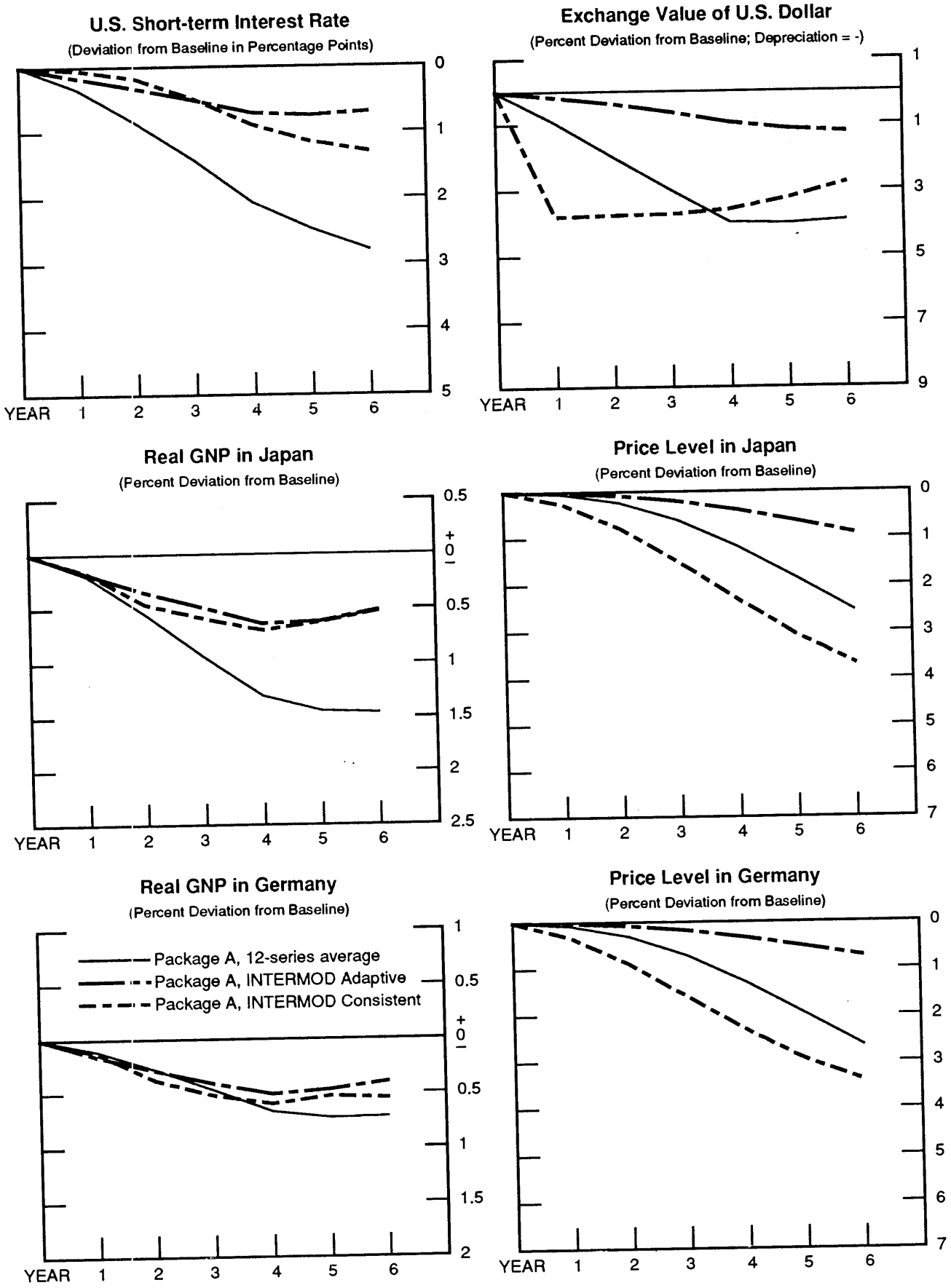


Figure 6-3 (continued)



consistent than with adaptive expectations. For example, package A is estimated to push real GNP below baseline by 1.4 percent in the second year (1.9 and 2.3 percent in the third and fourth years) when INTERMOD is run with adaptive expectations; the fall below baseline with expectations treated as model-consistent is only 0.4 percent in the second year (1.0 and 1.6 percent in the third and fourth years). When expectations are model-consistent, the exchange value of the dollar (top right panel of second page) and long-term interest rates (not shown in the chart) fall much more sharply in the initial year, and the U.S. price level falls more. Moreover, the reductions in the budget and the current-account deficits are larger than with adaptive expectations, even though the reductions in real GNP are markedly less. Hence the tradeoff is much better: if private agents regard the announced fiscal package as credible and therefore anticipate the effects of the expenditure cuts that will be implemented in future years, the initial cost in lost output per dollar of reduction in the twin deficits is significantly smaller.[58]

The consistent-expectations simulation shown in Figure 6-3 assumes that the phased-in fiscal package has complete credibility

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[58] The results reported in Figure 6-3 employ the published version of INTERMOD, in which money supply and money demand behave in ways that give very small reductions in interest rates in response to expenditure reductions. When a more typical specification is used for the money-demand equation, as reported in a footnote in section 4, interest rates fall further, and the crowding-in effects are correspondingly stronger. For example, when the revised money supply and demand equations are in effect in INTERMOD, and when the model treats expectations as model-consistent, real GNP in the Package-A simulation falls below control by a maximum of 0.8 percent (in year 4), is below control by 0.2 percent on average over the six years of the simulation, and is above control by the end of the period.

once it has been announced. Those estimates, and the differences between them and the results shown in Figures 6-1 and 6-2, do not illuminate cases in which private agents would distrust the announcement of a multi-year fiscal program and thus would doubt that the subsequent years of the program would actually be implemented as announced.[59]

Combinations of Fiscal Contraction and Some Monetary Offset. Would macroeconomic consequences such as those projected in Figures 6-1 to 6-3 be welcome? Judgments about the degree of welfare loss associated with the fall of output below baseline would of course depend on the details of the baseline outlook. Because phased-in budget compromises of the size of packages A, B, and C could cause U.S. output to fall further than might be judged appropriate, we include here some results for a further illustrative package of policies. For our example, we suppose that the Fed goes beyond allowing interest rates to fall as a consequence of its maintenance of the money stock on the baseline path and instead for a period of three years gradually raises the money supply above baseline, facilitating even larger declines in interest rates.

To acknowledge that a permanent monetary expansion could have undesired long-run consequences for the price level, we suppose that the Fed's monetary expansion is gradually reversed beginning in the sixth year of the simulation period. This change in the policy "mix," a fiscal contraction taking the form of expenditure cuts

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[59] The effects of a multi-year phased-in package that was regarded as partially credible might fall somewhere in the range between the two simulations highlighted in Figure 6-3.

combined with a partially offsetting monetary expansion, we label as "package D."[60] The estimated effects of this combination of fiscal and monetary policies are reported in Figure 6-4 with heavy dashed curves. For ease of comparison, the figure once again repeats the package-A results (solid curves) for fiscal contraction alone.

The differences in Figure 6-4 between the consequences of packages D and A are what concern us here. Interest rates in the United States would fall significantly further under package D, and the exchange value of the dollar would depreciate more. Because the monetary expansion would partially offset the effects of the fiscal contraction, the fall in U.S. real GNP would be markedly less with package D; according to these estimates, for example, the second and third year reductions below baseline would be only 0.5 and 0.8 percent, respectively, whereas under package A the comparable shortfalls would be 1.3 and 1.9 percent. The U.S. price level under package D would be little changed from baseline in the first and second years and then would begin to fall below baseline, but by

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[60] The size and timing of the expenditure cuts in package D is identical to that assumed for package A. The detailed assumption about monetary policy is that the Federal Reserve raises the level of its key monetary aggregate above baseline by 2 percent in year 1, 3 percent in year 2, 4 percent in each of years 3, 4, and 5, 3 percent in year 6, 2 percent in year 7 (which is beyond the actual simulation period), 1 percent in year 8, with money back on its baseline path in year 9 and thereafter. Not enough information is available to us from the newly generated evidence discussed in section 5 to permit the calculation of illustrative packages that combine monetary actions with the use of changes in transfers or taxes on the fiscal side. Hence our illustration of a change in the policy mix uses a combination of expenditure cutting and some monetary action. By using the information in Figure 6-2, readers interested in estimates incorporating transfers or taxes in a fiscal package can make rough adjustments to the results shown in Figure 6-4.

Figure 6-4

Estimated Effects of Phased-In Fiscal Contraction Combined with Monetary Expansion

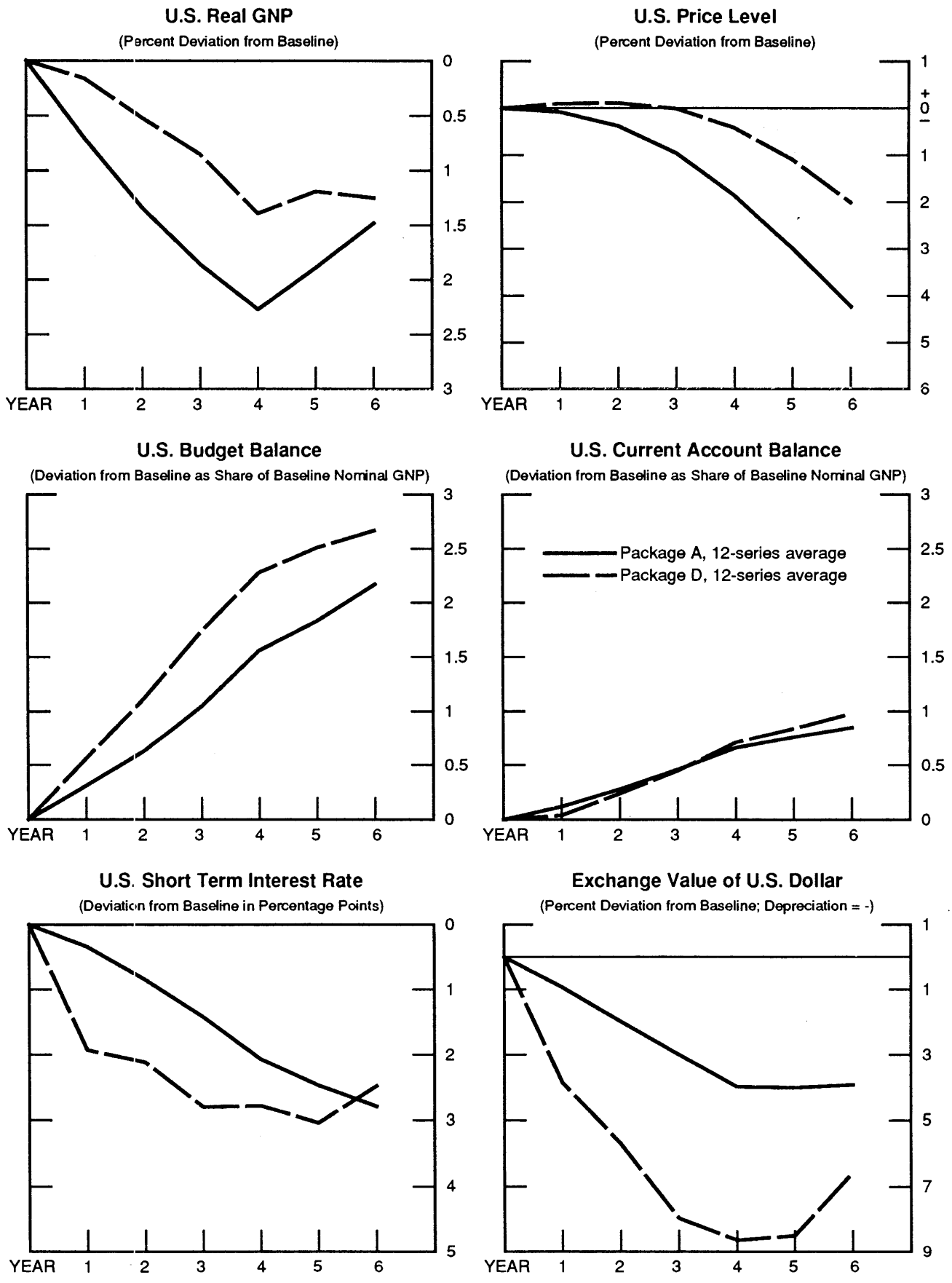
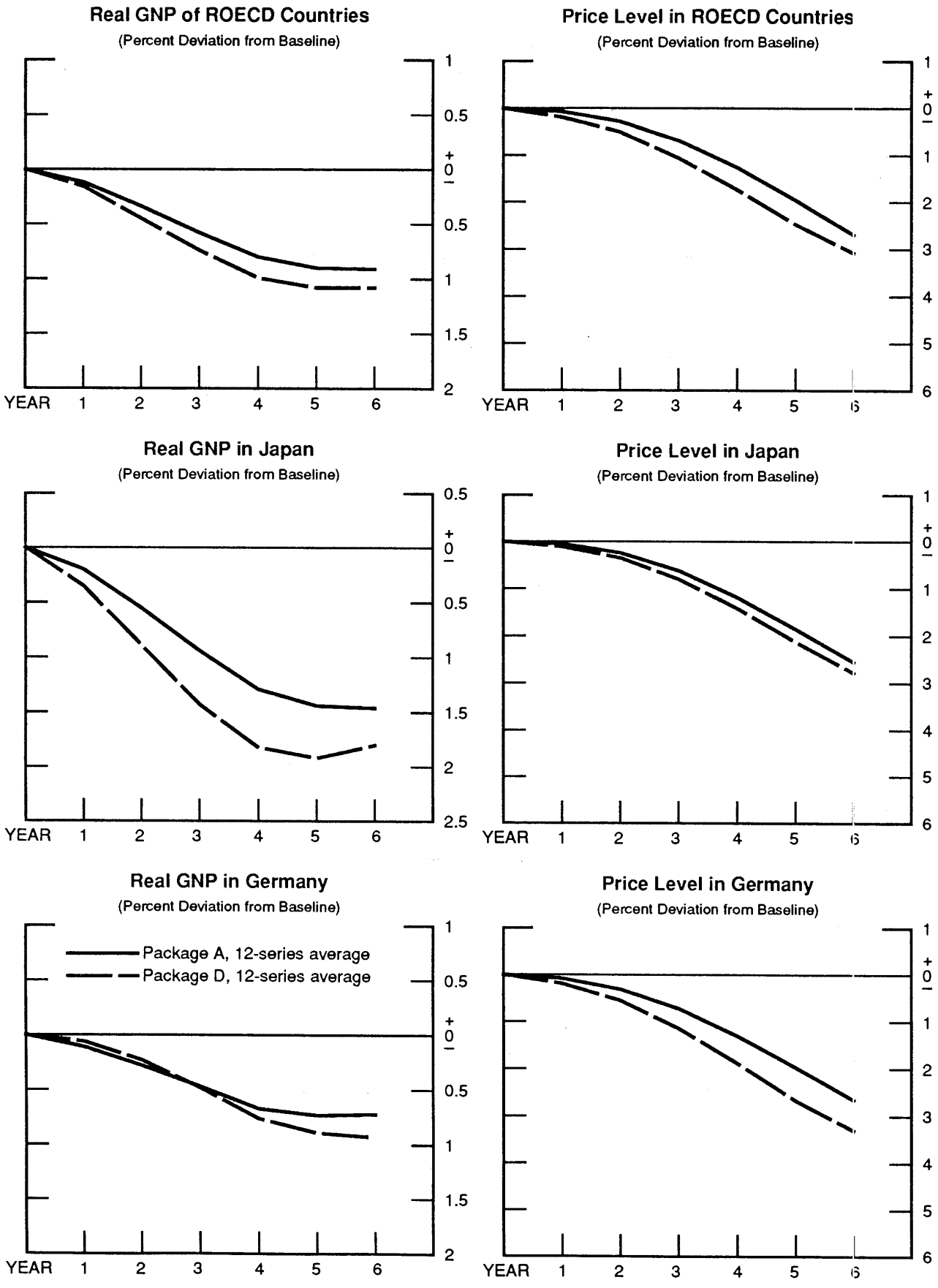


Figure 6-4 (continued)



smaller amounts than the declines under package A. As expected (see sections 2 and 3), the estimated improvement in the external imbalance is roughly the same for both packages. For package D, however, the expenditure-switching effects of a lower dollar (lower because of both fiscal contraction and monetary expansion) would account for considerably more of the net effects on the external deficit.[61] For the budget imbalance, in contrast, the two packages would produce significantly different results. Because of the additional decline in interest rates in package D, the budget deficit would have fallen by the fourth year by as much as 2.3 percent of baseline nominal GNP (some $140 billion) compared to 1.6 percent of GNP ($95 billion) in package A.

As with the effects shown in Figures 6-1 and 6-2, the estimates in Figure 6-4 ignore forward-looking expectations. The estimates could, therefore, give a misleading impression for cases where a phased-in combination of fiscal and monetary actions was announced and believed to be credible. As seen in Figure 6-3, if the fiscal package could be designed to be fully credible, the need for a temporary, offsetting monetary expansion would not be as large, and its consequences would be less advantageous.

Spillover Effects on Other Countries. The panels on the second page of Figure 6-4 show estimated effects of packages A and D on the real GNPs and price levels of Japan, Germany, and the aggregate of ROECD countries. Other countries would experience moderate but non-

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[61] The income-raising effects of the monetary expansion on the external balance would work to offset the income-reducing effects of the fiscal contraction.

trivial declines (below baseline) in output and prices. Most of the spillover effects would come from U.S. fiscal actions, with U.S. fiscal contraction reducing foreign income and prices. The temporary monetary expansion, which would help to cushion U.S. output, would achieve its gains for the United States partially at the expense of other countries, whose real GNP might be somewhat lower with package D than with package A. In addition, the lower value of the dollar and higher U.S. price level (in package D compared to package A) would reduce the real wealth of foreigners holding net claims in U.S. dollars.

For Germany, the estimated fall below baseline in real GNP from the package-A fiscal contraction by the United States builds up to about 3/4 percent by the fourth year. Because U.S. monetary policy seems to have such small net effects on German output, the effects of package D would be little different from those of package A. The effects of U.S. policy actions on Japan would be somewhat larger. Japanese real GNP by the fourth year would fall below baseline by some 1-1/3 percent under package A; the decline under package D, according to these estimates, could be as large as 1-3/4 percent. The relative size of effects on real GNP for the ROECD as a whole would probably be intermediate between those for Germany and Japan.

The extent of appropriate adjustments in the macroeconomic policies of individual foreign governments in response to U.S. policy actions would depend on details of the baseline outlook for their economies. If aggregate demand in the baseline outlook for a foreign country were judged to be excessively buoyant, the government for that country might welcome the moderate

contractionary effects on its output and prices of a U.S. fiscal retrenchment. In the IMF's October 1988 world economic outlook, however, a number of foreign countries were not expected to face that situation. Under those circumstances, it probably would be appropriate for some foreign governments to shift gradually in the direction of more expansionary macroeconomic policies than they would choose in the absence of U.S. policy changes.

7. Conclusion

In this paper we have summarized a substantial body of evidence about the effects of U.S. fiscal and monetary policies and presented some new evidence on the effects of alternative treatments of expectations and of alternative types of U.S. fiscal actions. We have also illustrated the possible consequences, in the current circumstances facing the United States, of some policy packages involving phased-in actions.

Predicted effects from individual models vary considerably. Nonetheless, the extended process of collaborative research underlying our model averages and standard deviations in sections 2 and 3 has generated estimates that we believe are useful for attaching rough magnitudes to the domestic and foreign effects of macroeconomic polices.

We likewise believe that the new results in sections 4 and 5 provide useful rough insights for the analysis of policy decisions. Those results, too, however, are tentative. Much research remains to be done analyzing the possible linkages between macroeconomic policies and macroeconomic performance. This need is especially

great for the analysis of international repercussions of national policies, which often depend on the net effects of offsetting tendencies and on the operation of internationally integrated markets that are strongly influenced by expectations of future events and policies.

Provided that analysts consider simulations generated by a variety of existing models, the predictions of any one model can be placed in a broader perspective. Results that are clear outliers or otherwise implausible can be weeded out. Averaging across the remaining results provides a mean outcome, and a quantifiable range of plausible outcomes around that mean.

Our average results, derived mainly from models with adaptive expectations, suggest that an unanticipated cut in U.S. federal purchases could have a substantial negative impact on the level of U.S. real output for up to several years, as well as on prices, interest rates, the exchange value of the dollar, and, to a lesser but still significant extent, on output outside the United States. The declines in U.S. prices, interest rates, and the dollar would eventually stimulate domestic demand and net exports enough to reverse most of the decline in output within five to six years. The external deficit would fall, although generally by only one third to one half as much as the budget deficit (a reminder that there is not a "one-for-one" relationship between the two deficits). A fiscal contraction has beneficial effects on the external deficit in large part by reducing total domestic expenditures and prices and to a lesser extent by lowering interest rates and the dollar.

With respect to the effects of monetary policy, the model

simulations suggest that initial declines in U.S. output stemming from fiscal contraction could be diminished by a temporary addition to the U.S. money stock. This offset to output in the United States would not, however, be matched by any analogous offset to output declines abroad; indeed, taken literally, the model-average results suggest that the addition of U.S. monetary expansion could even augment the losses in foreign output that would arise from the U.S. fiscal contraction without monetary expansion. A U.S. monetary expansion would cause further dollar depreciation. And, especially in the absence of credible prospects for a fiscal contraction, a monetary expansion might lead to counterproductive reactions in domestic financial markets.

In any event, simulations with forward-looking model-consistent expectations (discussed in section 4) suggest that -- even in the absence of a monetary expansion -- the initial depressing effects of a fiscal contraction on U.S. output could be substantially mitigated if the fiscal contraction were anticipated prior to implementation. With anticipation, the beneficial crowding-in effects, induced by more rapid initial declines in long-term interest rates and the dollar, would arrive sooner, in time to offset much of the output reduction that would occur when the fiscal contraction was actually implemented. Such beneficial effects of anticipated future actions, of course, could only occur if an announced fiscal program were widely thought to be credible. In turn, a credible program would be likely to require substantial up-front action if promises of future actions were to be regarded as genuine commitments.

Our tentative analysis of alternative fiscal policies suggests

that different types of commensurately sized fiscal actions would have effects on output, as well as on the twin deficits, that were quantitatively different but qualitatively similar in the first year or two. Over a longer horizon of three to five years, actions involving higher sales or corporate taxes would induce, relative to a cut in government purchases, a greater loss of actual and potential output for any given reduction in either the fiscal or the external deficit. The trade-off (loss in output per unit of gain in reducing one or the other of the deficits) for increased personal taxes or reduced transfers could be somewhat more favorable than that for a cut in purchases. Fiscal actions such as hikes in excise taxes or increases in the burden of corporate taxation might turn out to be politically less difficult to negotiate than others, for example increases in personal taxes or cuts in transfers. Increases in excise taxes could further other objectives such as energy conservation. Increases in excise or corporate taxes, however, cannot be recommended on more general macroeconomic grounds as the most efficient ways of reducing the domestic and external deficits.

If macroeconomic considerations were to be given paramount attention, our analysis suggests that a U.S. fiscal retrenchment should be phased in gradually, with announcement of the program embodying credible precommitments for the whole sequence of actions. Gradual, predictable programs would be most efficient -- again, in the sense of keeping output losses to the smallest possible size for any given targeted reduction in either the fiscal or the external deficit. Reduced government spending will undoubtedly play a significant role in any politically agreed compromise. On

macroeconomic grounds, our results point also to the inclusion of personal tax increases or transfer decreases. Either of those measures would appear to restrain private consumption and the fiscal deficit more, and discourage investment and total output less. Furthermore, fiscal packages embodying current and future phased-in increases in taxes would probably be more believable than packages promising only current and future cuts in government spending. And announced plans for future spending cuts, especially if unaccompanied by tax increases or transfer reductions, would likely be regarded with skepticism unless a significant amount of spending reduction were implemented at the outset of the process.

APPENDIX

This appendix provides detailed information and data underlying the analysis in the text. It is organized in two parts. The first part supplements sections 2 and 3 of the paper. The second reports the data used in the charts of sections 4, 5, and 6.

Sections 2 and 3

We identify here the model simulations underlying the discussion in sections 2 and 3 and supply reference data for readers who may wish to make further use of the sample averages.

Model Simulations Used. Many modeling groups have contributed to the collaborative research reviewed in our paper. The participating models, and the mnemonics we use to refer to them, are:[62]

DRI: Data Resources, Incorporated has an international model consisting of three large country models for the United States, Japan, and Canada, plus a separate regional model for Europe that contains submodels for Germany, France, the United Kingdom, and Italy. The main DRI model of the U.S. economy has more disaggregated detail for the domestic economy but much less detail than the international model in its treatment of foreign economies. Expectations in both of the models are

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[62] For additional discussion of most of the models and their main differences, the reader may consult the EMIE volume. See especially "Contrasts Among the Participating Models," Bryant, Henderson, Holtham, and others (1988, main volume, pp. 27-29). Additional bibliographic references for many of the models are given in the supplementary volume of that study, pp. 341-47.

treated adaptively.[63]

EEC: The COMPACT model, developed by the staff of the EC Commission, includes three small models of the United States, Japan, and the EC region, plus an abbreviated rest-of-world sector. The models for the United States and Japan are simplified versions of country sectors taken from the Japanese EPA model. Expecations are modeled adaptively. The model's trade linkage equations allocate a region's imports among the other regions in the model and computes its import prices as a weighted average of the export prices of the other regions. Capital flows and net external-asset positions are modeled in a modified portfolio adjustment framework.[64]

EPA: The World Econometric Model of the Japanese Economic Planning Agency, built and maintained in its Economic Research Institute, consists of nine medium-to-large country models for Japan, the United States, Germany, France, the United Kingdom, Italy, Canada, Australia, and South Korea, plus six smaller regional models covering the rest of the world. Expectations are modeled adaptively. Trade linkages are modeled along the lines developed by Samuelson and Kurihara (1980) and A. Amano and others (1980). Exchange rates can be treated as fixed or alternatively as floating under official management (with exchange rate bands and reserve-flow targets).[65]

GEM: The Global Economic Model of the National Institute of Economic and Social Research in London is a medium-sized model used in connection with the National Institute's forecasting and policy analysis. The model was based on a world model constructed in the U.K. Treasury but now includes numerous modifications, including endogenously

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[63] For references on the DRI models, see, for example, Brinner (1985) and Gault (1987).

[64] The model is described in Dramais (1986). The modeling of capital flows and net external assets in COMPACT followed the approach suggested by Klein and Marwah (1983). Research at the EC Commission in recent months is reported to be focusing on a successor model to COMPACT, known as QUEST.

[65] For an introduction to the EPA model, see Japanese Economic Planning Agency, World Economic Model Group (1986) and Yoshitomi and others (1984). The EPA model is unusually well documented; for additional references see Bryant, Henderson, Holtham and others (1988, supp. volume, pp. 341-43). Recent simulations with the EPA model are discussed in Edison, Helkie, Marquez, and Tryon (1988), Helliwell (1988c), Brayton and Marquez (1988), and Helliwell, Cockerline, and Lafrance (1988).

determined exchange rates. Beginning in 1988, NIESR and the Centre for Economic Forecasting of the London Business School will be collaborating in the development of GEM.[66]

INTERMOD: The INTERMOD modeling effort, sponsored by the Canadian Department of Finance, is closely related to the MULTIMOD research effort at the International Monetary Fund (see references below). Whereas the early versions of MULTIMOD contained an aggregate four-country region composed of Canada, France, Italy, and the United Kingdom (in addition to separate submodels for Japan, Germany, and the United States), the INTERMOD team of researchers disaggregated that region into four separate submodels. INTERMOD thus contains a submodel for each of the Group of Seven countries. INTERMOD can be simulated with expectations treated either as adaptive or model-consistent.[67]

LINK: Project LINK is the most extensive, and was the earliest, of existing attempts to conduct empirical research on the cross-border linkages among national economies. The project was initiated in the late 1960s by a group that included Lawrence R. Klein, R.J. Ball, Hidekazu Eguchi, R.A. Gordon, Bert G. Hickman, Wilhelm Krelle, Rudolf R. Rhomberg, John A. Sawyer, Petrus J. Verdoorn, Jean Waelbroeck, and Tsunehiko Watanabe.[68] The LINK system contains seventy-nine large individual country and regional models covering in principle the entire world economy. The U.S. model is an earlier version of the U.S. model developed by Wharton Econometric Associates. Models for most of the other industrial countries and a number of developing countries were constructed and are maintained separately by various organizations in the individual countries. Trade-matrix and exchange rate linkages are superimposed on the system at the Project LINK headquarters at the University of Pennsylvania.[69] The LINK system was originally developed for the Bretton Woods adjustable-peg system of exchange rates; subsequent modifications, using

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[66] For references on the model, see Wren-Lewis and Eastwood (1987) and Wren-Lewis and Barrell (1988). The original UK Treasury version is described in Horton (1984).

[67] INTERMOD and its simulation properties are described in Helliwell, Meredith, Bagnoli, and Durand (1988).

[68] Publications summarizing LINK-related research include Ball (1973), Waelbroeck (1976), Sawyer (1979), de Grauwe and Peters (1983), and Hickman (1983, 1988).

[69] For a description of the original trade-linkage system, see Klein and van Peetersson (1973).

purchasing power parity assumptions or official reaction functions, allow for floating exchange rates.[70] In each of the individual models of LINK, expectations are treated adaptively.

LIVERPOOL: The Liverpool model, built and maintained by Patrick Minford and his associates at the University of Liverpool, includes seven small models for the United States, Japan, Germany, France, the United Kingdom, Italy, and Canada, plus trade linkages with several other countries and regions. The model assumes that markets clear continuously. It includes equations specified for the current-account balance (rather than imports and exports separately); imports are thus determined indirectly, as a residual between total expenditures and expenditures on home-produced goods. Expectations are forward-looking and model-consistent. In determining exchange rates, the model imposes a real interest parity condition on real exchange rates.[71]

MCM: The Multicountry Model developed and maintained by the staff of the U.S. Federal Reserve Board consists of five large single-country models for the United States, Canada, Japan, Germany, and the United Kingdom, plus an abbreviated rest-of-world sector. Imports are determined bilaterally, as a function of income and relative prices (including competitors' prices). Exchange rates can be modeled exogenously or endogenously (in the latter case through real interest-parity equations. Expectations are modeled adaptively.[72]

MINIMOD: The MINIMOD model, constructed and maintained by Richard Haas and Paul Masson at the International Monetary Fund, is a small two-region model, with its regions the United States and an aggregation of other OECD countries (representative of Japan, Canada, Germany, and the United Kingdom). Many of the model's parameters were obtained from partial-equilibrium simulations using a version of the Federal Reserve MCM.[73] Exchange rates are determined using an open interest-parity condition. A rational expectations version of the model (with

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70 See Pauly and Petersen (1986).

71 See Minford and others (1984, 1985, forthcoming).

72 The basic volume describing the MCM model is G. Stevens and others (1984). An updated description is given in Edison, Marquez, and Tryon (1987). Recent simulations with the MCM are discussed in Edison, Helkie, Marquez, and Tryon (1988), Helliwell (1988c), Brayton and Marquez (1988), and Helliwell, Cockerline, and Lafrance (1988).

73 The technique is described in Masson (1988).

forward-looking, model-consistent expectations of exchange rates, inflation rates, and long-term interest rates) was used for the simulations produced for this conference.[74]

MPS: The Federal Reserve MPS model is a quarterly model of the U.S. economy maintained by the staff of the Board of Governors of the Federal Reserve System. It stems from research conducted jointly by the Federal Reserve staff and academic economists (particularly Franco Modigliani at MIT and Albert Ando at the University of Pennsylvania). The model emphasizes the channels through which U.S. monetary policy affects the real sectors of the U.S. economy.[75]

MULTIMOD: The MULTI-region econometric MODel of the IMF staff contains separate submodels for each of the three major industrial countries (the United States, Japan, Federal Republic of Germany), the remaining Group of Seven countries taken as an aggregate grouping (Canada, France, Italy, United Kingdom), the smaller industrial countries as a group, and the developing countries. The developing countries are divided into two submodels, the high-income oil exporters and the other developing countries. Trade flows among the regions are disaggregated into three types of goods: oil, primary commodity exports of developing countries, and remaining goods and non-factor services. Expectations for key variables such as interest rates and exchange rates are treated in a forward-looking and model-consistent manner.[76]

MSG: The MSG (McKibbin-Sachs Global) model was developed by Warwick McKibbin and Jeffrey Sachs at Harvard University. Its early versions included five small country and regional models of the United States, Japan, other OECD countries as a single region, OPEC countries, and other

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[74] Haas and Masson (1986) presented results for MINIMOD with and without a model-consistent treatment of expectations. The MINIMOD results used in the sample averages in this paper are the EMIE model-consistent simulations reported in Bryant, Henderson, Holtham, and others (1988).

[75] For references on the MPS model, see Brayton and Mauskopf (1985, 1987) and Anderson and Enzler (1987).

[76] The model is described in Masson, Symansky, and others (1988). Simulations from the model are discussed in Frenkel, Goldstein, and Masson (1988). In the fall of 1988, the MULTIMOD research team at the IMF was considering a change in their model to incorporate separate submodels for each G-7 country (as had already been done in INTERMOD).

developing countries. The model, rather than being estimated independently, takes most of its parameters from other models or from the research literature; the model is calibrated to 1983 trade shares and asset stocks. Imports are determined bilaterally by income and relative prices. Expectations in asset markets are forward-looking and model-consistent, so that long-term interest rates and expected exchange rates are conditioned on the model's solution for the future paths of interest rates and exchange rates. The model specifies asset demand functions in a general portfolio-balance fashion, but the parameter values imposed on the functions make the model behave almost as if assets denominated in different currencies were perfect substitutes.[77]

OECD: The Interlink model system, constructed and maintained by the Economics and Statistics Department of the OECD, consists of models for each of twenty-three OECD countries, plus abbreviated trade sectors for each of six non-OECD regions. The models for major OECD countries are large, while those for smaller countries are medium in scale (roughly 100 equations). Trade linkages are modeled with a modified version of the Samuelson-Kurihara method. Exchange rates are determined by a closed system of equations (FINLINK) based on a portfolio-balance theory of net capital flows. Expectations are modeled adaptively; they depend not only on the current value and past values of the variable in question but also on current and past values of other variables.[78]

TAYLOR: This model, developed and maintained by John Taylor and associates at Stanford University, contains small models for each of seven countries: the United States, Japan, Germany, France, the United Kingdom, Canada, and Italy. Imports are determined as functions of home income and relative prices; exports are determined as functions of relative prices and trade-weighted averages of foreign outputs. The model enforces open interest-parity conditions that assume perfect substitutability between assets denominated in different currencies.

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[77] References on the MSG model include McKibbin and Sachs (1986, 1987), Ishii, McKibbin, and Sachs (1986), McKibbin, Roubini, and Sachs (1987), Sachs and Roubini (1988), and McKibbin (1988).

[78] For an overview of the INTERLINK system, see OECD (1979), Llewellyn, Samuelson, and Potter (1985), and Richardson (1988). FINLINK is described in Holtham (1984). The trade linkages in the OECD model are discussed in Richardson (1987). Recent simulations with the OECD model are discussed in Edison, Helkie, Marquez, and Tryon (1988), Helliwell (1988c), Brayton and Marquez (1988), and Helliwell, Cockerline, and Lafrance (1988).

Expectations about long-term interest rates and exchange rates are forward-looking and model-consistent.[79]

VAR: The Minneapolis World VAR Model is the work of Robert Litterman and Christopher Sims at the University of Minnesota and the Federal Reserve Bank of Minneapolis. It is a vector autoregression of three small regional blocks (fifteen endogenous variables each) for the United States, Japan, and Europe; Europe is represented by an aggregation of Germany, France, and the United Kingdom. The full model also includes several endogenous rest-of-world variables.[80]

WHARTON: The World Model of Wharton Econometrics Forecasting Associates includes twenty-four medium to large models for each of twenty-three OECD countries plus South Africa, together with six regional models for developing countries and centrally planned economies. It uses a modified version of the Samuelson-Kurihara approach to trade linkages. Exchange rates are determined by long-run purchasing-power-parity relationships modified by current-account imbalances. Capital flows and interactions between interest rates and exchange rates are not modeled in the version of the model used for the simulations reported here. Expectations are modeled adaptively.[81]

The EMIE evidence contains simulations for U.S. fiscal and monetary actions for twelve of the above models. The May 1988 Federal Reserve conference generated simulations for U.S. fiscal and monetary actions by seven models, six of which had also run simulations for EMIE.[82] Three further sets of simulations for U.S.

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[79] For initial references, see Taylor (1988, forthcoming).

[80] An abbreviated description of the model and the conceptual perspective that motivated its construction are contained in Sims (1988).

[81] This model is an extension of research carried out by Project LINK at the University of Pennsylvania. An earlier version of the model is described in Johnson (1978). The 1987 version is discussed in Green and Howe (1987).

[82] The simulations of U.S. policy actions generated for the March 1988 EPA symposium were essentially the same results as those reported at the May 1988 conference.

policy actions were available to us, one from MULTIMOD and two from INTERMOD (one with adaptive and the other with model-consistent expectations). Although the various simulations differed in some ways, most were performed with standardized definitions of the policy actions and with roughly comparable baselines. In principle, therefore, 22 simulated time series were available to us (for the two types of policy action, and for each one of a list of key macroeconomic variables).[83]

Adjustments to Simulation Results. Several adjustments were required to the simulations to place them on as comparable a basis as possible. The EMIE simulations were carried out for the six years 1985-90 (base year 1984); the May 1988 conference simulations were run for 1987-92; the MULTIMOD and INTERMOD simulations covered 1988-95. When preparing the sample averages, we adjusted the timing of all the simulations to start them in the same "year 1" (with base

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[83] The data for the EMIE simulations are reported in the supplementary volume of Bryant, Henderson, Holtham, and others (1988). Selected data from the May 1988 simulations are reported in the appendix of Brayton and Marquez (1988); we are grateful to Jaime Marquez and his colleagues for giving us a data tape with the full quarterly details. The MULTIMOD simulations included in our sample averages are taken from Masson, Symansky, and others (1988, Appendix I Tables 11 and 12, pp. 70-71). The INTERMOD adaptive results used in the sample averages are from the appendix tables of Helliwell, Meredith, Bagnoli, and Durand (1988). The consistent expectations fiscal policy results used in the averages differ slightly from those in Helliwell, Meredith, Bagnoli and Durand (1988) because the new results hold the expenditure increase level for six years, while in the earlier paper it was held level for eight years, to match the corresponding MULTIMOD experiments reported in Masson, Symansky and others,(1988). In both cases, the expenditure increase then drops gradually to zero. The INTERMOD experiments reported in sections 4 and 6 involve permanent reductions in spending, with matching decreases in the parameters setting the expected long-run share of government spending in GNP, and the target ratio of government spending to GNP.

period "year 0"). All data for the quarterly and semi-annual models were transformed to annual averages.

The fiscal-policy shocks for most of the simulations had been defined as a reduction of real U.S. government purchases of goods and services equal to 1 percent of baseline U.S. real GNP, maintained throughout the simulation period. In a few cases, modeling groups had defined the shock as a comparably sized fiscal expansion rather than contraction (increase rather than decrease in real government purchases); for such cases, we multiplied the simulation results by minus one, assuming that the underlying model responses are symmetric within the relevant range.[84]

The most serious sources of non-comparability in the simulations stem from differing treatments of monetary policy. For the EMIE experiments, M1 in the United States was specified as the "exogenous" component of monetary policy. For the 1988 Federal Reserve Board and EPA conferences, some modeling groups specified M2 rather than M1 in the United States as the exogenous component of U.S. monetary policy. Key monetary aggregates in other countries, both for the EMIE results and the 1988 conference, were variously M1, M2, or the monetary base. MULTIMOD and INTERMOD use the monetary base (in all countries) as the key monetary aggregate; a target path for this aggregate is specified exogenously, but its actual path is determined endogenously in the short run (given by a reaction function for the monetary authorities that adjusts the

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[84] This assumption needs to be tested in future research. We are not confident that it is broadly valid for all models, even as a rough approximation.

short-term interest rate so as to make actual money equal to targeted money over a long run).[85]

The differences in assumptions about monetary policy across the available simulations make it difficult to interpret the evidence with confidence. It would be analytically preferable to work with simulations all prepared on the basis of fully comparable monetary assumptions. For the time being, however, that option was not open to us.[86]

The sizes of the assumed shocks for U.S. monetary-policy actions also differed somewhat across the simulations. We tried to correct for these differences, when necessary, by adjusting the simulation results. Our calculated sample averages for a U.S. monetary expansion pertain to a raising of the "exogenous" aggregate above baseline by 1 percent throughout the six years of the simulation period. That was the size of the shock specified for the May 1988 Federal Reserve conference, so no adjustments were required in the simulations done for that conference. In the EMIE experiments, the assumed increase above baseline in the exogenous monetary aggregate was 4 percent, but phased in gradually over the

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[85] The MPS model assumes that foreign monetary authorities choose to have foreign interest rates follow U.S. interest rates. In the MPS simulation included in our full sample of simulations, therefore, foreign monetary aggregates were not held unchanged along baseline paths.

[86] The evidence shown in Figure 5-4 of the paper provides little comfort for the presumption that results of simulation experiments are insensitive to whether M1 or M2 is assumed to be the exogenous component of monetary policy.

first year of the simulation period.[87] To make the EMIE results roughly comparable with the more recent simulations, we divided the EMIE results by four (with adjustments varying across the models in the first year depending on how the modeling groups conducted the initial phasing in). In the MULTIMOD monetary simulation, the expansion was a 5 percent increase in (target) money above baseline; the data used in our sample averages are thus one-fifth of the effects shown in the published source.

Definition of Samples. Before calculating statistics for samples of the simulation results, we excluded the EMIE simulations for WHARTON and the Minneapolis VAR. Each of those modeling groups was itself not satisfied with its simulations, either because of errors that were subsequently discovered or because of features of the model no longer believed to be appropriate.[88] We also excluded the EMIE monetary simulations by the MSG model.[89]

For our full sample of the available results, we thus

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[87] For discussion, see Bryant, Henderson, Holtham, and others (1988, supplementary volume, pp. 8, 12-13).

[88] The version of the WHARTON model used for the EMIE simulations differed from all the other models in not modeling international capital movements explicitly. Because capital flows could not respond to interest rates, a U.S. fiscal contraction caused the dollar to appreciate rather than depreciate. After the EMIE conference, the WHARTON model was altered to modify this feature; see Green and Howe (1987).

[89] When carrying out the EMIE monetary simulations, the MSG modeling group raised the U.S. money stock by 4 percent above baseline throughout the first year rather than phasing in the 4 percent gradually. Given that model's features, its first-year responses were extreme. Inclusion of the MSG monetary results in sample statistics strongly affects the results, but in a misleading way. For further discussion of the EMIE monetary results for the MSG model, see Bryant, Henderson, Holtham, and others (1988, pp. 38-44).

typically used 20 time series for a U.S. fiscal contraction and 19 time series for a U.S. monetary expansion. Slightly fewer time series were available for some of the foreign-spillover variables. For example, not every model participating in the EMIE simulations reported separate data for Japan and Germany. It was not possible to compute weighted averages for the aggregate of ROECD countries for some of the simulations prepared for the 1988 Federal Reserve conference.

Tables A-1 and A-2 provide the underlying data for the responses of two key variables, U.S. real GNP and the exchange value of the U.S. dollar, to a U.S. fiscal contraction (cut in purchases). Tables A-3 and A-4 show analogous data for the responses of U.S. real GNP and the U.S. current-account balance to a U.S. monetary expansion.

Inspection of Tables A-1 through A-4 reveals considerable diversity in the simulated results. Much of this diversity reflects fundamental uncertainty that can be diminished only by further empirical research. In the case of some particular models, however, outlier simulations can be traced to unusual properties that are, on the basis of already existing knowledge, suspected of being problematic. Analysts and policymakers seldom wish to give equal weight to every piece of information bearing on an analytical issue. When preparing this review, we were reluctant to exclude some of the evidence altogether. At the same time, we felt uncomfortable showing statistics for only the full sample of simulation results. Our compromise solution is to show statistics for a partial sample as well as the full sample.

Our partial sample is a subset of 12 of the 20 times series included in the full sample (12 out of the 19 for U.S. monetary expansion). The series in the partial sample, with labels corresponding to those used in Tables A-1 through A-4, are: DRI (EMIE); EEC (EMIE); INTERMOD adaptive; INTERMOD model-consistent; MCM (EMIE); MCM (1988 FR); MINIMOD (EMIE); MULTIMOD; OECD (EMIE); OECD (1988 FR); TAYLOR (EMIE); and TAYLOR (1988 FR).

For the full sample, Tables A-5 (U.S. fiscal contraction) and A-6 (U.S. monetary expansion) present means, standard deviations, and ranges (maximum value less minimum value) for key macroeconomic variables. Analogous data for the partial sample are shown in Tables A-7 and A-8. All the data plotted in Figures 2-1 and 3-1 in the text are taken from these four tables.

To give the reader another perspective on the data shown in Figures 2-1 and 3-1, we include four additional charts emphasizing the diversity of the results across models. These charts plot not only the sample means and intervals for plus and minus one standard deviation, but also (with small dots in the background) the data for the individual simulation results. For example, Figure A-1 -- the simulated effects of a U.S. fiscal contraction on U.S. real GNP -- repeats the information in the top left panel of Figure 2-1 but also plots the responses of each series making up the sample averages. Readers can identify the individual series by consulting Table A-1. Figures A-2 through A-4, constructed in a similar way, make use of the individual model series in Tables A-2 through A-4.

Sections 4, 5, and 6

The remainder of the appendix gives actual data used in preparing the charts in sections 4 through 6 of the paper. Table A-9 supplies data for Figure 4-1, Table A-10 for Figure 5-1, and so on.

(Appendix charts and tables
appear following the list of references)

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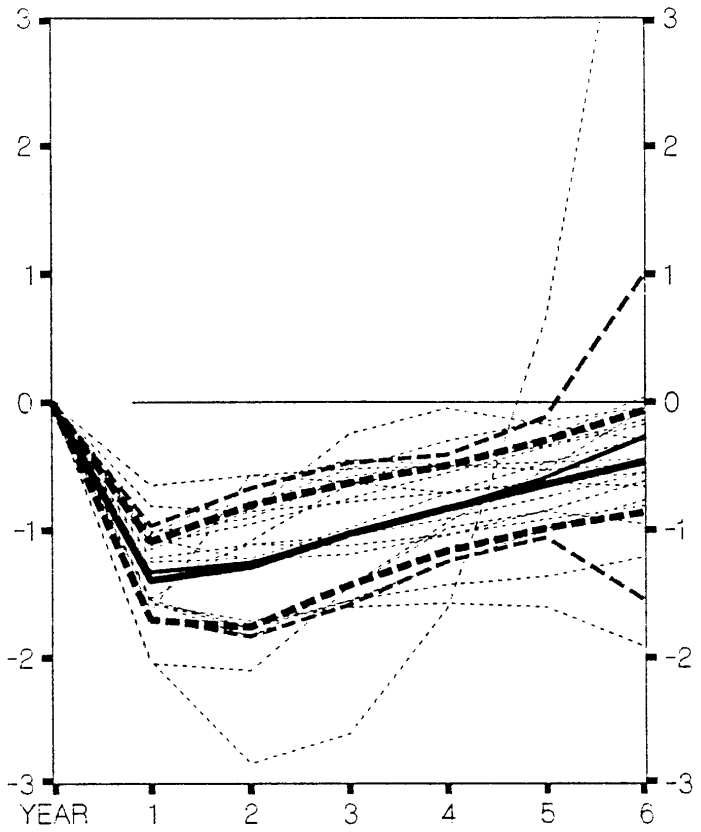
Figure A-1

EFFECTS ON U.S. REAL GNP OF A U.S. FISCAL CONTRACTION

(Percent Deviation from Baseline)



Reduction below baseline in real U.S. government purchases equal to 1% of baseline U.S. real GNP, maintained throughout 6 years of simulation.

Average for partial sample (12 series)

Average response for partial sample plus or minus 1 standard deviation

Average for full sample (20 series)

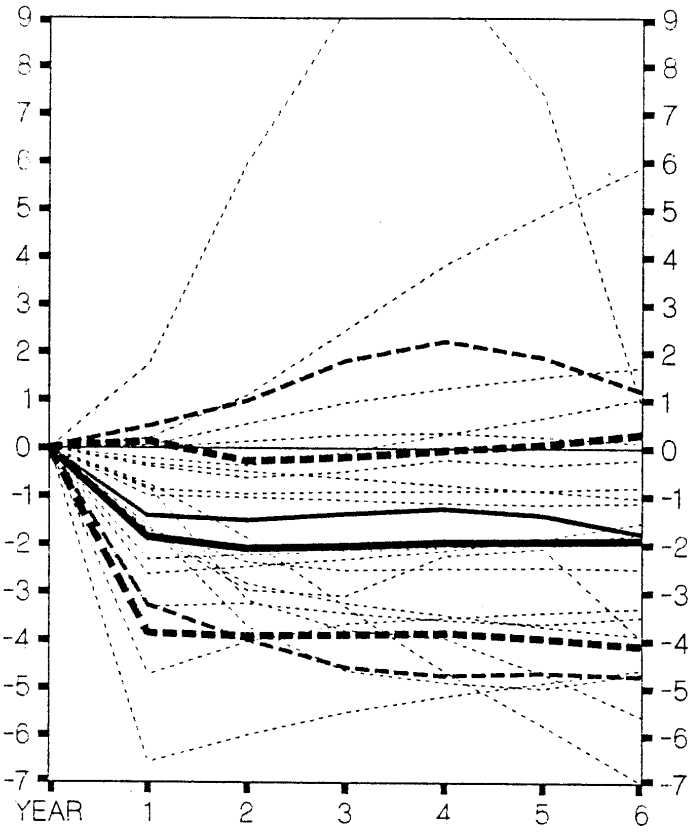
Average response for full sample plus or minus 1 standard deviation

Individual simulation results

Figure A-2

EFFECTS ON EXCHANGE VALUE OF U.S. DOLLAR OF A U.S. FISCAL CONTRACTION

(Percent Deviation from Baseline; Depreciation = -)



Reduction below baseline in real U.S. government purchases equal to 1% of baseline U.S. real GNP, maintained throughout 6 years of simulation.

Average for partial sample (12 series)

Average response for partial sample plus or minus 1 standard deviation

Average for full sample (20 series)

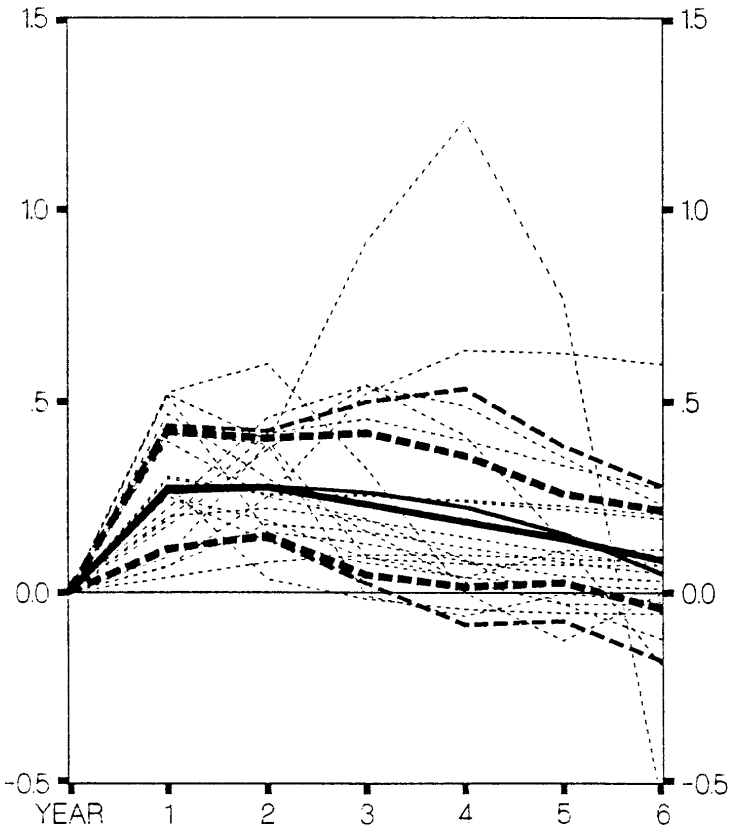
Average response for full sample plus or minus 1 standard deviation

Individual simulation results

Figure A-3

EFFECTS ON U.S. REAL GNP OF U.S. MONETARY EXPANSION

(Percent Deviation from Baseline)



Increase of money stock above baseline by 1 percent, maintained throughout the six years of simulation period.

Average for partial sample (12 series)

Average response for partial sample plus or minus 1 standard deviation

Average for full sample (20 series)

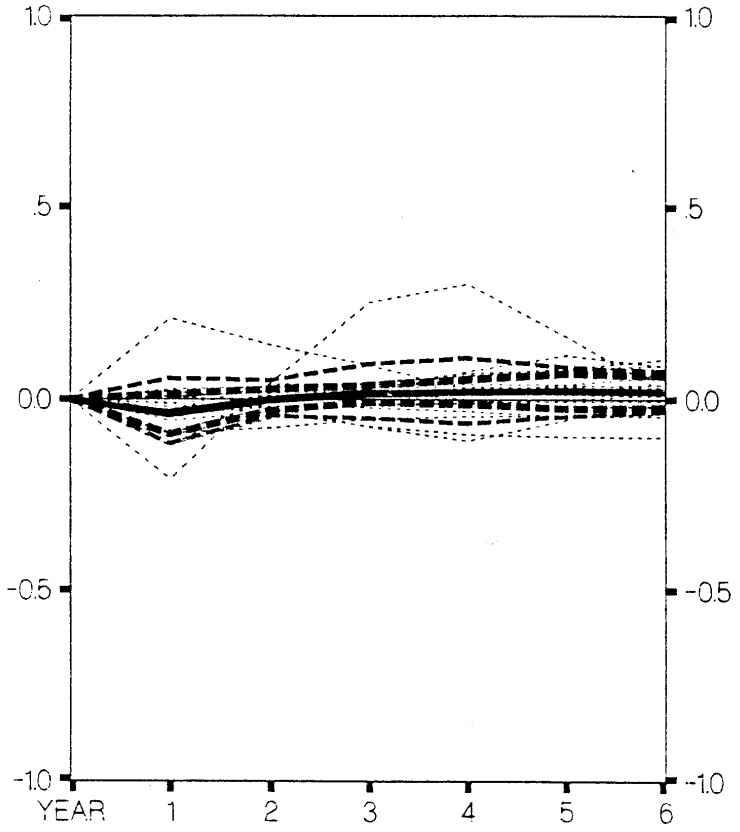
Average response for full sample plus or minus 1 standard deviation

Individual simulation results

Figure A-4

EFFECTS ON U.S. CURRENT ACCOUNT BALANCE OF U.S. MONETARY EXPANSION

(Deviation from Baseline as Percent of Baseline Nominal GNP)



Increase of money stock above baseline by 1 percent, maintained throughout the six years of simulation period.

Average for partial sample (12 series)

Average response for partial sample plus or minus 1 standard deviation

Average for full sample (20 series)

Average response for full sample plus or minus 1 standard deviation

Individual simulation results

Table A-1

INDIVIDUAL SIMULATION RESULTS: EFFECTS ON U.S. REAL GNP OF A U.S. FISCAL CONTRACTION*

(Percent Deviation from Baseline)

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
DRI (EMIE)	-2.049	-2.103	-1.444	-0.980	-0.853	-0.957
EEC (EMIE)	-1.340	-1.245	-1.049	-0.850	-0.645	-0.446
EPA (EMIE)	-1.578	-1.710	-1.605	-1.575	-1.604	-1.916
EPA (1988 FR)	-1.406	-1.111	-1.118	-1.034	-0.917	-0.809
GEM (1988 FR)	-1.150	-0.850	-0.250	-0.050	-0.175	-0.300
INTERMOD ADAPTIVE	-1.550	-1.760	-1.550	-1.260	-0.990	-0.760
INTERMOD CONSISTENT	-1.220	-1.110	-1.050	-0.910	-0.740	-0.550
LINK (EMIE)	-1.247	-1.219	-0.983	-0.709	-0.474	-0.282
LINK (1988 FR)	-1.030	-0.660	-0.450	-0.490	-0.530	-0.480
LIVERPOOL (EMIE)	-0.653	-0.573	-0.523	-0.498	-0.471	-0.447
MCM (EMIE)	-1.564	-1.838	-1.434	-0.936	-0.522	-0.057
MCM (1988 FR)	-1.565	-1.773	-1.552	-1.429	-1.366	-1.212
MINIMOD (EMIE)	-1.106	-0.953	-0.753	-0.552	-0.353	-0.173
MPS (1988 FR)	-2.031	-2.838	-2.601	-1.612	0.648	4.822
MULTIMOD	-1.064	-1.232	-1.188	-1.040	-0.846	-0.616
MSG (EMIE)	-0.811	-0.855	-0.780	-0.703	-0.621	-0.552
OECD (EMIE)	-1.536	-1.082	-0.637	-0.510	-0.275	0.043
OECD (1988 FR)	-1.012	-0.907	-0.578	-0.476	-0.339	-0.136
TAYLOR (EMIE)	-1.636	-0.567	-0.626	-0.711	-0.626	-0.657
TAYLOR (1988 FR)	-1.120	-0.804	-0.520	-0.303	-0.147	-0.046

*Reduction below baseline in real U.S. government purchases of goods and services equal to 1 percent of baseline U.S. real GNP, maintained throughout the six years of simulation period.

Table A-2

INDIVIDUAL SIMULATION RESULTS: EFFECTS ON EXCHANGE VALUE OF U.S. DOLLAR OF A U.S. FISCAL CONTRACTION*

(Percent Deviation from Baseline; Depreciation = -)

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
DRI (EMIE)	-0.809	-3.176	-3.786	-3.951	-4.699	-5.612
EEC (EMIE)	-0.385	-0.623	-0.487	-0.239	-0.352	-0.238
EPA (EMIE)	-0.744	-1.878	-3.305	-4.645	-5.791	-7.010
EPA (1988 FR)	-1.623	-3.719	-4.638	-4.885	-5.003	-4.678
GEM (1988 FR)	-1.750	-2.975	-3.075	-2.225	-2.075	-3.975
INTERMOD ADAPTIVE	-0.330	-0.500	-0.630	-0.760	-0.890	-1.040
INTERMOD CONSISTENT	-2.630	-2.470	-2.310	-2.120	-1.870	-1.540
LINK (EMIE)	0.008	0.138	0.276	0.320	0.240	0.107
LINK (1988 FR)	0.190	1.100	2.470	3.830	4.900	5.900
LIVERPOOL (EMIE)	-0.864	-0.954	-0.906	-0.887	-0.879	-0.812
MCM (EMIE)	-1.723	-2.831	-3.230	-3.466	-3.703	-3.899
MCM (1988 FR)	-1.706	-2.379	-2.541	-2.496	-2.474	-2.499
MINIMOD (EMIE)	-0.995	-1.039	-1.085	-1.133	-1.169	-1.137
MPS (1988 FR)	1.740	6.009	9.224	9.969	7.400	0.835
MULTIMOD	-2.320	-2.232	-2.149	-2.060	-1.947	-1.786
MSG (EMIE)	-3.311	-3.242	-3.434	-3.571	-3.652	-3.501
OECD (EMIE)	-0.217	-0.379	-0.082	0.293	0.638	1.041
OECD (1988 FR)	0.048	0.501	0.945	1.239	1.494	1.692
TAYLOR (EMIE)	-4.727	-4.032	-3.648	-3.520	-3.413	-3.309
TAYLOR (1988 FR)	-6.572	-5.999	-5.512	-5.170	-4.885	-4.602

*Reduction below baseline in real U.S. government purchases of goods and services equal to 1 percent of baseline U.S. real GNP, maintained throughout the six years of simulation period.

Table A-3

INDIVIDUAL SIMULATION RESULTS: EFFECTS ON U.S. REAL GNP OF A U.S. MONETARY EXPANSION*

(Percent Deviation from Baseline)

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
DRI (EMIE)	0.222	0.460	0.545	0.412	0.134	-0.194
EEC (EMIE)	0.300	0.255	0.253	0.243	0.228	0.205
EPA (EMIE)	0.397	0.251	0.194	0.086	-0.030	-0.122
EPA (1988 FR)	0.251	0.190	0.090	0.076	0.073	0.071
GEM (1988 FR)	0.525	0.600	0.325	0.000	-0.125	0.000
INTERMOD ADAPTIVE	0.040	0.080	0.100	0.100	0.090	0.080
INTERMOD CONSISTENT	0.070	0.180	0.160	0.120	0.080	0.050
LINK (EMIE)	0.067	0.252	0.524	0.634	0.627	0.598
LINK (1988 FR)	0.470	0.300	0.160	0.030	-0.030	-0.030
LIVERPOOL (EMIE)	0.283	0.035	-0.017	-0.043	-0.053	-0.055
MCM (EMIE)	0.176	0.377	0.543	0.490	0.354	0.229
MCM (1988 FR)	0.193	0.418	0.457	0.400	0.333	0.270
MINIMOD (EMIE)	0.306	0.259	0.257	0.239	0.218	0.194
MPS (1988 FR)	0.094	0.393	0.917	1.230	0.767	-0.575
MULTIMOD	0.201	0.222	0.190	0.146	0.105	0.072
OECD (EMIE)	0.520	0.400	0.094	0.040	0.112	0.114
OECD (1988 FR)	0.421	0.389	-0.009	-0.061	-0.002	-0.025
TAYLOR (EMIE)	0.517	0.158	0.128	0.083	0.044	0.031
TAYLOR (1988 FR)	0.254	0.134	0.078	0.041	0.021	0.011

*Increase of Money Stock above baseline by 1 percent, maintained throughout the six years of simulation period.

Table A-4

INDIVIDUAL SIMULATION RESULTS: EFFECTS ON U.S. CURRENT ACCOUNT BALANCE OF A U.S. MONETARY EXPANSION*

(Deviation from Baseline as Percent of Baseline Nominal GNP)

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
DRI (EMIE)	0.022	-0.008	0.018	0.075	0.116	0.087
EEC (EMIE)	-0.019	-0.017	-0.021	-0.030	-0.043	-0.043
EPA (EMIE)	0.009	-0.008	0.011	0.020	0.040	0.061
EPA (1988 FR)	-0.036	0.015	0.045	0.069	0.081	0.105
GEM (1988 FR)	-0.210	0.046	0.253	0.301	0.164	0.019
INTERMOD ADAPTIVE	-0.010	0.010	0.020	0.030	0.030	0.030
INTERMOD CONSISTENT	-0.030	0.040	0.040	0.040	0.040	0.030
LINK (EMIE)	-0.012	-0.036	-0.070	-0.091	-0.097	-0.098
LINK (1988 FR)	0.211	0.142	0.090	0.027	0.012	0.010
LIVERPOOL (EMIE)	-0.089	-0.075	-0.052	-0.043	-0.041	-0.037
MCM (EMIE)	-0.044	-0.018	-0.011	-0.010	0.002	0.011
MCM (1988 FR)	0.008	0.017	0.022	0.028	0.035	0.038
MINIMOD (EMIE)	-0.122	0.016	0.044	0.064	0.078	0.090
MPS (1988 FR)	-0.009	-0.024	-0.073	-0.108	-0.053	0.086
MULTIMOD	0.027	0.032	0.034	0.034	0.032	0.027
OECD (EMIE)	-0.120	-0.051	0.011	-0.001	-0.017	-0.017
OECD (1988 FR)	-0.091	-0.006	0.023	0.001	-0.015	-0.019
TAYLOR (1988 FR)	-0.056	-0.032	-0.015	-0.008	-0.005	-0.004

*Increase of money stock above baseline by 1 percent, maintained throughout the six years of simulation period.

Table A-5

FULL SAMPLE:
AVERAGES, STANDARD DEVIATIONS, AND RANGES FOR SIMULATED EFFECTS
OF A U.S. FISCAL CONTRACTION*

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
U.S. REAL GNP (Percent Deviation from Baseline)						
Mean	-1.333	-1.260	-1.035	-0.831	-0.592	-0.277
Standard Deviation	0.363	0.580	0.554	0.417	0.471	1.283
Range	1.396	2.271	2.351	1.562	2.252	6.738
U.S. PRICE LEVEL (Percent Deviation from Baseline)						
Mean	-0.135	-0.575	-1.147	-1.791	-2.445	-3.044
Standard Deviation	0.148	0.380	0.837	1.485	2.172	2.643
Range	0.664	1.469	3.465	6.240	9.077	10.505
U.S. SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.687	-1.064	-1.270	-1.498	-1.747	-1.964
Standard Deviation	0.411	0.727	0.938	1.178	1.401	1.578
Range	1.357	2.540	3.524	4.436	5.011	5.848
U.S. LONG-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.495	-0.812	-1.021	-1.217	-1.412	-1.618
Standard Deviation	0.573	0.627	0.720	0.874	1.063	1.283
Range	2.500	2.655	2.738	2.725	3.523	4.478
U.S. GOVERNMENT BUDGET BALANCE (Deviation from Baseline as Percent of Baseline Nominal GNP)						
Mean	0.578	0.583	0.767	0.941	1.104	1.281
Standard Deviation	0.249	0.249	0.258	0.346	0.454	0.634
Range	0.947	0.856	1.023	1.472	1.930	2.499
WEIGHTED AVERAGE EXCHANGE VALUE OF U.S. DOLLAR (Percent Deviation from Baseline)						
Mean	-1.436	-1.534	-1.395	-1.274	-1.407	-1.803
Standard Deviation	1.856	2.483	3.199	3.486	3.292	2.967
Range	8.312	12.008	14.736	15.139	13.191	12.910
U.S. CURRENT BALANCE (Deviation from Baseline as Percent of Baseline Nominal GNP)						
Mean	0.240	0.334	0.370	0.400	0.431	0.471
Standard Deviation	0.117	0.154	0.186	0.219	0.282	0.369
Range	0.422	0.556	0.712	0.777	0.998	1.465

(Table A-5 continued)

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
JAPANESE REAL GNP (Percent Deviation from Baseline)						
Mean	-0.321	-0.568	-0.632	-0.654	-0.714	-0.846
Standard Deviation	0.194	0.432	0.569	0.730	0.975	1.336
Range	0.645	1.468	1.743	2.590	3.650	5.103
JAPANESE PRICE LEVEL (Percent Deviation from Baseline)						
Mean	-0.133	-0.395	-0.664	-0.941	-1.207	-1.471
Standard Deviation	0.170	0.349	0.576	0.894	1.242	1.559
Range	0.730	1.082	1.951	3.104	4.334	5.396
JAPANESE SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.146	-0.350	-0.445	-0.503	-0.562	-0.635
Standard Deviation	0.136	0.282	0.343	0.393	0.484	0.605
Range	0.500	0.920	1.240	1.530	1.830	2.230
GERMAN REAL GNP (Percent Deviation from Baseline)						
Mean	-0.247	-0.480	-0.516	-0.526	-0.528	-0.521
Standard Deviation	0.291	0.714	0.831	1.086	1.331	1.539
Range	1.318	3.064	3.448	5.229	6.520	7.579
GERMAN PRICE LEVEL (Percent Deviation from Baseline)						
Mean	-0.138	-0.401	-0.673	-0.944	-1.215	-1.499
Standard Deviation	0.118	0.310	0.554	0.833	1.119	1.413
Range	0.345	1.073	2.056	3.176	4.357	5.486
GERMAN SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.196	-0.332	-0.375	-0.423	-0.502	-0.559
Standard Deviation	0.205	0.307	0.270	0.263	0.315	0.376
Range	0.797	1.125	1.040	0.920	0.916	1.070
ROECD REAL GNP (Percent Deviation from Baseline)						
Mean	-0.239	-0.390	-0.463	-0.489	-0.523	-0.574
Standard Deviation	0.162	0.250	0.403	0.569	0.744	0.961
Range	0.648	0.917	1.599	2.263	2.927	3.682
ROECD PRICE LEVEL (Percent Deviation from Baseline)						
Mean	-0.142	-0.397	-0.708	-1.015	-1.323	-1.629
Standard Deviation	0.135	0.303	0.554	0.866	1.189	1.496
Range	0.412	1.102	2.093	3.257	4.470	5.626
ROECD SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.186	-0.374	-0.501	-0.608	-0.731	-0.860
Standard Deviation	0.147	0.282	0.365	0.426	0.517	0.641
Range	0.440	0.880	1.260	1.530	1.890	2.350

*Reduction below baseline in real U.S. government purchases of goods and services equal to 1 percent of baseline U.S. real GNP, maintained throughout the six years of simulation period.

Table A-6

FULL SAMPLE:
AVERAGES, STANDARD DEVIATIONS, AND RANGES FOR SIMULATED EFFECTS
OF A U.S. MONETARY EXPANSION*

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
U.S. REAL GNP (Percent Deviation from Baseline)						
Mean	0.279	0.282	0.263	0.225	0.155	0.049
Standard Deviation	0.159	0.142	0.238	0.309	0.229	0.228
Range	0.485	0.565	0.934	1.291	0.892	1.173
U.S. PRICE LEVEL (Percent Deviation from Baseline)						
Mean	0.130	0.230	0.349	0.466	0.586	0.686
Standard Deviation	0.207	0.272	0.331	0.381	0.518	0.704
Range	0.923	1.023	1.237	1.300	2.332	3.318
U.S. SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.685	-0.259	-0.175	-0.119	-0.087	-0.116
Standard Deviation	0.539	0.275	0.270	0.385	0.522	0.486
Range	2.003	0.949	1.105	1.836	2.600	2.495
U.S. LONG-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.239	-0.202	-0.190	-0.161	-0.117	-0.099
Standard Deviation	0.205	0.183	0.181	0.209	0.282	0.353
Range	0.744	0.638	0.594	0.746	1.321	1.749
U.S. GOVERNMENT BUDGET BALANCE (Deviation from Baseline as Percent of Baseline Nominal GNP)						
Mean	0.174	0.212	0.226	0.222	0.238	0.295
Standard Deviation	0.179	0.175	0.179	0.224	0.365	0.620
Range	0.675	0.726	0.650	0.986	1.611	2.665
WEIGHTED AVERAGE EXCHANGE VALUE OF U.S. DOLLAR (Percent Deviation from Baseline)						
Mean	-1.517	-1.300	-1.305	-1.157	-0.954	-0.785
Standard Deviation	1.495	1.331	1.146	0.899	0.814	0.609
Range	6.270	5.705	4.745	4.480	3.490	2.493
U.S. CURRENT BALANCE (Deviation from Baseline as Percent of Baseline Nominal GNP)						
Mean	-0.032	0.002	0.020	0.022	0.020	0.021
Standard Deviation	0.086	0.047	0.072	0.086	0.064	0.053
Range	0.421	0.217	0.326	0.409	0.261	0.203

(Table A-6 continued)

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
JAPANESE REAL GNP (Percent Deviation from Baseline)						
Mean	-0.068	-0.120	-0.149	-0.130	-0.088	-0.060
Standard Deviation	0.140	0.177	0.200	0.164	0.187	0.277
Range	0.562	0.707	0.727	0.574	0.718	1.201
JAPANESE PRICE LEVEL (Percent Deviation from Baseline)						
Mean	-0.106	-0.110	-0.135	-0.143	-0.125	-0.108
Standard Deviation	0.125	0.160	0.171	0.175	0.173	0.163
Range	0.422	0.500	0.572	0.637	0.571	0.531
JAPANESE SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.069	-0.066	-0.078	-0.078	-0.050	-0.020
Standard Deviation	0.106	0.118	0.137	0.121	0.078	0.121
Range	0.433	0.470	0.477	0.410	0.310	0.635
GERMAN REAL GNP (Percent Deviation from Baseline)						
Mean	-0.046	-0.068	-0.083	-0.093	-0.086	-0.072
Standard Deviation	0.189	0.180	0.174	0.225	0.236	0.273
Range	0.764	0.717	0.775	0.982	0.959	1.291
GERMAN PRICE LEVEL (Percent Deviation from Baseline)						
Mean	-0.075	-0.111	-0.161	-0.208	-0.220	-0.199
Standard Deviation	0.073	0.121	0.226	0.329	0.367	0.325
Range	0.232	0.375	0.789	1.238	1.470	1.322
GERMAN SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.052	-0.050	-0.086	-0.118	-0.100	-0.064
Standard Deviation	0.149	0.090	0.143	0.178	0.159	0.161
Range	0.600	0.319	0.557	0.605	0.620	0.680
ROECD REAL GNP (Percent Deviation from Baseline)						
Mean	-0.016	-0.043	-0.053	-0.051	-0.056	-0.066
Standard Deviation	0.055	0.073	0.088	0.101	0.115	0.130
Range	0.192	0.237	0.306	0.371	0.395	0.416
ROECD PRICE LEVEL (Percent Deviation from Baseline)						
Mean	-0.055	-0.071	-0.107	-0.128	-0.128	-0.116
Standard Deviation	0.057	0.093	0.160	0.183	0.157	0.144
Range	0.183	0.327	0.578	0.659	0.549	0.421
ROECD SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.084	-0.064	-0.069	-0.075	-0.071	-0.064
Standard Deviation	0.084	0.085	0.097	0.100	0.085	0.072
Range	0.222	0.272	0.323	0.331	0.272	0.198

*Increase of Money Stock above baseline by 1 percent, maintained throughout the six years of simulation period.

Table A-7

PARTIAL SAMPLE:
AVERAGES, STANDARD DEVIATIONS, AND RANGES FOR SIMULATED EFFECTS OF A U.S. FISCAL CONTRACTION*

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
U.S. REAL GNP (Percent Deviation from Baseline)						
Mean	-1.397	-1.281	-1.032	-0.830	-0.642	-0.464
Standard Deviation	0.307	0.478	0.400	0.334	0.345	0.399
Range	1.037	1.536	1.032	1.126	1.219	1.255
U.S. PRICE LEVEL (Percent Deviation from Baseline)						
Mean	-0.153	-0.604	-1.166	-1.791	-2.428	-3.069
Standard Deviation	0.139	0.323	0.613	1.021	1.521	2.056
Range	0.496	1.111	1.988	3.346	4.918	6.528
U.S. SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.675	-1.024	-1.140	-1.297	-1.484	-1.661
Standard Deviation	0.331	0.571	0.613	0.692	0.806	0.907
Range	0.936	1.478	1.660	1.808	2.163	2.587
U.S. LONG-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.367	-0.645	-0.816	-0.938	-1.060	-1.186
Standard Deviation	0.217	0.313	0.449	0.564	0.683	0.807
Range	0.729	0.995	1.270	1.562	1.741	2.018
U.S. GOVERNMENT BUDGET BALANCE (Deviation from Baseline as Percent of Baseline Nominal GNP)						
Mean	0.615	0.644	0.850	1.013	1.161	1.321
Standard Deviation	0.212	0.210	0.210	0.316	0.443	0.568
Range	0.614	0.560	0.653	1.009	1.575	2.079
WEIGHTED AVERAGE EXCHANGE VALUE OF U.S. DOLLAR (Percent Deviation from Baseline)						
Mean	-1.864	-2.097	-2.043	-1.949	-1.939	-1.911
Standard Deviation	2.000	1.820	1.846	1.899	2.012	2.199
Range	6.620	6.500	6.457	6.409	6.379	7.304
U.S. CURRENT ACCOUNT BALANCE (Deviation from Baseline as Percent of Baseline Nominal GNP)						
Mean	0.238	0.320	0.354	0.396	0.442	0.501
Standard Deviation	0.095	0.121	0.141	0.167	0.211	0.264
Range	0.281	0.460	0.496	0.639	0.806	0.986

(Table A-7 continued)

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR6
JAPANESE REAL GNP (Percent Deviation from Baseline)						
Mean	-0.392	-0.717	-0.772	-0.711	-0.690	-0.742
Standard Deviation	0.149	0.351	0.451	0.510	0.613	0.802
Range	0.407	0.995	1.157	1.441	1.695	2.538
JAPANESE PRICE LEVEL (Percent Deviation from Baseline)						
Mean	-0.107	-0.378	-0.746	-1.119	-1.461	-1.765
Standard Deviation	0.141	0.359	0.650	1.018	1.415	1.771
Range	0.461	1.082	1.758	2.686	3.791	4.800
JAPANESE SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.157	-0.392	-0.491	-0.514	-0.536	-0.576
Standard Deviation	0.113	0.233	0.246	0.210	0.220	0.261
Range	0.415	0.628	0.750	0.625	0.660	0.787
GERMAN REAL GNP (Percent Deviation from Baseline)						
Mean	-0.224	-0.342	-0.380	-0.387	-0.357	-0.312
Standard Deviation	0.106	0.108	0.172	0.260	0.292	0.337
Range	0.288	0.351	0.528	0.704	0.804	1.053
GERMAN PRICE LEVEL (Percent Deviation from Baseline)						
Mean	-0.155	-0.467	-0.821	-1.158	-1.495	-1.826
Standard Deviation	0.131	0.310	0.561	0.865	1.161	1.404
Range	0.332	0.829	1.505	2.353	3.208	3.999
GERMAN SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.249	-0.409	-0.455	-0.502	-0.600	-0.686
Standard Deviation	0.233	0.334	0.261	0.218	0.259	0.319
Range	0.797	1.105	0.900	0.760	0.680	0.864
ROECD REAL GNP (Percent Deviation from Baseline)						
Mean	-0.244	-0.428	-0.478	-0.459	-0.444	-0.440
Standard Deviation	0.093	0.163	0.193	0.222	0.257	0.355
Range	0.277	0.449	0.590	0.711	0.852	1.070
ROECD PRICE LEVEL (Percent Deviation from Baseline)						
Mean	-0.137	-0.423	-0.793	-1.161	-1.533	-1.881
Standard Deviation	0.121	0.325	0.604	0.937	1.262	1.540
Range	0.370	0.961	1.773	2.655	3.498	4.215
ROECD SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.155	-0.316	-0.417	-0.500	-0.591	-0.688
Standard Deviation	0.115	0.208	0.229	0.244	0.270	0.295
Range	0.335	0.630	0.715	0.800	0.895	0.945

*Reduction below baseline in real U.S. government purchases of goods and services equal to 1 percent of baseline U.S. real GNP, maintained throughout the six years of simulation period.

Table A-8

PARTIAL SAMPLE:
AVERAGES, STANDARD DEVIATIONS, AND RANGES FOR SIMULATED EFFECTS
OF A U.S. MONETARY EXPANSION*

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
U.S. REAL GNP (Percent Deviation from Baseline)						
Mean	0.268	0.278	0.233	0.188	0.143	0.086
Standard Deviation	0.155	0.127	0.186	0.171	0.116	0.129
Range	0.480	0.380	0.554	0.552	0.356	0.464
U.S. PRICE LEVEL (Percent Deviation from Baseline)						
Mean	0.089	0.199	0.331	0.452	0.562	0.645
Standard Deviation	0.076	0.173	0.234	0.260	0.271	0.263
Range	0.236	0.622	0.861	0.988	1.053	0.991
U.S. SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.798	-0.234	-0.174	-0.154	-0.121	-0.107
Standard Deviation	0.590	0.248	0.201	0.169	0.155	0.164
Range	1.731	0.776	0.735	0.623	0.541	0.541
U.S. LONG-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.241	-0.172	-0.150	-0.126	-0.094	-0.079
Standard Deviation	0.207	0.181	0.159	0.142	0.109	0.116
Range	0.706	0.562	0.527	0.527	0.357	0.362
U.S. GOVERNMENT BUDGET BALANCE (Deviation from Baseline as Percent of Baseline Nominal GNP)						
Mean	0.124	0.184	0.191	0.172	0.157	0.144
Standard Deviation	0.118	0.118	0.114	0.103	0.101	0.124
Range	0.366	0.291	0.308	0.271	0.281	0.362
WEIGHTED AVERAGE EXCHANGE VALUE OF U.S. DOLLAR (Percent Deviation from Baseline)						
Mean	-1.465	-1.126	-1.188	-1.176	-1.059	-0.939
Standard Deviation	1.045	0.876	1.035	0.905	0.486	0.332
Range	3.268	3.396	3.985	3.510	1.825	1.289
U.S. CURRENT BALANCE (Deviation from Baseline as Percent of Baseline Nominal GNP)						
Mean	-0.039	-0.002	0.015	0.020	0.023	0.021
Standard Deviation	0.053	0.028	0.022	0.033	0.046	0.042
Range	0.149	0.091	0.065	0.105	0.160	0.133

(Table A-8 continued)

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
JAPANESE REAL GNP (Percent Deviation from Baseline)						
Mean	-0.076	-0.128	-0.145	-0.126	-0.103	-0.099
Standard Deviation	0.152	0.219	0.228	0.184	0.164	0.186
Range	0.502	0.707	0.727	0.562	0.418	0.486
JAPANESE PRICE LEVEL (Percent Deviation from Baseline)						
Mean	-0.028	-0.039	-0.056	-0.068	-0.070	-0.062
Standard Deviation	0.035	0.026	0.050	0.073	0.107	0.146
Range	0.114	0.090	0.140	0.252	0.354	0.531
JAPANESE SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.055	-0.051	-0.055	-0.052	-0.038	-0.019
Standard Deviation	0.125	0.126	0.115	0.080	0.042	0.043
Range	0.433	0.470	0.419	0.272	0.131	0.157
GERMAN REAL GNP (Percent Deviation from Baseline)						
Mean	0.027	0.013	-0.022	-0.044	-0.046	-0.048
Standard Deviation	0.052	0.049	0.030	0.079	0.124	0.145
Range	0.178	0.154	0.095	0.231	0.400	0.476
GERMAN PRICE LEVEL (Percent Deviation from Baseline)						
Mean	-0.056	-0.089	-0.137	-0.179	-0.192	-0.165
Standard Deviation	0.077	0.120	0.240	0.350	0.395	0.339
Range	0.232	0.369	0.789	1.168	1.357	1.207
GERMAN SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.029	-0.023	-0.052	-0.095	-0.095	-0.075
Standard Deviation	0.174	0.062	0.075	0.148	0.187	0.181
Range	0.600	0.229	0.233	0.484	0.620	0.658
ROECD REAL GNP (Percent Deviation from Baseline)						
Mean	-0.017	-0.046	-0.050	-0.042	-0.043	-0.052
Standard Deviation	0.059	0.083	0.089	0.086	0.089	0.102
Range	0.192	0.237	0.306	0.316	0.315	0.329
ROECD PRICE LEVEL (Percent Deviation from Baseline)						
Mean	-0.059	-0.081	-0.119	-0.137	-0.126	-0.094
Standard Deviation	0.064	0.105	0.182	0.207	0.172	0.136
Range	0.183	0.327	0.572	0.650	0.549	0.376
ROECD SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Mean	-0.070	-0.064	-0.073	-0.078	-0.073	-0.064
Standard Deviation	0.077	0.092	0.106	0.108	0.091	0.074
Range	0.185	0.272	0.323	0.331	0.272	0.198

*Increase of money stock above baseline by 1 percent, maintained throughout the six years of simulation period.

Table A-9

DATA FOR FIGURE 4-1: SIMULATED EFFECTS FOR A U.S. FISCAL CONTRACTION WITH ALTERNATIVE TREATMENTS OF EXPECTATIONS*

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
U.S. REAL GNP (Percent Deviation from Baseline)						
Adaptive	-1.54	-1.72	-1.48	-1.15	-0.84	-0.40
Model Consistent, Anticipated	-0.80	-0.94	-0.72	-0.39	-0.08	0.35
Model Consistent, Permanent	-1.31	-1.04	-0.74	-0.38	-0.07	0.35
U.S. PRICE LEVEL (Percent Deviation from Baseline)						
Adaptive	-0.16	-0.53	-1.07	-1.72	-2.42	-3.11
Model Consistent, Anticipated	-0.58	-1.35	-2.35	-3.43	-4.46	-5.27
Model Consistent, Permanent	-0.41	-1.23	-2.28	-3.40	-4.44	-5.27
U.S. GOVERNMENT BUDGET BALANCE (Deviation from Baseline as Percent of Baseline Nominal GNP)						
Adaptive	0.68	0.74	0.85	0.97	1.09	1.00
Model Consistent, Anticipated	0.80	0.89	1.03	1.16	1.28	1.20
Model Consistent, Permanent	0.68	0.85	1.00	1.15	1.27	1.20
U.S. CURRENT ACCOUNT BALANCE (Deviation from Baseline as Percent of Baseline Nominal GNP)						
Adaptive	0.19	0.24	0.28	0.32	0.36	0.39
Model Consistent, Anticipated	0.28	0.32	0.37	0.41	0.45	0.46
Model Consistent, Permanent	0.10	0.34	0.36	0.42	0.46	0.47
U.S. SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Adaptive	-0.35	-0.44	-0.48	-0.52	-0.57	-0.60
Model Consistent, Anticipated	-0.23	-0.40	-0.53	-0.65	-0.77	-0.83
Model Consistent, Permanent	-0.30	-0.39	-0.51	-0.64	-0.76	-0.83
WEIGHTED AVERAGE EXCHANGE VALUE OF U.S. DOLLAR (Percent Deviation from Baseline)						
Adaptive	-0.34	-0.53	-0.66	-0.80	-0.96	-1.08
Model Consistent, Anticipated	-2.22	-2.12	-1.95	-1.76	-1.52	-1.24
Model Consistent, Permanent	-2.49	-2.28	-2.08	-1.86	-1.61	-1.30
JAPANESE REAL GNP (Percent Deviation from Baseline)						
Adaptive	-0.36	-0.46	-0.45	-0.43	-0.42	-0.41
Model Consistent, Anticipated	-0.35	-0.45	-0.42	-0.34	-0.27	-0.22
Model Consistent, Permanent	-0.34	-0.54	-0.51	-0.44	-0.35	-0.28
JAPANESE PRICE LEVEL (Percent Deviation from Baseline)						
Adaptive	-0.04	-0.15	-0.31	-0.49	-0.68	-0.89
Model Consistent, Anticipated	-0.50	-0.96	-1.46	-1.92	-2.27	-2.49
Model Consistent, Permanent	-0.21	-0.62	-1.12	-1.63	-2.05	-2.33
GERMAN REAL GNP (Percent Deviation from Baseline)						
Adaptive	-0.32	-0.39	-0.35	-0.32	-0.30	-0.32
Model Consistent, Anticipated	-0.27	-0.40	-0.38	-0.31	-0.26	-0.29
Model Consistent, Permanent	-0.27	-0.46	-0.45	-0.39	-0.30	-0.32
GERMAN PRICE LEVEL (Percent Deviation from Baseline)						
Adaptive	-0.04	-0.13	-0.26	-0.40	-0.55	-0.71
Model Consistent, Anticipated	-0.56	-1.00	-1.43	-1.79	-2.03	-2.13
Model Consistent, Permanent	-0.25	-0.66	-1.13	-1.54	-1.85	-2.02

*Reduction below baseline in real U.S. government purchases of goods and services equal to 1 percent of baseline U.S. real GNP, maintained throughout the six years of simulation period.

TABLE A-10

DATA FOR FIGURE 5-1: EFFECTS OF ALTERNATIVE U.S. FISCAL POLICIES ON KEY U.S. VARIABLES:

BASED ON AVERAGES OF DRI, MCM AND MPS SIMULATIONS

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
REAL GNP					
REDUCED PURCHASES.....	-1.60	-1.68	-0.88	-0.05	0.46
REDUCED TRANSFERS.....	-1.42	-1.71	-0.58	0.56	0.91
INCREASED PERSONAL TAX RATE.	-1.16	-1.25	-0.41	0.25	0.46
INCREASED CORPORATE TAX RATE	-0.78	-1.66	-1.60	-0.72	0.84
INCREASED SALES TAX RATE....	-1.39	-1.92	-1.84	-1.59	-1.20
REAL CONSUMER EXPENDITURES					
REDUCED PURCHASES.....	-0.74	-1.05	-0.63	-0.11	0.12
REDUCED TRANSFERS.....	-1.85	-2.65	-2.04	-1.25	-1.08
INCREASED PERSONAL TAX RATE.	-1.59	-2.18	-1.78	-1.38	-1.31
INCREASED CORPORATE TAX RATE	-0.81	-1.62	-1.81	-1.56	-1.02
INCREASED SALES TAX RATE....	-1.56	-2.26	-2.38	-2.29	-2.08
BUDGET BALANCE					
REDUCED PURCHASES.....	0.50	0.66	1.03	1.37	1.60
REDUCED TRANSFERS.....	0.68	0.84	1.30	1.71	1.86
INCREASED PERSONAL TAX RATE.	0.64	0.75	1.09	1.37	1.54
INCREASED CORPORATE TAX RATE	0.70	0.61	0.79	1.21	1.69
INCREASED SALES TAX RATE....	0.35	0.27	0.36	0.50	0.67
PRICE LEVEL					
REDUCED PURCHASES.....	-0.09	-0.60	-1.26	-1.86	-2.17
REDUCED TRANSFERS.....	-0.01	-0.51	-1.19	-1.70	-1.79
INCREASED PERSONAL TAX RATE.	-0.01	-0.40	-0.89	-1.31	-1.51
INCREASED CORPORATE TAX RATE	-0.01	-0.35	-1.13	-2.21	-3.23
INCREASED SALES TAX RATE....	1.45	1.51	1.28	0.77	0.01
REAL BUSINESS FIXED INVESTMENT					
REDUCED PURCHASES.....	-0.09	-0.60	-1.26	-1.86	-2.17
REDUCED TRANSFERS.....	-0.01	-0.51	-1.19	-1.70	-1.79
INCREASED PERSONAL TAX RATE.	-0.01	-0.40	-0.89	-1.31	-1.51
INCREASED CORPORATE TAX RATE	-0.01	-0.35	-1.13	-2.21	-3.23
INCREASED SALES TAX RATE....	1.45	1.51	1.28	0.77	0.01
SHORT TERM INTEREST RATE					
REDUCED PURCHASES.....	-1.09	-1.87	-1.88	-1.72	-1.45
REDUCED TRANSFERS.....	-1.59	-2.42	-2.13	-1.59	-1.21
INCREASED PERSONAL TAX RATE.	-1.23	-1.82	-1.66	-1.47	-1.32
INCREASED CORPORATE TAX RATE	-0.56	-1.74	-2.76	-3.27	-2.72
INCREASED SALES TAX RATE....	0.31	-0.45	-0.61	-0.98	-1.46

TABLE A-11

DATA FOR FIGURE 5-2: EFFECTS OF ALTERNATIVE U.S. FISCAL POLICIES ON U.S. GNP AND PRICES: EFFECTS FOR THE INDIVIDUAL MODELS

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
REAL GNP - DRI						
REDUCED PURCHASES.....	-1.67	-1.94	-1.38	-0.85	-0.40	0.09
REDUCED TRANSFERS.....	-0.95	-1.00	-0.10	0.58	0.82	0.94
INCREASED PERSONAL TAX RATE.	-0.76	-0.46	0.46	0.93	0.96	0.83
INCREASED CORPORATE TAX RATE	-0.26	-0.68	-0.29	0.57	1.38	1.87
INCREASED SALES TAX RATE....	-1.48	-2.07	-2.07	-1.62	-1.15	-0.61
REAL GNP - MCM						
REDUCED PURCHASES.....	-1.63	-1.92	-1.66	-1.52	-1.52	-1.44
REDUCED TRANSFERS.....	-1.52	-2.71	-2.44	-1.93	-1.77	-1.64
INCREASED PERSONAL TAX RATE.	-1.54	-2.45	-2.15	-1.87	-1.82	-1.70
INCREASED CORPORATE TAX RATE	-1.57	-2.52	-2.22	-1.91	-1.86	-1.73
INCREASED SALES TAX RATE....	-1.38	-2.04	-1.98	-2.01	-2.18	-2.19
REAL GNP - MPS						
REDUCED PURCHASES.....	-1.51	-1.17	0.42	2.21	3.30	
REDUCED TRANSFERS.....	-1.77	-1.41	0.81	3.02	3.69	
INCREASED PERSONAL TAX RATE.	-1.19	-0.85	0.46	1.69	2.26	
INCREASED CORPORATE TAX RATE	-0.51	-1.77	-2.31	-0.81	3.00	
INCREASED SALES TAX RATE....	-1.30	-1.65	-1.49	-1.15	-0.26	
PRICE LEVEL - DRI						
REDUCED PURCHASES.....	-0.10	-0.41	-0.77	-1.26	-1.81	-2.27
REDUCED TRANSFERS.....	-0.07	-0.30	-0.42	-0.54	-0.67	-0.69
INCREASED PERSONAL TAX RATE.	-0.07	-0.24	-0.25	-0.25	-0.22	-0.08
INCREASED CORPORATE TAX RATE	-0.03	-0.28	-0.70	-1.18	-1.71	-2.17
INCREASED SALES TAX RATE....	1.53	1.51	1.35	1.07	0.62	0.13
PRICE LEVEL - MCM						
REDUCED PURCHASES.....	0.03	-0.33	-0.91	-1.62	-2.48	-3.48
REDUCED TRANSFERS.....	0.04	-0.29	-1.03	-1.95	-3.01	-4.22
INCREASED PERSONAL TAX RATE.	0.04	-0.29	-0.97	-1.82	-2.84	-4.03
INCREASED CORPORATE TAX RATE	0.04	-0.29	-0.99	-1.86	-2.90	-4.12
INCREASED SALES TAX RATE....	1.15	1.32	1.26	1.00	0.44	-0.38
PRICE LEVEL - MPS						
REDUCED PURCHASES.....	-0.20	-1.07	-2.09	-2.70	-2.22	
REDUCED TRANSFERS.....	0.01	-0.95	-2.11	-2.60	-1.69	
INCREASED PERSONAL TAX RATE.	-0.01	-0.68	-1.44	-1.85	-1.47	
INCREASED CORPORATE TAX RATE	-0.04	-0.49	-1.70	-3.58	-5.08	
INCREASED SALES TAX RATE....	1.67	1.68	1.24	0.25	-1.03	

TABLE A-12

DATA FOR FIGURE 5-3: EFFECTS OF ALTERNATIVE U.S. FISCAL POLICIES ON KEY INTERNATIONAL VARIABLES:

BASED ON AVERAGES OF DRI, MCM, AND MPS SIMULATIONS

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
CURRENT ACCOUNT BALANCE					
REDUCED PURCHASES.....	0.22	0.39	0.34	0.30	0.36
REDUCED TRANSFERS.....	0.26	0.53	0.47	0.41	0.50
INCREASED PERSONAL TAX RATE.	0.20	0.37	0.34	0.35	0.43
INCREASED CORPORATE TAX RATE	0.12	0.35	0.49	0.46	0.28
INCREASED SALES TAX RATE....	0.16	0.30	0.27	0.26	0.26
FOREIGN REAL GNP					
REDUCED PURCHASES.....	-0.26	-0.66	-0.34	0.17	0.41
REDUCED TRANSFERS.....	-0.20	-0.51	0.04	0.74	0.88
INCREASED PERSONAL TAX RATE.	-0.18	-0.40	0.06	0.53	0.58
INCREASED CORPORATE TAX RATE	-0.11	-0.42	-0.42	0.12	0.95
INCREASED SALES TAX RATE....	-0.27	-0.70	-0.65	-0.35	-0.08
FOREIGN INTEREST RATES					
REDUCED PURCHASES.....	-0.50	-0.99	-0.75	-0.58	-0.59
REDUCED TRANSFERS.....	-0.80	-1.33	-0.77	-0.42	-0.50
INCREASED PERSONAL TAX RATE.	-0.61	-0.97	-0.63	-0.49	-0.55
INCREASED CORPORATE TAX RATE	-0.23	-0.65	-0.93	-1.00	-0.81
INCREASED SALES TAX RATE....	-0.18	-0.66	-0.35	-0.33	-0.59
EXCHANGE VALUE OF THE DOLLAR					
REDUCED PURCHASES.....	-0.20	-0.10	-0.13	-1.07	-2.18
REDUCED TRANSFERS.....	-0.75	-0.93	-1.07	-2.18	-3.20
INCREASED PERSONAL TAX RATE.	-0.81	-1.34	-1.60	-2.28	-2.96
INCREASED CORPORATE TAX RATE	-0.47	-0.56	0.44	0.86	-0.92
INCREASED SALES TAX RATE....	-0.15	0.31	0.90	0.94	0.28
FOREIGN PRICE LEVEL					
REDUCED PURCHASES.....	-0.10	-0.14	-0.17	-0.41	-0.69
REDUCED TRANSFERS.....	-0.04	0.10	0.27	0.10	-0.09
INCREASED PERSONAL TAX RATE.	-0.04	0.06	0.18	0.11	0.02
INCREASED CORPORATE TAX RATE	-0.03	-0.13	-0.13	-0.08	-0.22
INCREASED SALES TAX RATE....	-0.03	-0.04	0.03	-0.09	-0.35

TABLE A-13

DATA FOR FIGURE 5-4: EFFECTS OF FISCAL CONTRACTION UNDER ALTERNATIVE U.S. MONETARY POLICIES

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
MCM: REAL GNP						
M2 EXOGENOUS	-1.63	-1.92	-1.66	-1.52	-1.52	-1.44
M1 EXOGENOUS	-1.75	-2.40	-2.37	-2.25	-2.31	-2.41
INTEREST RATES EXOGENOUS	-1.86	-2.98	-3.74	-4.47	-5.25	-6.04
MCM: PRICE LEVEL						
M2 EXOGENOUS	0.03	-0.33	-0.91	-1.62	-2.48	-3.48
M1 EXOGENOUS	0.01	-0.42	-1.15	-2.11	-3.29	-4.71
INTEREST RATES EXOGENOUS	-0.01	-0.53	-1.50	-2.98	-5.02	-7.67
MCM: SHORT TERM INTEREST RATE						
M2 EXOGENOUS	-1.16	-1.63	-1.86	-2.21	-2.77	-3.37
M1 EXOGENOUS	-0.57	-1.12	-1.60	-1.86	-2.26	-2.72
INTEREST RATES EXOGENOUS	0.00	-0.00	-0.00	-0.00	-0.00	-0.00
MPS: REAL GNP						
M2 EXOGENOUS	-1.51	-1.17	0.42	2.21	3.30	
M1 EXOGENOUS	-1.80	-3.09	-3.94	-4.59	-4.70	
INTEREST RATES EXOGENOUS	-1.89	-3.54	-6.09	-8.88	-11.56	
MPS: PRICE LEVEL						
M2 EXOGENOUS	-0.26	-1.40	-2.84	-3.82	-3.28	
M1 EXOGENOUS	-0.17	-1.10	-3.09	-6.36	-10.96	
INTEREST RATES EXOGENOUS	-0.17	-1.14	-3.35	-7.42	-13.88	
MPS: SHORT TERM INTEREST RATE						
M2 EXOGENOUS	-1.69	-3.00	-2.50	-1.33	0.31	
M1 EXOGENOUS	-0.40	-1.17	-1.88	-2.84	-4.24	
INTEREST RATES EXOGENOUS	0.00	0.00	0.00	0.00	0.00	

Table A-14

DATA FOR FIGURE 6-1: ESTIMATED EFFECTS OF A PHASED-IN PACKAGE OF EXPENDITURE CUTS

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
U.S. REAL GNP (Percent Deviation from Baseline)						
Package A, 12-series average	-0.70	-1.34	-1.86	-2.27	-1.89	-1.48
Package A, 3-series average	-0.80	-1.64	-2.08	-2.10	-1.07	
U.S. PRICE LEVEL (Percent Deviation from Baseline)						
Package A, 12-series average	-0.08	-0.38	-0.96	-1.86	-2.99	-4.23
Package A, 3-series average	-0.05	-0.35	-0.98	-1.90	-2.94	
U.S. GOVERNMENT BUDGET BALANCE (Deviation from Baseline as Percent of Baseline Nominal GNP)						
Package A, 12-series average	0.31	0.63	1.05	1.56	1.83	2.17
Package A, 3-series average	0.25	0.58	1.10	1.78	2.33	
U.S. CURRENT ACCOUNT BALANCE (Deviation from Baseline as Percent of Baseline Nominal GNP)						
Package A, 12-series average	0.12	0.28	0.46	0.66	0.76	0.85
Package A, 3-series average	0.11	0.31	0.48	0.62	0.69	
U.S. SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Package A, 12-series average	-0.34	-0.85	-1.42	-2.07	-2.47	-2.79
Package A, 3-series average	-0.55	-1.48	-2.42	-3.28	-3.46	
WEIGHTED AVERAGE EXCHANGE VALUE OF U.S. DOLLAR (Percent Deviation from Baseline)						
Package A, 12-series average	-0.93	-1.98	-3.00	-3.98	-4.01	-3.92
Package A, 3-series average	-0.10	-0.15	-0.21	-0.75	-1.73	
ROECD REAL GNP (Percent Deviation from Baseline)						
Package A, 12-series average	-0.12	-0.34	-0.58	-0.80	-0.90	-0.91
Package A, 3-series average	-0.13	-0.46	-0.63	-0.54	-0.21	
ROECD PRICE LEVEL (Percent Deviation from Baseline)						
Package A, 12-series average	-0.07	-0.28	-0.68	-1.26	-1.96	-2.69
Package A, 3-series average	-0.05	-0.12	-0.20	-0.41	-0.71	

Table A-15

DATA FOR FIGURE 6-2: ESTIMATED EFFECTS OF ALTERNATIVE PACKAGES OF PHASED-IN FISCAL CONTRACTION

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
U.S. REAL GNP (Percent Deviation from Baseline)						
Package A, 3-model average	-0.80	-1.64	-2.08	-2.10	-1.07	
Package B, 3-model average	-0.64	-1.39	-1.63	-1.43	-0.44	
Package C, 3-model average	-0.54	-1.44	-2.30	-2.88	-2.42	
Package A, 12-series average	-0.67	-1.30	-1.81	-2.23	-1.86	-1.37
U.S. PRICE LEVEL (Percent Deviation from Baseline)						
Package A, 3-model average	-0.05	-0.35	-0.98	-1.90	-2.94	
Package B, 3-model average	-0.01	-0.23	-0.75	-1.51	-2.32	
Package C, 3-model average	0.36	0.65	0.69	0.33	-0.84	
Package A, 12-series average	-0.08	-0.38	-0.96	-1.86	-2.99	-4.23
U.S. GOVERNMENT BUDGET BALANCE (Deviation from Baseline as Percent of Baseline Nominal GNP)						
Package A, 3-model average	0.25	0.58	1.10	1.78	2.33	
Package B, 3-model average	0.33	0.73	1.33	2.10	2.61	
Package C, 3-model average	0.26	0.48	0.77	1.20	1.53	
Package A, 12-series average	0.31	0.63	1.05	1.56	1.83	2.17
U.S. CURRENT ACCOUNT BALANCE (Deviation from Baseline as Percent of Baseline Nominal GNP)						
Package A, 3-model average	0.11	0.31	0.48	0.62	0.69	
Package B, 3-model average	0.11	0.34	0.54	0.73	0.85	
Package C, 3-model average	0.07	0.23	0.42	0.60	0.67	
Package A, 12-series average	0.12	0.28	0.46	0.66	0.76	0.85
U.S. SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Package A, 3-model average	-0.55	-1.48	-2.42	-3.28	-3.46	
Package B, 3-model average	-0.71	-1.77	-2.71	-3.48	-3.41	
Package C, 3-model average	-0.06	-0.61	-1.45	-2.51	-3.50	
Package A, 12-series average	-0.34	-0.85	-1.42	-2.07	-2.47	-2.79
WEIGHTED AVERAGE EXCHANGE VALUE OF U.S. DOLLAR (Percent Deviation from Baseline)						
Package A, 3-model average	-0.10	-0.15	-0.21	-0.74	-1.73	
Package B, 3-model average	-0.39	-0.96	-1.62	-2.74	-3.89	
Package C, 3-model average	-0.16	-0.22	0.12	0.57	0.56	
Package A, 12-series average	-0.93	-1.98	-3.00	-3.98	-4.01	-3.92
ROECD REAL GNP (Percent Deviation from Baseline)						
Package A, 3-model average	-0.13	-0.46	-0.63	-0.54	-0.21	
Package B, 3-model average	-0.09	-0.32	-0.30	0.02	0.48	
Package C, 3-model average	-0.09	-0.37	-0.64	-0.69	-0.38	
Package A, 12-series average	-0.12	-0.34	-0.58	-0.80	-0.90	-0.91
ROECD PRICE LEVEL (Percent Deviation from Baseline)						
Package A, 3-model average	-0.05	-0.12	-0.20	-0.41	-0.71	
Package B, 3-model average	-0.02	0.02	0.13	0.19	0.19	
Package C, 3-model average	-0.02	-0.06	-0.08	-0.13	-0.25	
Package A, 12-series average	-0.07	-0.28	-0.68	-1.26	-1.96	-2.69

Table A-16

DATA FOR FIGURE 6-3: ESTIMATED EFFECTS OF PHASED-IN EXPENDITURE CUTS UNDER ALTERNATIVE EXPECTATIONS ASSUMPTIONS

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
U.S. REAL GNP (Percent Deviation from Baseline)						
Package A, 12-series average	-0.70	-1.34	-1.86	-2.27	-1.89	-1.48
Package A, INTERMOD Adaptive	-0.77	-1.36	-1.85	-2.26	-1.79	-0.82
Package A, INTERMOD Consistent	-0.36	-0.38	-0.96	-1.55	-1.24	-0.42
U.S. PRICE LEVEL (Percent Deviation from Baseline)						
Package A, 12-series average	-0.08	-0.38	-0.96	-1.86	-3.00	-4.23
Package A, INTERMOD Adaptive	-0.08	-0.32	-0.76	-1.45	-2.33	-3.25
Package A, INTERMOD Consistent	-0.26	-0.90	-1.98	-3.51	-5.33	-7.11
U.S. GOVERNMENT BUDGET BALANCE (Deviation from Baseline as Percent of Baseline Nominal GNP)						
Package A, 12-series average	0.31	0.63	1.06	1.56	1.84	2.17
Package A, INTERMOD Adaptive	0.34	0.76	1.23	1.73	1.94	1.76
Package A, INTERMOD Consistent	0.35	0.91	1.39	1.90	2.08	2.00
U.S. CURRENT ACCOUNT BALANCE (Deviation from Baseline as Percent of Baseline Nominal GNP)						
Package A, 12-series average	0.12	0.28	0.46	0.66	0.76	0.85
Package A, INTERMOD Adaptive	0.10	0.18	0.28	0.40	0.44	0.43
Package A, INTERMOD Consistent	-0.08	0.34	0.47	0.64	0.71	0.71
U.S SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Package A, 12-series average	-0.34	-0.85	-1.42	-2.07	-2.47	-2.79
Package A, INTERMOD Adaptive	-0.17	-0.33	-0.51	-0.71	-0.75	-0.70
Package A, INTERMOD Consistent	-0.05	-0.18	-0.49	-0.89	-1.15	-1.30
WEIGHTED AVERAGE EXCHANGE VALUE OF U.S. DOLLAR (Percent Deviation from Baseline)						
Package A, 12-series average	-0.93	-1.98	-3.00	-3.98	-4.02	-3.92
Package A, INTERMOD Adaptive	-0.17	-0.37	-0.63	-0.95	-1.15	-1.24
Package A, INTERMOD Consistent	-3.80	-3.76	-3.73	-3.59	-3.25	-2.79
JAPANESE REAL GNP (Percent Deviation from Baseline)						
Package A, 12-series average	-0.20	-0.55	-0.94	-1.30	-1.44	-1.46
Package A, INTERMOD Adaptive	-0.18	-0.35	-0.49	-0.64	-0.62	-0.52
Package A, INTERMOD Consistent	-0.17	-0.46	-0.59	-0.70	-0.63	-0.53
JAPANESE PRICE LEVEL (Percent Deviation from Baseline)						
Package A, 12-series average	-0.05	-0.24	-0.62	-1.18	-1.85	-2.55
Package A, INTERMOD Adaptive	-0.02	-0.09	-0.21	-0.40	-0.64	-0.90
Package A, INTERMOD Consistent	-0.26	-0.79	-1.51	-2.31	-3.07	-3.68
GERMAN REAL GNP (Percent Deviation from Baseline)						
Package A, 12-series average	-0.11	-0.28	-0.47	-0.67	-0.73	-0.72
Package A, INTERMOD Adaptive	-0.16	-0.29	-0.41	-0.51	-0.47	-0.40
Package A, INTERMOD Consistent	-0.13	-0.38	-0.52	-0.60	-0.53	-0.55
GERMAN PRICE LEVEL (Percent Deviation from Baseline)						
Package A, 12-series average	-0.08	-0.31	-0.72	-1.30	-1.97	-2.65
Package A, INTERMOD Adaptive	-0.02	-0.08	-0.18	-0.34	-0.53	-0.73
Package A, INTERMOD Consistent	-0.33	-0.90	-1.61	-2.32	-2.96	-3.41

Table A-17

DATA FOR FIGURE 6-4: ESTIMATED EFFECTS OF PHASED-IN FISCAL CONTRACTION COMBINED WITH MONETARY EXPANSION

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
U.S. REAL GNP (Percent Deviation from Baseline)						
Package A, 12-series average	-0.70	-1.34	-1.86	-2.27	-1.89	-1.48
Package D, 12-series average	-0.16	-0.52	-0.85	-1.39	-1.19	-1.25
U.S. PRICE LEVEL (Percent Deviation from Baseline)						
Package A, 12-series average	-0.08	-0.38	-0.96	-1.86	-2.99	-4.23
Package D, 12-series average	0.10	0.11	-0.01	-0.42	-1.09	-2.01
U.S. GOVERNMENT BUDGET BALANCE (Deviation from Baseline as Percent of Baseline Nominal GNP)						
Package A, 12-series average	0.31	0.63	1.05	1.56	1.83	2.17
Package D, 12-series average	0.56	1.12	1.74	2.28	2.51	2.67
U.S. CURRENT ACCOUNT BALANCE (Deviation from Baseline as Percent of Baseline Nominal GNP)						
Package A, 12-series average	0.12	0.28	0.46	0.66	0.76	0.85
Package D, 12-series average	0.04	0.24	0.45	0.71	0.84	0.98
U.S. SHORT-TERM INTEREST RATE (Deviation from Baseline in Percentage Points)						
Package A, 12-series average	-0.34	-0.85	-1.42	-2.07	-2.47	-2.79
Package D, 12-series average	-1.93	-2.12	-2.80	-2.78	-3.04	-2.48
WEIGHTED AVERAGE EXCHANGE VALUE OF U.S. DOLLAR (Percent Deviation from Baseline)						
Package A, 12-series average	-0.93	-1.98	-3.00	-3.98	-4.01	-3.92
Package D, 12-series average	-3.86	-5.70	-7.97	-8.64	-8.50	-6.57
ROECD REAL GNP (Percent Deviation from Baseline)						
Package A, 12-series average	-0.12	-0.34	-0.58	-0.80	-0.90	-0.91
Package D, 12-series average	-0.16	-0.45	-0.74	-0.99	-1.08	-1.08
ROECD PRICE LEVEL (Percent Deviation from Baseline)						
Package A, 12-series average	-0.07	-0.28	-0.68	-1.26	-1.96	-2.69
Package D, 12-series average	-0.19	-0.50	-1.06	-1.74	-2.47	-3.08
JAPANESE REAL GNP (Percent Deviation from Baseline)						
Package A, 12-series average	-0.20	-0.55	-0.94	-1.29	-1.44	-1.46
Package D, 12-series average	-0.35	-0.89	-1.43	-1.82	-1.92	-1.80
JAPANESE PRICE LEVEL (Percent Deviation from Baseline)						
Package A, 12-series average	-0.05	-0.24	-0.62	-1.18	-1.85	-2.55
Package D, 12-series average	-0.11	-0.35	-0.80	-1.41	-2.12	-2.78
GERMAN REAL GNP (Percent Deviation from Baseline)						
Package A, 12-series average	-0.11	-0.28	-0.47	-0.67	-0.73	-0.72
Package D, 12-series average	-0.06	-0.23	-0.48	-0.76	-0.89	-0.93
GERMAN PRICE LEVEL (Percent Deviation from Baseline)						
Package A, 12-series average	-0.08	-0.31	-0.72	-1.30	-1.97	-2.65
Package D, 12-series average	-0.19	-0.55	-1.14	-1.88	-2.67	-3.30

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