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Possible Effects of European Monetary Union on Switzerland: A Case Study of Policy Dilemmas Caused by Low Inflation and the Nominal Interest Rate Floor

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Abstract

This paper examines the possible effects on Switzerland of asset preference shifts in favor of Swiss-franc-denominated assets that could result from EMU. Alternative policy responses to temporary and persistent asset preference shifts and the consequent pressures for exchange rate appreciation are examined. Simulations of a stylized macroeconomic model of the Swiss economy indicate that monetary policy is likely to be the most effective tool for stabilizing output in the short run, but at the cost of a temporary increase in inflationary pressures. The simulations highlight the dilemmas faced by policymakers in an environment with low inflation and nominal interest rates.

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SUMMARY

As the planned date for the third stage of European Monetary Union (EMU) draws near, the spillover effects are likely to be felt in countries not just in the EU but also outside it. Switzerland is one such European country that could be considerably affected by the developments surrounding EMU.

This paper provides a simulation analysis, using a stylized open economy macroeconomic model of Switzerland, of the possible effects of EMU on the Swiss economy. A number of different EMU scenarios are analyzed and the potential effects on Switzerland are examined. A possible outcome, of concern to Swiss policymakers, is that uncertainties related to EMU could lead to capital flight from EU currencies to assets denominated in other hard currencies, including the Swiss franc. This could result in pressures for an appreciation of the Swiss franc real exchange rate, with consequent adverse effects on domestic output and employment in Switzerland.

The paper investigates alternative policy responses to both temporary and persistent asset preference shifts in favor of assets denominated in Swiss francs. The simulation results suggest that monetary policy is likely to be a more effective tool than fiscal policy for stabilizing output in the short run. The conduct of monetary policy is, however, considerably complicated by the low levels of inflation and nominal interest rates (close to the nominal interest rate floor at zero percent) currently prevailing in Switzerland. The model therefore incorporates some innovative elements that capture possible nonlinearities in the economy—both in the Phillips curve relationship and in the demand for money. Alternative monetary policy strategies—including a temporary exchange rate ceiling—are analyzed. The simulations suggest that timely and forceful monetary policy responses to asset preference shifts could be crucial for reducing short-run output losses and mitigating the associated costs in terms of future increases in inflation.

I. Introduction

As the target date for the third stage of European Monetary Union (EMU) approaches, the effects of EMU are likely to be felt not just on the likely participants but also on countries that, although in some cases not even part of the European Union, have substantial trade and other economic relationships with EMU participants. This paper presents a case study of the possible macroeconomic effects of EMU on one such country, Switzerland. Although the analytical framework developed in this paper could, in principle, be applied more broadly to countries in Europe that will not participate in EMU, this focus on the Swiss economy is particularly interesting from an analytical perspective for a number of reasons that are discussed below.

The initial ramifications of EMU on the Swiss economy will depend on a number of factors, including investors' perceptions of the macroeconomic and financial discipline within EMU. Concerns about such discipline could well lead to an increase in investors' preferences for assets denominated in hard currencies outside the new *euro* area, including the Swiss franc. This paper focuses on the macroeconomic implications of a potential increase in the demand for Swiss-franc-denominated assets on the Swiss economy and considers alternative policy responses.[1]

A stylized open economy macroeconomic model of Switzerland is constructed and used to examine a number of scenarios that could help gauge the possible effects of EMU on the Swiss economy. The model is constructed within the broader analytical framework of MULTIMOD, the IMF's global macroeconometric model. Modeling the effects of a shift in investors' preferences towards assets denominated in Swiss francs is complicated for a number of reasons. First, the magnitude and persistence of the preference shift toward Swiss-franc-denominated assets is a matter of conjecture. Second, for a small open economy such as Switzerland, the impact of such asset preference shifts on the exchange rate and domestic interest rate is not independent of the policy rules adopted by the authorities. Simulations of the Swiss model are used in this paper to analyze alternative scenarios derived from different assumptions about the magnitude and persistence of the increased demand for Swiss-franc-denominated assets that could be stimulated by EMU and to then investigate the effects of various policy responses.

The simulation experiments indicate that monetary policy is likely to be a more effective tool than fiscal policy for stabilizing domestic output in response to portfolio preference shifts in favor of Swiss-franc-denominated assets. The magnitude and persistence of such asset preference shifts is difficult to determine in advance but the effectiveness of

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[1]Many of the issues discussed in this paper are also contained in a Swiss report prepared by an EMU Working Group of the *Kommission für Konjunkturfragen*. This report presents a less formal discussion of various EMU scenarios and possible policy responses.

policy measures in stabilizing output depends on a prompt and commensurate policy response to these shifts.

The simulations also illustrate the additional risks posed by the constraints on monetary policy in responding to external shocks in an environment with low levels of domestic inflation and nominal interest rates. Alternative monetary policy strategies for reducing short-run output losses from upward pressures on the Swiss franc are examined—either increasing the rate of growth of money supply within the monetary targeting framework or explicitly allowing monetary policy to be guided by exchange rate developments. The simulations indicate that stabilizing output in the short run using monetary policy does entail the risk of increasing inflation over the medium term. This highlights the premium placed on timely policy responses to asset preference shifts.

It is worth emphasizing that this paper takes a macro approach and does not address the possible distributional consequences within Switzerland of the types of "EMU shocks" examined here. In addition, the paper does not examine other aspects of the costs and benefits to Switzerland of remaining outside the European Union.

The next section provides a more detailed background for the analysis in this paper. Section III describes the construction of the Swiss macroeconomic model and highlights some modeling issues that are of particular relevance to the questions addressed in this paper. Section IV presents simulation results under alternative assumptions about the nature of the increase in foreign investors' demand for Swiss-franc-denominated assets. The effects of alternative policy responses are then analyzed. Section V summarizes the main conclusions.

II. Background

This section reviews some salient features of and recent developments in the Swiss economy that provide a context for the analysis in this paper. Over the last three decades, the Swiss have enjoyed relatively low rates of inflation and a trend appreciation in the real effective exchange rate. Households in Switzerland also appear to have a significantly lower rate of time preference compared to other OECD countries. This low rate of time preference is reflected in a domestic saving rate (30 percent of GDP) and a ratio of net foreign assets to GDP (over 100 percent) that are the highest among OECD countries. Swiss real interest rates—adjusted for the real exchange rate appreciation—have been markedly lower than real interest rates in other industrialized economies including Germany, although this differential relative to Germany has narrowed during the 1990s. This departure from the standard open interest parity condition has been interpreted as an exchange rate risk discount—indicating a willingness by foreign investors to hold Swiss-franc-denominated assets, even though they yield a lower rate of return than assets denominated in other hard currencies.[2]

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[2]For a recent analysis of Switzerland as a low "interest rate island", as well as additional references on this issue, see Mauro (1995).

Since the beginning of the 1990s, economic performance in Switzerland has deteriorated, with an average real GDP growth rate close to zero and an unemployment rate that has risen to over 5 percent, well above its historical average. A sharp appreciation of the Swiss franc from 1993 through 1995 caused a decline in net exports and is widely regarded as having dampened aggregate output growth. In this context, a further appreciation of the Swiss franc could significantly worsen prospects for economic recovery and medium-term growth. Hence, an analysis of the channels through which EMU could affect the Swiss economy is of considerable topical interest as well.

Possible responses by monetary and fiscal policy to exchange rate appreciation pressures are, however, constrained by present circumstances in Switzerland. CPI inflation has fallen below 1 percent per annum. The official discount rate was lowered during 1996 to 1 percent, and overnight market rates are currently around 1½ percent. Such low interest rates limit the scope for further easing of monetary policy, given the nominal interest rate floor of zero percent. In these circumstances, monetary policy can affect the short-term real interest rate only by increasing inflation, rather than through reductions in the short-term nominal interest rate. To highlight the dilemmas facing policy makers in an environment with low levels of inflation and interest rates, the Swiss model in MULTIMOD is extended to incorporate two innovative elements, i.e., nonlinearities in the Phillips curve and money demand relationships.

The effectiveness of fiscal policy at the Confederation (federal) level in Switzerland is limited by the relative openness of the economy; for example, an expansionary fiscal policy could result in higher imports and would lead, *ceteris paribus*, to pressures on the currency to appreciate, thereby dampening the direct aggregate demand effects on real GDP. These effects are quantified in the model simulations. In addition, the effectiveness of fiscal policy for short-run demand management in Switzerland has been limited by the relatively small size of the Confederation budget (excluding transfers), the procyclical behavior of fiscal balances at lower levels of government, and substantial policy inertia imparted by political institutions.

III. Analytical Issues in Modeling a Shift in Investor Preferences

This section provides a brief overview of the construction of an open economy macroeconomic model for Switzerland within the framework of MULTIMOD and describes the enhancements to the basic model that were necessary for the simulation exercises conducted in this paper. A synopsis of the main features of MULTIMOD is contained in Appendix I.[3]

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[3]A detailed description of the model can be found in Masson, Symansky and Meredith (1990). See Zurlinden (1992) for an earlier extension of MULTIMOD to the case of Switzerland.

MULTIMOD is a general equilibrium macroeconometric model developed at the IMF to analyze the transmission of changes in macroeconomic policy within and across countries. The model is not intended as a tool for making unconditional forecasts. Rather, MULTIMOD takes the World Economic Outlook (WEO) forecasts made by IMF country specialists as the baseline for simulation scenarios analyzing the effects of policy changes or other exogenous changes in the economic environment. The basic version of MULTIMOD is an annual model that includes each of the G-7 countries plus two country blocks that aggregate the small industrial countries and developing countries, respectively. For the purposes of this paper, Switzerland has been modeled separately, while the other small industrial countries remain in a single block.

Some features of MULTIMOD are worth highlighting before proceeding. The model derives a consistent path for all endogenous variables in response to exogenous shocks, while respecting stock-flow equilibrium conditions during the transition to the new steady state. The model incorporates forward-looking expectations and these expectations are imposed in a model-consistent manner. Since the model has an explicit characterization of technology, household preferences, and other structural features, it is possible to calibrate the model to replicate certain stylized facts and thereby gain a better understanding of the economy's dynamic properties. For instance, under certain assumptions, an economy with a lower rate of time preference than that implied by the world real interest rate would have a relatively high domestic saving rate, a trend appreciation of the real exchange rate and a path of accumulation of net foreign assets similar to that observed for Switzerland. Thus, in addition to policy experiments, the model could provide a basis for explaining certain relevant stylized facts.

The proximate determinant of exchange rates in MULTIMOD is an equation for open interest parity across short-term interest rates in different countries; that is, the Swiss short-term interest rate is equal to the expected appreciation of the Swiss franc relative to any other currency plus the short-term interest rate on assets denominated in the latter currency.[4] More specifically, the open interest parity equation that determines the Swiss franc-DM exchange rate is as follows:

$$1 + SWI/100 = (1 + DMI/100)*(ER(t+1)/ER(t)) + RES\_ER \qquad (1)$$

where SWI and DMI are the nominal short-term interest rates on assets denominated in Swiss francs and Deutsche marks, respectively; ER is the nominal exchange rate expressed as DM per Swiss franc (i.e., an increase in the exchange rate indicates an appreciation of the Swiss franc); and RES_ER is a residual term. The expected values of both ER and RES_ER are unobservable. Forward-looking expectations of the nominal exchange rate are, however, generated internally by the model and are consistent with forecasted values. The residual term

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[4]The level of the exchange rate, particularly in the long run, is of course determined by economic fundamentals.

RES_ER reflects deviations from open interest parity and is interpretable as a premium paid for holding Swiss-franc-denominated assets. A negative residual indicates that investors are willing, at the margin, to accept a lower nominal rate of return on assets denominated in Swiss francs than in DM (which may be interpreted as an exchange rate risk discount). In simulations of the model, reducing this residual (i.e., making it more negative) is the obvious way of modeling an increase in investors' preferences for assets denominated in Swiss francs.

There is, of course, a real counterpart to the open interest parity equation that was described above in nominal terms. The trend real appreciation of the Swiss franc in recent years, despite a persistently lower real interest rate in Switzerland than in Germany, indicates that there was also a persistent residual in the interest parity relationship in real terms, which reflects the lower real return that investors appear to be willing to accept for the privilege of holding Swiss-franc-denominated assets.[5]

Both real and nominal outcomes are of interest in these simulations. MULTIMOD works with an interest parity equation that is defined in nominal terms but the differential would carry through in real terms. The nominal interest parity equation is crucial because the conduct of monetary policy is through instruments such as the nominal interest rate and the presence of a floor on nominal interest rates therefore has important implications. To account for the effects of a nominal interest rate floor at zero percent, a nonlinear money demand specification was estimated for Switzerland. The estimated elasticities appear quite reasonable (see Appendix II) but there are some important caveats. First, the span of the available time series data is not long and does not cover many periods with low levels of interest rates and inflation. Second, nonlinear models are difficult to estimate with much precision given the span of the data available and, in particular, statistical tests for discriminating among different nonlinear models have limited power. Given the importance of this issue for the operation of monetary policy in an environment with low nominal interest rates, however, the use of a nonlinear specification could not be avoided.[6]

A second dimension in which MULTIMOD is nonlinear is the Phillips curve relationship. Although the long-run Phillips curve is vertical, the model allows for short-run inflation-unemployment tradeoffs. The convexity in the short-run Phillips curve implies that demand management policies can not significantly boost output in the short run without

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[5]Mauro (1995) presents evidence showing that the real interest differentials between Switzerland and other countries reflect premia attributable to lower foreign exchange rate risk on Swiss-franc-denominated assets rather than premia paid by investors to have deposits located in Switzerland owing to "safe haven" considerations.

[6]This approach does not capture the institutional features that could account for the nominal interest rate floor at zero percent but it has the merit of avoiding discontinuities that could complicate the model simulations. See Chadha and Tsiddon (1996) for a theoretical analysis of the consequences of this floor for monetary policy and its effects on output variability.

severe inflationary consequences. In addition, the forward-looking structure of expectations and the role for policy credibility in the model could result in downward inflation inertia. This implies that a substantial and prolonged contraction of output would be required to lower inflation in response to large aggregate demand shocks that drive output above potential. The convexity also implies that the attainment of a very low level of inflation could involve substantial real costs in terms of output and unemployment.

Estimating a nonlinear Phillips curve for each country is, unfortunately, fraught with complications, stemming in part from the wide confidence intervals around the parameter estimates. The general strategy that has been employed for MULTIMOD is to estimate a nonlinear Phillips curve using pooled data from the G-7 countries and to impose those common parameters on all industrial countries.[7] Although the data do not reject the use of common parameters among the G-7 countries, using the same parameters for Switzerland raises a number of issues. Switzerland's unemployment history has been different from that of the G-7 countries. Switzerland has traditionally had a lower measured unemployment rate than has been observed in G-7 countries. In addition, wage differentiation and nominal wage flexibility appear to be greater in Switzerland than that prevailing on average in most G-7 and European economies (see, for instance, the 1996 *OECD Economic Survey* of the Swiss economy). Both of these considerations, but particularly the latter one, suggest that the short-run trade off in Switzerland may be better than that for the G-7 countries.

However, in the absence of a well-grounded empirical alternative, the nonlinear Phillips curve specification with parameters based on G-7 data was retained for the MULTIMOD simulations because this specification has important implications for the conduct of monetary policy. A nonlinear short-run Phillips curve implies, for instance, that prompt actions to offset positive aggregate demand shocks can reduce the need for stronger compensating actions down the road to reduce inflationary pressures. On the other hand, the real costs of reducing inflation to very low levels could be quite substantial. In a world rife with uncertainty, including uncertainty about the levels of potential output and the output gap, the nonlinear Phillips curve places a premium on forward-looking and timely policy actions that could minimize the deleterious effects of exogenous shocks.

Another important issue that arises in adapting MULTIMOD to the Swiss economy concerns the re-estimation of certain equations. Previously, all small industrial countries (SIC) were grouped into one block and parameters were estimated for this block as a whole. In the context of a small open economy, the trade equations are of particular interest and, therefore,

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[7]The functional form, econometric procedure, and estimation results are described in detail in Laxton, Meredith and Rose (1995). As noted in that paper, single-country estimates of nonlinear Phillips curves are very imprecise. Debelle and Laxton (1996) argue that, for certain G-7 countries, a nonlinear Phillips curve model fits the data better than linear models.

these equations were re-estimated for Switzerland.[8] The export and import volume equations for manufactured goods were re-estimated for Switzerland using annual data over the period 1970-1995 as was the export price equation. The parameter estimates were different from the previously estimated SIC parameters, but the differences were not large. The estimated equations and the coefficient estimates are presented in Appendix II. These equations have more explanatory power, as measured by the adjusted Rsquared, for the Swiss data than the corresponding equations for the SICs. For certain equations such as the oil consumption equation, individual country estimation yielded very imprecise and sometimes implausible estimates. Hence, pooled estimates from the full model have been retained.

It is also necessary, from a theoretical perspective, to impose the small open economy assumption on the model for Switzerland. In practice, this simply means that changes in Swiss variables are constrained not to have an effect on any global variables. This assumption is particularly important when analyzing the effects of changes in the stance of macroeconomic policies in Switzerland. It implies, for instance, that changes in Swiss interest rates do not affect the benchmark "world interest rate."

IV. MULTIMOD SIMULATIONS

This section presents results from a set of MULTIMOD simulations that attempt to model the possible effects of EMU on Switzerland. A possible scenario could run as follows: in early 1998, an announcement is made—based on data for 1997—concerning the initial participants in stage 3 of EMU in 1999. The group of countries could be large and based on a "flexible" interpretation of the Maastricht criteria. The resulting *euro* is perceived as a "soft" currency by market participants and the new European Central Bank (ECB) lacks the credibility of the outgoing Bundesbank. Consequently, holders of the new *euro* prefer to hold assets denominated either in higher-yield currencies (e.g., pound sterling or U.S. dollar) or low-yield currencies (i.e., Swiss franc) outside EMU.

The magnitude and persistence of such portfolio shifts is a matter of conjecture and the share that would be directed towards Swiss-franc-denominated assets is difficult to predict ex ante. In early 1997, Swiss short-term interest rates were about 375 basis points and 400 basis points, respectively, below comparable rates for U.S.-dollar and pound-sterling-denominated assets. These differentials could make it very expensive to move into Swiss franc assets rather than assets denominated in dollars or sterling. An additional consideration in the simulations is that, reflecting uncertainty, the *euro* interest rate could rise above the present baseline interest rate for deutsche-mark-denominated assets, placing upward pressures on Swiss interest rates. For analytical purposes, in the simulations presented below, these

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[8]Switzerland is quite open to international trade. Over the period 1975-1995, the average ratio of exports plus imports of good and services relative to GDP was 0.71 while the ratio of merchandise exports plus imports to GDP was 0.56.

considerations will be examined separately. It should be recognized that the eventual outcome is likely to be some combination of the effects analyzed in this paper (see, e.g., Masson and Turtelboom, 1997).

As noted earlier, a shift in investor sentiment can be introduced in the model by changing the exogenous residual term in the open interest rate parity equation. A decrease in this residual reflects an exogenous increase in the preference of foreign investors for assets denominated in Swiss francs (i.e., an increase in the exchange rate risk discount). Given the world interest rate, the combination of domestic interest rate declines and exchange rate appreciations that maintain the interest parity condition are then determined by the dynamics of behavioral relationships in the model.

In MULTIMOD, a monetary feedback rule based on money targeting is used to anchor nominal variables over the medium term, although this rule operates somewhat flexibly in the short run. In the short run, nominal money balances are adjusted to be consistent with changes in the price level and output.[9] This feedback rule appears to be a reasonable representation of the regular operation of the Swiss monetary policy framework. The nonlinear specification of the money demand function prevents the interest rate in any of the simulations from falling to zero. The monetary feedback rule is assumed to be credible and known to all agents.

A. Temporary Portfolio Preference Shifts

First, a scenario is considered where investors temporarily increase their preferences for Swiss-franc-denominated assets due to the uncertainty and possible instability engendered by the formation of EMU. A plausible scenario would be one where shifts in investors' preferences are repeated for a few years and then, as the uncertainties concerning EMU diminish, the preference of international investors for Swiss-franc-denominated assets would gradually decline. A key feature of this transitory preference shift is that it does not alter any long-run fundamentals of the Swiss economy even though it could have important short-run effects.

This scenario is modeled as a temporary change in the exogenized residual of the interest parity equation. The effect that the change in this residual has on interest rates and exchange rates is determined by the properties of the model. This scenario is modeled as a sequence of repeated shocks that diminish in size as the market uncertainties surrounding EMU are resolved. The residual is lowered (i.e., made more negative relative to its baseline level) by 0.05 for three years beginning in 1998, by 0.025 in the fourth year, and is set to zero

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[9]For instance, consider an asset preference shift that would normally result in a change in domestic interest rates. If domestic interest rates were for some reason constrained to remain temporarily unchanged, the nominal money supply would have to adjust to accommodate the change in money demand.

thereafter.[10] The simulations are presented in Figure 1, with a few key variables also shown in Table 1 as Scenario A1[11]. This scenario assumes a delayed reaction of monetary policy, i.e., short-run interest rates are kept unchanged in the first year. Consequently, the full impact of the preference shift is on the nominal exchange rate, which appreciates by about 4.3 percent in the first year, while the real exchange rate appreciates by about 2.6 percent.[12] Investment increases due to the decline in ex ante real interest rates, even though nominal short-term interest rates do not decline in the first year.[13] On the other hand, given that Switzerland is a very open economy, the trade balance deteriorates sharply in the short run due to the exchange rate appreciation and the high import propensity. The net contractionary impact leads to a fall in disposable income and, hence, in consumption. Overall, real GDP contracts by about 1.2 percent. The deterioration in the current account balance also implies a decline in the ratio of net foreign assets to GDP.[14]

In the second year, interest rates begin to decline and, over the next two years, they fall by more than 2 percentage points relative to the baseline. As the projection for the short-term interest rate in the WEO baseline is over 4 percent in 1998 and increases gradually thereafter, the interest rate floor is not binding in this scenario.

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[10]Reducing this residual by 0.05 would, if interest rates were held unchanged, result in a 5 percent appreciation of the exchange rate in order to satisfy the interest parity condition.

[11]Note that the simulation results are all expressed as deviations from the baseline staff projections taken from the October 1996 World Economic Outlook.

[12]In MULTIMOD, the real effective exchange rate is calculated as the ratio of the home country's export price to a foreign price that includes weighted averages of foreign GDP deflators and competitors' export prices. An increase in this index represents an appreciation of the real effective exchange rate.

[13]Note that the figure only shows the ex-post realizations of interest and inflation rates in response to a sequence of shocks. Investment decisions at each point in time are based on current and future ex-ante real interest rates, which are not shown here. As noted in Appendix I, the investment equation in MULTIMOD is a formulation based on Tobin's Q.

[14]Although it is not apparent from the figure, which shows the simulation results only through the year 2010, the net foreign assets to GDP ratio does return to control over the longer term in this and all other simulations below. The desired NFA/GDP ratio in the model is influenced by fundamental determinants such as the rate of time preference, the real interest rate, and the planning horizon of agents in the model.

This simulation illustrates the negative short-run consequences of a temporary increase in the demand for Swiss-franc-denominated assets. Aggregate output and, in particular, the traded goods sector are adversely affected by the resulting real exchange rate appreciation.[15] At the same time, the transitory nature of this shift implies that any possible long-run benefits from a lower interest rate are considerably dampened.

We now consider alternative policy responses. It should be emphasized that the aim here is only to illustrate the effects of a range of policy actions, rather than to determine precisely the optimal policy response. The real appreciation in the exchange rate and the fall in output could potentially be offset by a more timely easing of monetary policy—the consequences of a lowering of interest rates in the first year are shown in Scenario A2 (Figure 2). The nominal exchange rate takes up less of the burden of adjustment in the first year and, consequently, the real exchange rate appreciation is smaller than in Scenario A1. This policy response has favorable implications for all components of domestic demand and, since the real exchange rate appreciation is smaller, also leads to a smaller deterioration in the trade balance.[16] The output gap is thus smaller due to the rapid monetary accommodation in response to the external shock. This is achieved without a substantially different medium-term inflation outcome, indicating the benefits of a timely and appropriate monetary reaction.

Next, in response to the same shock, we consider the effects of fiscal policy. Contractionary fiscal policy could, through standard Mundell-Flemming channels, offset the appreciation of the real exchange rate generated by the shift in asset preferences.[17] However, the direct negative effects on aggregate demand would tend to dominate the effects of resisting the exchange rate appreciation in the short run, exacerbating the short-run weakness in economic activity. Conversely, a fiscal expansion, in isolation, would also tend be of limited effectiveness as the direct expansionary effects on aggregate demand would be diluted by the consequent exchange rate appreciation, which would be unhelpful in view of the initially

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[15]This is in some respects similar to the "Dutch disease" phenomenon. As in the case of that phenomenon, the traded goods sector is adversely affected by the exchange rate appreciation but the net welfare effect on the economy could in fact be positive (see, e.g., van Wijnbergen, 1994).

[16]The response of imports appears similar in the two simulations since the smaller exchange rate appreciation in the latter simulation is partially offset by the effects of stronger domestic activity.

[17]Changes in the stance of fiscal policy could influence the long-term credibility of fiscal discipline and, if these effects were strong enough, could have the opposite effect on the exchange rate. This channel is probably not very important in the case of Switzerland.

postulated excessive currency appreciation.[18] Hence, any fiscal expansion aimed at stimulating demand may need to be accompanied by a greater easing of monetary policy.

Scenario A3 shows the effects of a temporary increase of 2 percentage points in the ratio of government expenditure to GDP that is accommodated by a concomitant lowering of short-term interest rates in response to the portfolio preference shift. The output and inflation effects of this policy mix are similar to those in the previous scenario with the monetary policy reaction. Short-term interest rates decline marginally less and the exchange rate appreciates more in the short run. The principal effect of choosing between a monetary policy reaction and a mix of monetary and fiscal policy is on the composition of aggregate demand. In the latter case, private demand is crowded out to some extent by the increase in government consumption and the traded goods sector is more adversely affected.

In the simulations presented above, it was assumed that the portfolio preference shift would occur in 1998, when the short-term interest rate is projected to be over 4 percent. If this preference shift occurred earlier, however, or if interest rates in 1998 turned out to be significantly lower than the baseline forecast of 4 percent, then the interest rate floor could become a tighter constraint on the interest rate channel for monetary policy. Another possibility is that the preference shift would be much larger than in the simulations presented here, again constraining the interest rate response to accommodate the shock. In this case, the effects of the preference shift on the domestic economy could be larger.

This is illustrated in the next simulation (Scenario A4), which repeats the same shock considered in the previous three simulations, but assumes that nominal short-term interest rates are fully constrained by the interest rate floor in the first year and can then fall by a maximum of 200 basis points in the following three years. In this case, the exchange rate appreciation is larger and more persistent and, in addition, the smaller decline in interest rates yields a correspondingly smaller positive effect on domestic demand. Consequently, relative to the baseline, the cumulative output loss over the first three years is 3.4 percent of potential output compared to 2.1 percent in Scenario A2, without the binding interest rate constraint. The price level falls sharply in the short run, resulting in a decline in inflation that is balanced by a moderate increase of about 0.5 percentage points in medium-term inflation as prices return to their baseline level.

This scenario highlights the real output costs of the constraints imposed on monetary policy in responding to an asset preference shift when the inflation rate and the short-term interest rate are at low levels. In the event that nominal interest rate reductions were constrained, a faster increase in the money supply could be engineered within the existing

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[18]Simulation results showed, for instance, that the external sector leakages resulting from an exchange rate appreciation caused by even a large increase in government expenditure (five percentage points of GDP), coupled with the crowding out effects caused by an increase in interest rates, yielded a trivial short-run output response.

monetary targeting framework or, alternatively, monetary policy could be guided more explicitly by exchange rate developments. These policy responses are likely to have the effect of limiting the appreciation of the exchange rate and dampening short-term output losses, but at the cost of increasing medium-term inflation. The next two simulations consider the effects of these two strategies.

A simulation of the first type of policy response is shown in Scenario A5 (Figure 3). This scenario assumes a five percent increase in the money supply target starting in the third year of the simulation. Since nominal interest rates are constrained in the model, the increase in the money supply target has the effect of depreciating the nominal exchange rate sharply after the third year. This gives a boost to the external sector and, consequently, has a positive effect on aggregate output. Relative to Scenario A4, this expansionary monetary policy results in a net output gain of 1.6 percent over a three-year horizon (2000-2002). The cost of this policy, however, is a marked (although temporary) increase in medium-term inflation relative to the scenarios presented before, with inflation rising by over one percentage point above the baseline level by the sixth year of the simulation.[19]

Scenario A6 (Figure 4) shows the effects of an implicit (and credible) temporary exchange rate ceiling, where the monetary authority tries to limit the initial nominal exchange rate appreciation to about 2 percent (relative to baseline) and then counters any further short-term upward pressures on the exchange rate. In this case, the output losses are smaller than in the previous scenario and, in addition, the medium-term inflation outcome is relatively subdued due to the more rapid response of monetary policy. Both these simulations are suggestive of the trade-offs between output and inflation that will have to be faced when using the monetary policy instrument in response to EMU-related shocks.

B. Persistent Portfolio Preference Shift

An alternative scenario that we now explore is one where the shift in investors' preferences in favor of assets denominated in Swiss francs is persistent. In this case, since Switzerland is a small open economy, the long-run adjustment effect would be borne entirely by the domestic interest rate, although a nominal interest rate floor could potentially complicate this adjustment process. Through its permanent effect on domestic interest rates and, hence, on capital accumulation, the long-term implications of a permanent asset preference shift are very different from those of a temporary shift. Consider a persistent shift in favor of financial assets denominated in Swiss francs modeled as a permanent reduction (of

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[19]Since the model incorporates a nonlinear Phillips curve relationship, initial conditions do matter in the sense that the inflation responses are likely to be larger if the baseline output gap were smaller. The baseline forecast assumes an output gap of about 4 percent of potential GDP in 1996, declining to zero by the year 2003.

0.01) in the residual term of the interest parity equation (Scenario B1, Figure 5).[20] In this scenario, the increased preference for Swiss-franc-denominated assets translates into persistently lower domestic interest rates and rates of return on real assets in Switzerland. The real exchange rate appreciates initially and then returns to baseline so that the long-run effect of this shift is transmitted entirely to the domestic interest rate. The persistent decline in the interest rate is accompanied by a reduction in the cost of capital, leading to an investment boom which results in a gradual increase in the capital stock and an increase in the rate of growth of potential output.

This simulation suggests that the Swiss economy would benefit from a persistent shift into Swiss-franc-denominated assets, particularly productive assets, since a persistent exogenous increase in the preference for Swiss-franc-denominated assets feeds through into lower domestic interest rates and higher investment and increases potential output growth. All would not be well, however, from the Swiss point of view. The shift does have a contractionary effect on output in the short run. The real exchange rate appreciates, which leads to a deterioration in the trade balance and, in addition, private consumption declines temporarily. Inflation declines in the short-run, although not by very much. Nonetheless, it does raise the specter of a deflationary economy as the current inflation rate is around 1 percent, which could impose significant real costs in the event of future adverse shocks to the economy.[21]

The short-run adverse consequences on output of this shift could be mitigated by an easing of monetary policy, as shown in Scenario B2, where the medium-term money supply target is increased by 1 percentage point relative to its baseline. The real effects in the long run are, of course, similar to those in Scenario B1, but the short-run real differences are striking. The exchange rate appreciation is now substantially smaller in the short run and the effect on exports is considerably smaller. In addition, the decline in the short-term interest rate towards its long-run level is achieved more quickly, slightly sharpening the short-run investment response. The negative short-run effect on aggregate output is now virtually zero and actual output tracks potential output very closely. Following an initial decline, the price level, as measured by either the GDP deflator or the absorption deflator, returns to its baseline level, unlike in Scenario B1 where the decline in the price level is more persistent. A notable feature of this simulation is that, despite the easing of monetary policy, the business cycle

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[20]Strictly speaking, this persistent shift is modeled as being long-lived (over twenty years) but not permanent. Hence, the steady state is not affected and potential output returns to its baseline level in the very long run. For expositional purposes, the phrase medium term here refers to a horizon of about five to seven years, while the phrase long run refers to a longer time horizon but does not reflect effects that are permanent.

[21]In this context, Akerlof, Dickens, and Perry (1996) argue that standard measurements understate the extent of actual nominal wage rigidity in the United States. Measurements of nominal wage rigidity in Switzerland could be similarly biased.

stabilization effects are achieved without a significant increase in inflation, although this relatively benign outcome should be viewed relative to the inflation reduction achieved in Scenario B1.

These simulations indicate that, upon impact, an exogenous persistent increase in the preference of investors for Swiss-franc-denominated assets could have beneficial long-term effects but negative short-run effects on the Swiss economy, although these short-run effects are smaller than in the case of a temporary asset preference shift. To minimize the initial output costs, the simulations suggest that monetary policy should be eased to dampen the exchange rate appreciation and to provide support to the economy in the short run.

C. A Change in the Foreign Interest Rate

Finally, we consider the possibility that the baseline foreign interest rate could increase concurrently with a shift in investors' preferences toward Swiss-franc-denominated assets. The appropriate benchmark foreign interest rate is presumably a composite of interest rates in major industrial economies including Germany and the United States. For the purposes of this paper, baseline U.S. interest rates are assumed to be unaffected by the announcement of the participants in stage 3 of EMU and, thus, the DM interest rate is the key foreign interest rate. However, with the entry of Germany into EMU, the DM interest rate will disappear and the relevant point of comparison will be the *euro* interest rate. Since Germany has lower interest rates than most of other major countries that could be part of EMU in 1999, it is plausible that the initial *euro* interest rate could be higher than the baseline DM interest rate in the WEO forecast. Moreover, investors may require a higher rate of return on *euro* assets owing to the initial lack of credibility of the ECB and, more generally, to compensate for the higher risk associated with this new asset.

Although the premium paid by investors for Swiss-franc-denominated assets could still increase relative to the baseline, the net impact on Swiss interest rates can not be determined ex ante. For illustrative purposes, the *euro* interest rate was raised permanently by 50 basis points relative to the present baseline German interest rate in the simulation, while the residual in the interest parity equation was also reduced permanently as in the previous scenario. Both changes are assumed to be persistent. The simulation results (Scenario C1, Figure 6) are similar to the simulation for Scenario B1. Although the response profiles are similar, the effects of this composite shock on domestic interest rates, the components of domestic demand, the real exchange rate, and external demand are dampened relative to Scenario B1. For instance, the change in the rate of growth of potential output relative to the baseline is smaller in Scenario C1 than in Scenario B1 and so is the short-run decline in aggregate output. Consequently, the policy implications are also similar, except in terms of the magnitudes of the policy responses needed to offset the adverse short-run effects.

It should be recognized, of course, that the relative magnitudes of the changes in the foreign interest rate and the premium on Swiss-franc-denominated assets are difficult to determine ex ante. In addition, as noted earlier, the relevant "foreign interest rate" is a

composite of interest rates not just in Europe but also in the other major industrial economies including the United States. The effects of EMU on interest rates in these other economies have been abstracted from in this exercise but could be potentially important from the Swiss perspective.

V. Conclusions

European Monetary Union is likely to have a significant effect not just on its participants but also on neighboring countries with close economic and financial links to the EMU countries. This paper has examined the possible effects of EMU on one such country, Switzerland. As the target date for EMU approaches, the uncertainties surrounding the creation of EMU may lead to a shift in investors' preferences towards assets denominated in hard currencies outside the EMU, including the Swiss franc. Using a stylized open economy macroeconomic model of Switzerland, a number of illustrative scenarios were examined that suggest that the implications for the Swiss economy could range from being adverse to being quite beneficial. These simulations indicate that the magnitude and persistence of the shift in portfolio preferences could have an important bearing on the eventual outcome, as would the policy response.

Determining the appropriate policy response is a difficult task that is further complicated by the current cyclical weakness of the Swiss economy. The effectiveness of expansionary fiscal policy is limited by the exchange rate implications; a fiscal expansion would have a positive impact on domestic demand in the short run, but at the cost of an appreciation in the real exchange rate, thereby dampening the net impact on aggregate output. On the other hand, a fiscal contraction would indeed induce a currency depreciation but the direct effects of reduced government consumption on domestic demand could outweigh the positive demand effects.

Thus, monetary policy appears to be a more effective tool for stabilizing output in response to the types of shocks analyzed in this paper, both through its effects on domestic demand and on the exchange rate. Even with an expansionary fiscal policy in the short run, monetary easing is required in order to dampen the adverse short-term output effects of these shocks. As indicated by the simulations, the inflationary consequences of a delayed monetary response to an asset preference shift could be larger than if the response were rapid and sufficiently large. The simulations also illustrated the additional risks posed by the constraints on monetary policy in responding to external shocks in an environment with low levels of domestic inflation and interest rates. In particular, over the next few years, monetary policy in Switzerland is likely to be faced with some difficult choices between short-run output losses and temporary but significant increases in medium-term inflation, although this trade-off could be mitigated by timely and forceful policy responses.

Table 1. Switzerland: MULTIMOD Simulation Scenarios

	1998	1999	2000	2001	2002	2003	2004	2005
Output gap								
Scenario A1	-1.19	-1.00	-0.55	0.26	0.70	0.32	-0.10	-0.30
Scenario A2	-0.81	-0.75	-0.50	0.18	0.59	0.26	-0.11	-0.27
Scenario A3	-0.72	-0.65	-0.44	0.16	0.51	0.21	-0.11	-0.24
Scenario A4	-1.25	-1.22	-0.88	0.16	0.85	0.52	-0.01	-0.32
Scenario A5	-1.25	-1.22	-0.19	0.85	1.10	0.29	-0.47	-0.75
Scenario A6	-0.53	-0.61	-0.55	0.36	0.97	0.31	-0.36	-0.61
Scenario B1	-0.40	-0.28	-0.10	0.04	0.11	0.10	0.05	0.00
Scenario B2	-0.15	-0.03	0.07	0.07	0.05	0.01	-0.01	-0.02
Scenario C1	-0.20	-0.13	-0.04	0.02	0.05	0.05	0.02	-0.00
GNP inflation								
Scenario A1	-0.25	-0.38	-0.48	-0.31	0.12	0.44	0.46	0.27
Scenario A2	-0.16	-0.27	-0.35	-0.23	0.12	0.38	9.37	0.20
Scenario A3	-0.16	-0.24	-0.31	-0.18	0.12	0.33	0.32	0.16
Scenario A4	-0.26	-0.45	-0.63	-0.49	0.02	0.50	0.61	0.43
Scenario A5	-0.26	-0.45	-0.30	0.24	1.07	1.49	1.28	0.78
Scenario A6	-0.10	-0.18	-0.25	-0.02	0.58	0.94	0.80	0.40
Scenario B1	-0.12	-0.21	-0.26	-0.25	-0.19	-0.12	-0.07	-0.05
Scenario B2	-0.05	-0.07	-0.05	-0.02	0.02	0.03	0.03	0.02
Scenario C1	-0.06	-0.10	-0.13	-0.12	-0.09	-0.06	-0.03	-0.03
Short-term nominal interest rate								
Scenario A1	0.00	-1.55	-2.39	-2.22	-1.18	-0.12	0.50	0.59
Scenario A2	-1.03	-1.83	-2.33	-2.06	-1.06	-0.09	0.44	0.50
Scenario A3	-0.95	-1.68	-2.13	-1.85	-0.92	-0.07	0.37	0.40
Scenario A4	0.00	-1.20	-1.60	-1.95	-1.44	-0.35	0.47	0.71
Scenario A5	0.00	-1.20	-1.99	-2.19	-1.08	0.52	1.38	1.35
Scenario A6	-1.75	-1.70	-1.69	-2.18	-1.77	0.00	0.92	0.95
Scenario B1	-0.56	-0.97	-1.21	-1.32	-1.29	-1.19	-1.08	-1.00
Scenario B2	-0.88	-1.01	-1.23	-1.13	-1.03	-0.96	-0.92	-0.92
Scenario C1	-0.28	-0.48	-0.61	-0.66	-0.64	-0.59	-0.54	-0.50

Table 1. Switzerland: MULTIMOD Simulation Scenarios (concluded)

	1998	1999	2000	2001	2002	2003	2004	2005
Nominal effective exchange rate								
Scenario A1	4.26	2.19	1.64	0.34	0.06	1.21	1.21	0.84
Scenario A2	3.00	1.96	1.67	0.30	-0.13	0.88	0.97	0.55
Scenario A3	3.17	2.19	1.89	0.39	-0.24	0.64	0.71	0.35
Scenario A4	4.49	2.86	2.49	0.46	-0.09	1.30	1.64	1.19
Scenario A5	4.49	2.86	0.23	-1.40	-1.70	-0.68	-1.17	-2.46
Scenario A6	2.14	1.98	1.88	-0.72	-1.79	-0.10	-0.10	-0.98
Scenario B1	1.34	0.91	0.87	1.08	1.39	1.67	1.86	1.93
Scenario B2	0.52	0.40	0.41	0.62	0.75	0.78	0.74	0.66
Scenario C1	0.65	0.43	0.41	0.51	0.67	0.81	0.89	0.93
Real effective exchange rate								
Scenario A1	2.56	1.11	0.49	-0.54	-0.68	0.29	0.65	0.54
Scenario A2	1.82	1.06	0.69	-0.32	-0.55	0.30	0.60	0.48
Scenario A3	1.92	1.23	0.88	-0.17	-0.53	0.21	0.45	0.34
Scenario A4	2.70	1.49	0.90	-0.69	-1.08	0.06	0.66	0.66
Scenario A5	2.70	1.49	-0.34	-1.27	-0.87	0.68	1.19	0.87
Scenario A6	1.31	1.15	0.97	-0.68	-1.06	0.57	1.10	0.82
Scenario B1	0.79	0.40	0.23	0.20	0.28	0.39	0.48	0.51
Scenario B2	0.31	0.20	0.17	0.31	0.41	0.46	0.47	0.44
Scenario C1	0.38	0.19	0.10	0.09	0.13	0.19	0.23	0.24

Note: All simulation results represent deviations from the baseline forecast in the IMF's World Economic Outlook. The output gap is expressed as the percentage deviation of actual GDP from potential GDP. The inflation and interest rate responses are in percentage points while the exchange rate responses are in percent.

Figure 1. Switzerland: Temporary Portfolio Preference Shift with a Delayed Monetary Reaction

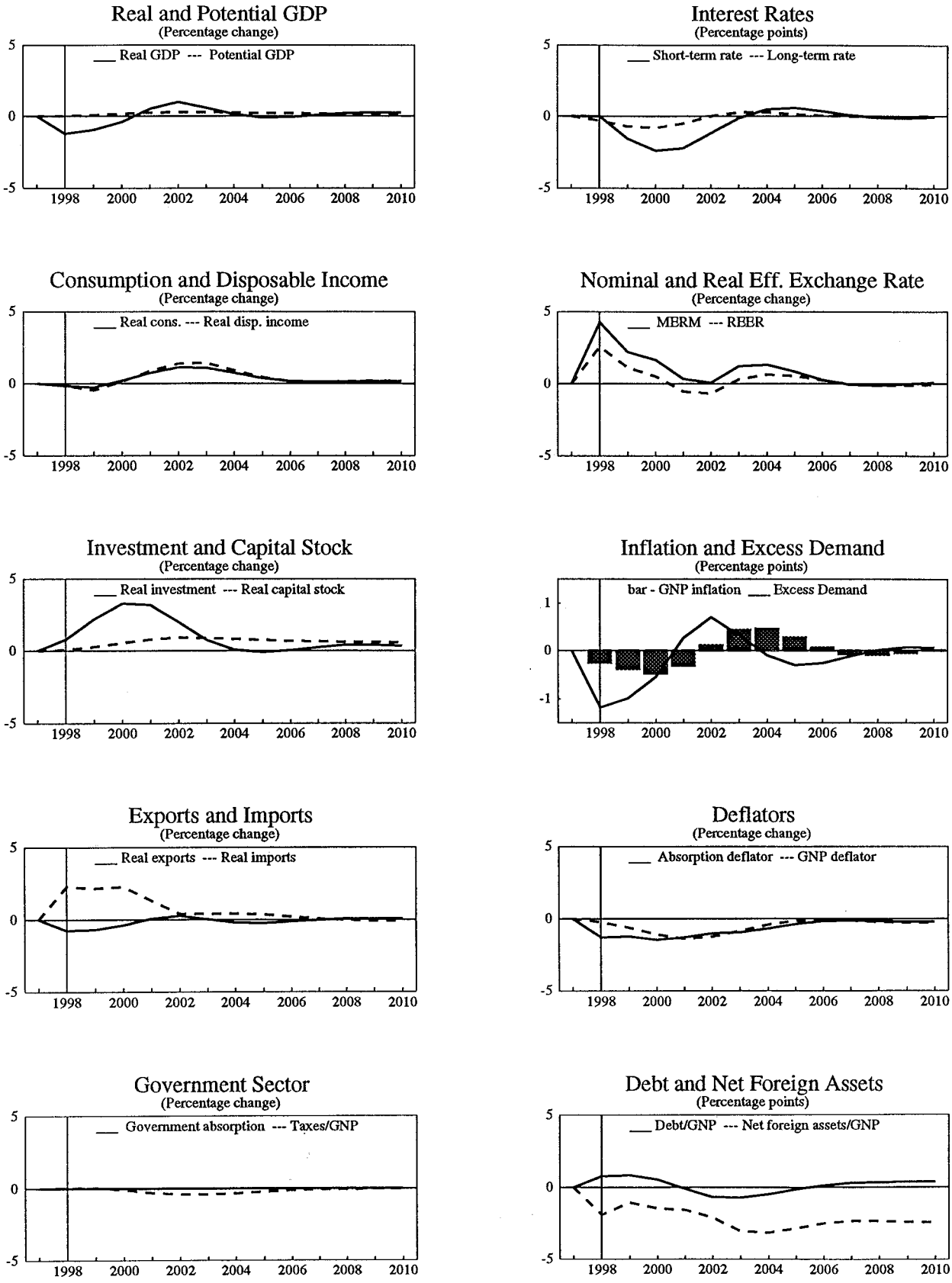


Figure 2. Switzerland: Temporary Portfolio Preference Shift with a Timely Monetary Reaction

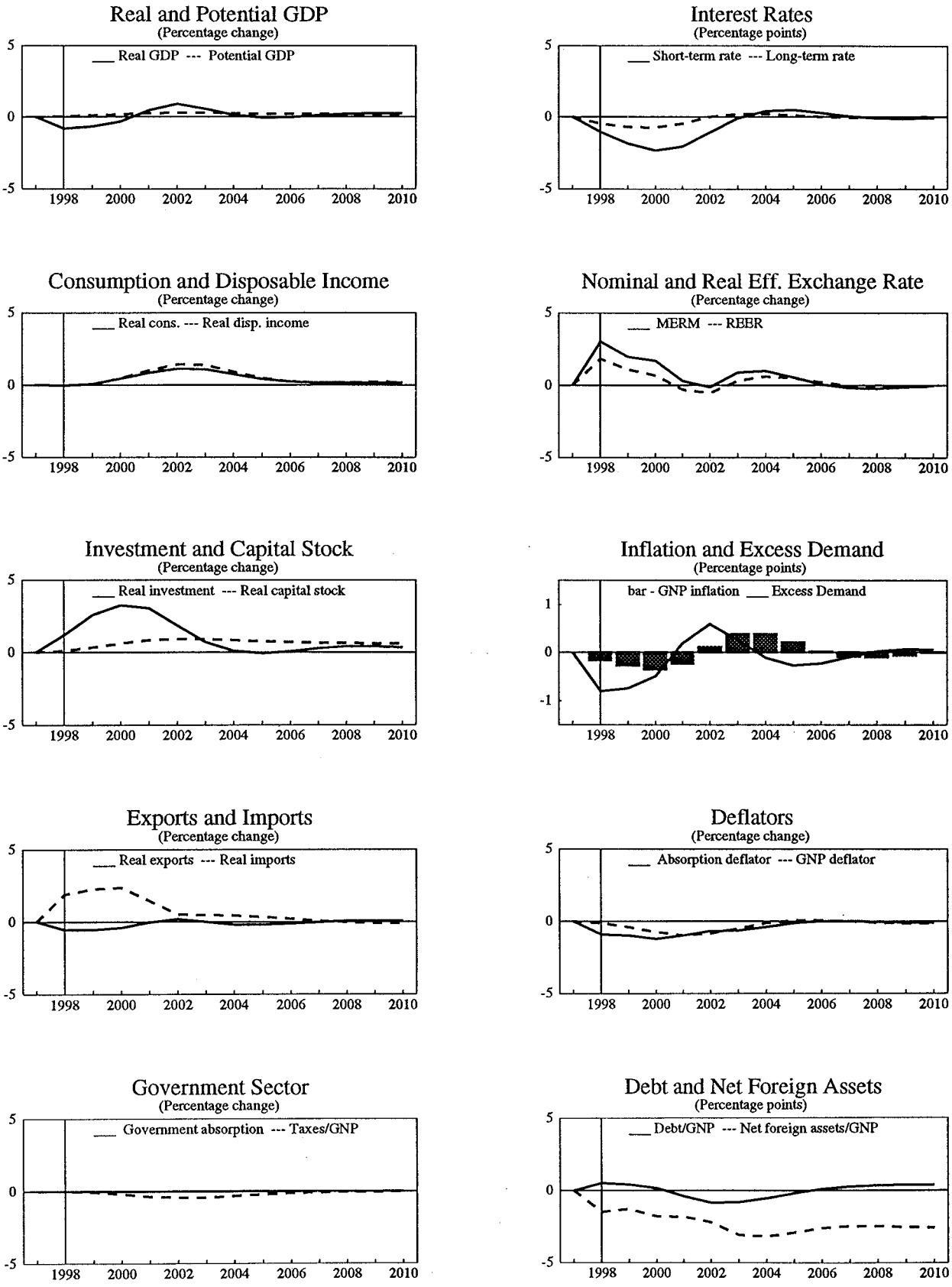


Figure 3. Switzerland: Portfolio Preference Shift with an Interest Rate Floor and Monetary Stimulus

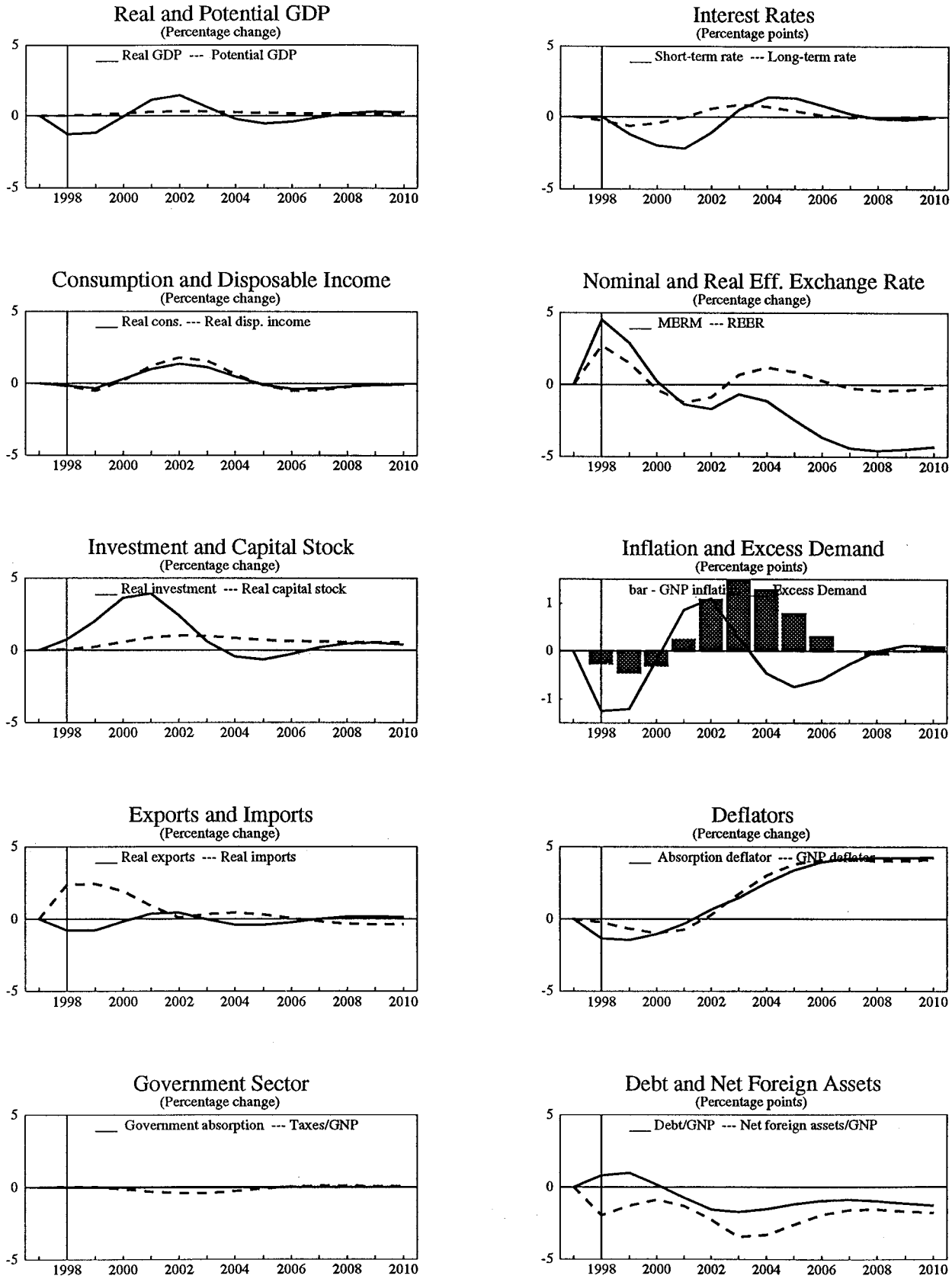


Figure 4. Switzerland: Portfolio Preference Shift with a Temporary Exchange Rate Ceiling

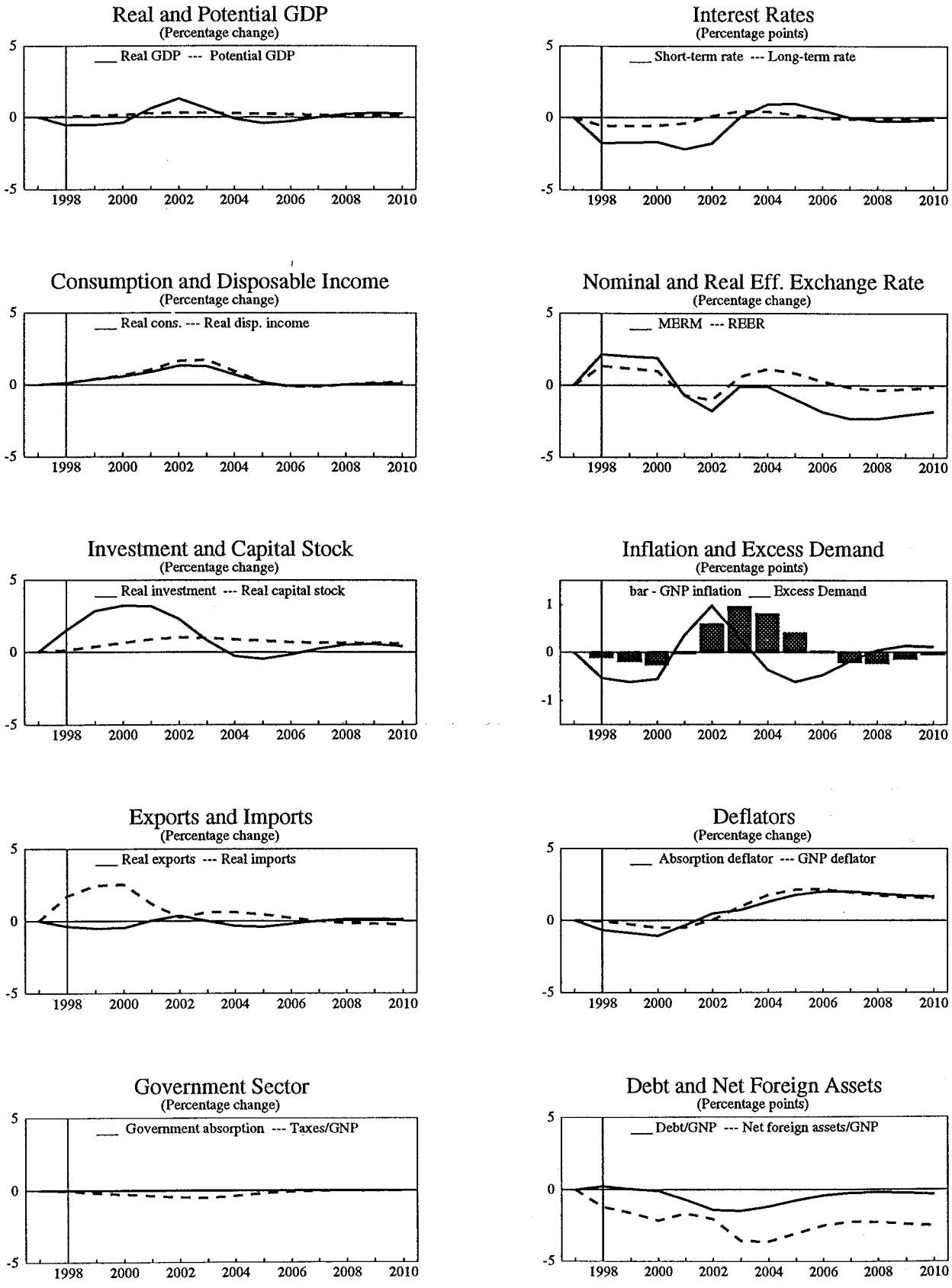


Figure 5. Switzerland: A Persistent Portfolio Preference Shift Without Monetary Accomodation

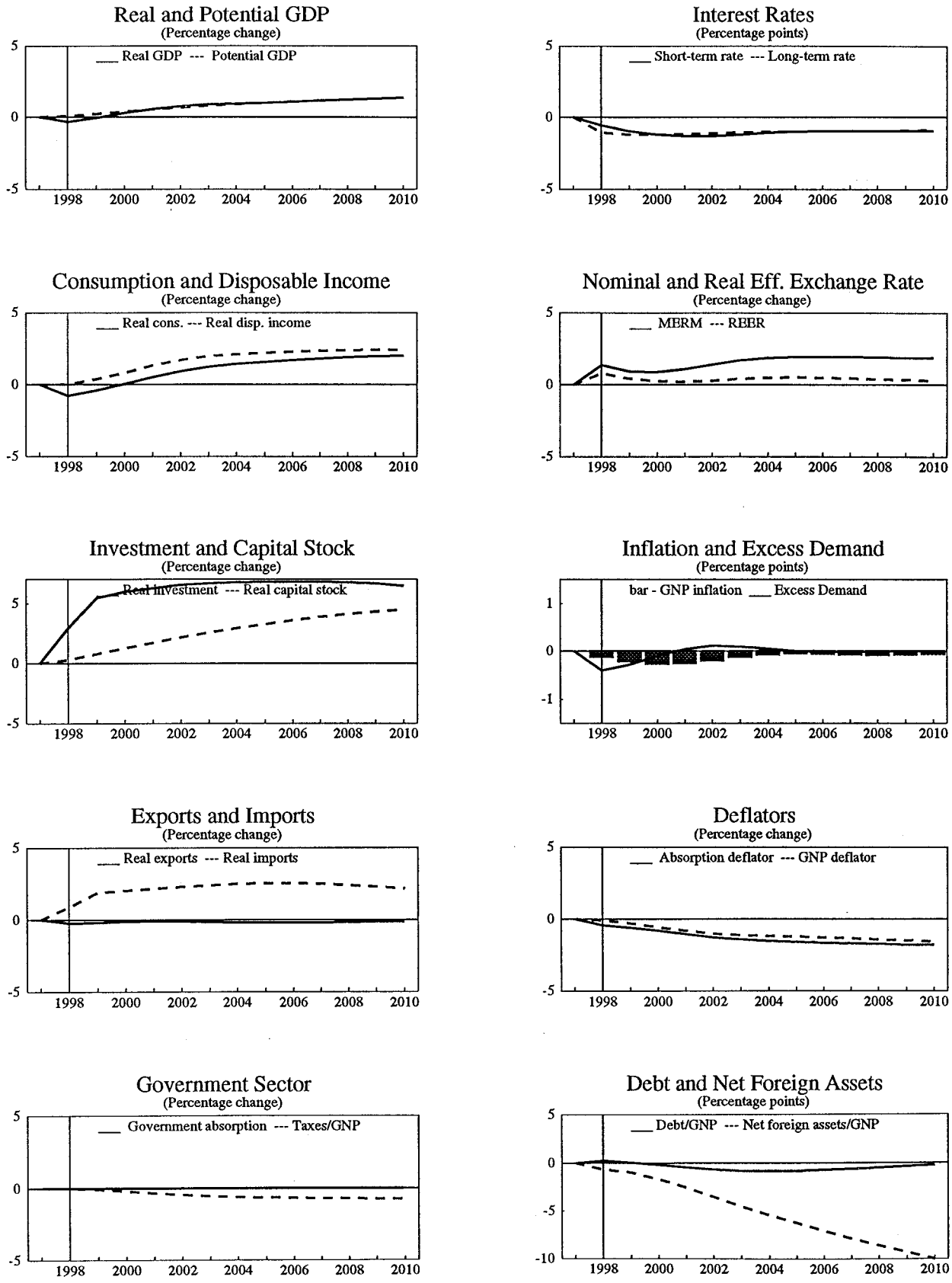
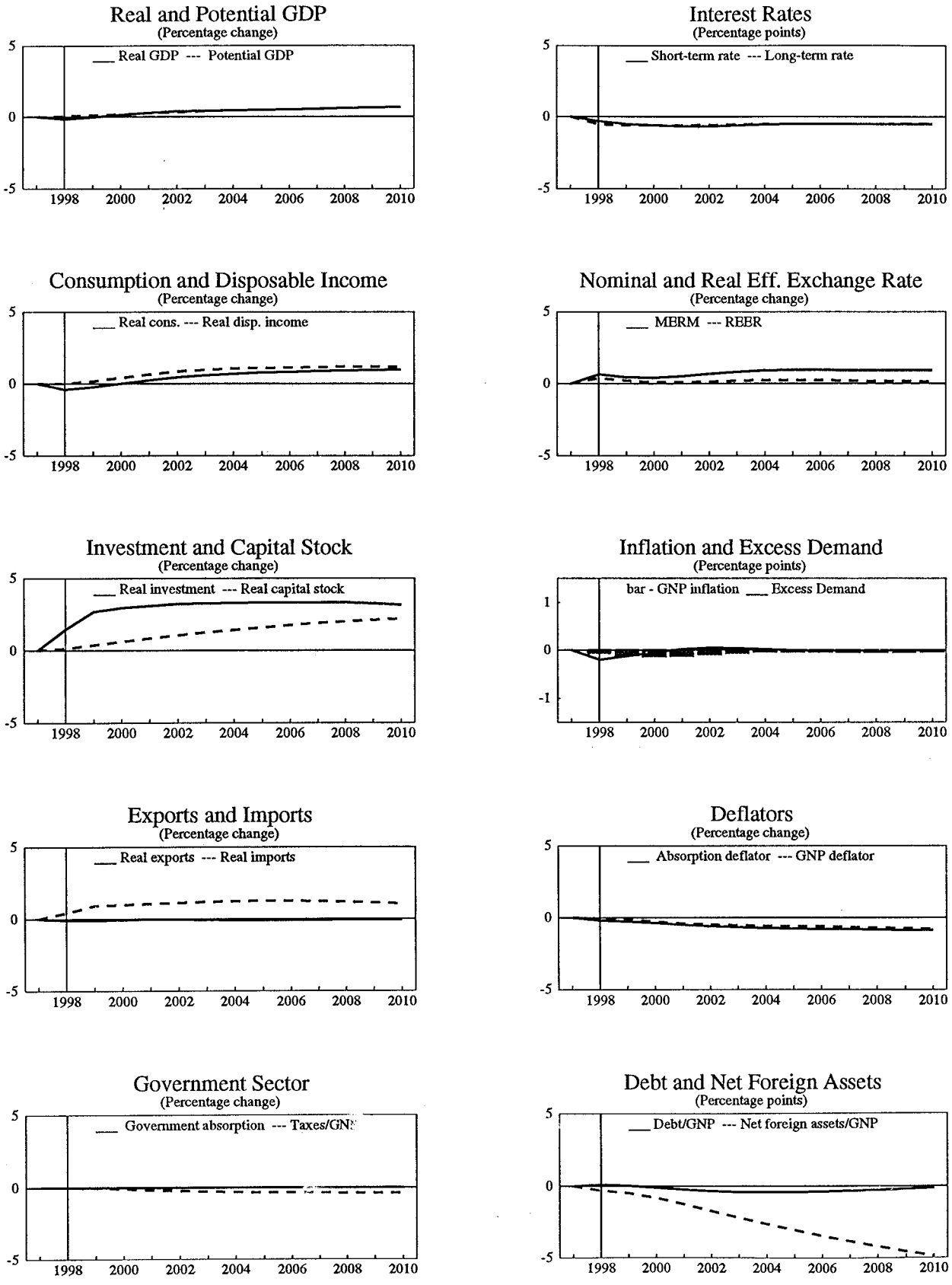


Figure 6. Switzerland: A Higher Foreign Real Interest Rate



A BRIEF DESCRIPTION OF THE MAIN FEATURES OF MULTIMOD MARK III

A. The Model

MULTIMOD is a dynamic multicountry macro model of the world economy that has been designed to study the transmission of shocks across countries as well as the short-run and medium-term consequences of alternative monetary and fiscal policies. This Mark III generation includes explicit country models for each of the major industrial countries and an aggregate grouping of 14 smaller industrial countries. The remaining economies of the world are then aggregated into two separate blocks of less developed countries: countries that are oil exporters and those that are dependent on oil imports.

The modeling system also includes well-defined, steady-state analogue models that are used to construct terminal conditions for the dynamic model and to study the effects of shocks that have permanent consequences on savings, investment, output, real interest rates, real exchange rates etc. The structure of the model is simple enough that it is fairly straightforward to include additional country models for the smaller economies.

The model has not been designed to be a forecasting tool. The baseline scenarios are taken from the medium-term World Economic Outlook projections. These medium-term projections are then extended into a model-consistent balanced-growth path where the real interest rate is greater than the world real growth rate.

B. Basic Structure and Properties of the Model

Despite the focus on medium-term and long-run properties, the model also has important short-run Keynesian dynamics that feature significant wage and price rigidities, as well as asymmetries that arise because of short-run capacity constraints. Unlike linear models of the inflation process, an implication of the model is that a failure to avoid boom and bust cycles can have first-order welfare implications. Thus, the structure of the model provides a fundamental role for stabilization policies and shows that it can be costly to delay necessary adjustments in monetary and fiscal instruments.

The model assumes forward-looking behavior in all markets but it is possible to study the effects of shocks under alternative assumptions about imperfect policy credibility. The model is solved with state-of-the-art simulation algorithms that have been designed specifically to solve such problems.

The consumption/savings model is based on an extended Blanchard-Weil-Buiter model where agents are assumed to have finite planning horizons. The model has been extended to allow for realistic life cycle income profiles and the fact that a significant proportion of consumers are constrained by their disposable incomes because they are unable to borrow against their future labor income streams.

The investment model is based on Tobin's Q theory in which the desired rate of investment exceeds the steady-state rate as long as the expected marginal product of capital is greater than its cost. The model allows for significant adjustment costs.

The model has a standard trade sector that embodies the notion that countries trade in diversified products. Imports are a function of domestic absorption and the real exchange rate and exports are modeled to approximately represent the mirror image of the foreign import demand functions.

Exchange rates are determined through an adjusted interest parity relationship that allows for persistent risk premia.

The fiscal policy instruments include government absorption, distortionary capital taxes, and nondistortionary labor taxes. In the standard version of the model, government absorption is exogenous and the aggregate tax rate is adjusted to ensure that government debt converges to its target level. However, in the short run, it is possible to set all three fiscal instruments as exogenous variables.

Given the forward-looking nature of the model, the fundamental role of the monetary authorities is to provide an anchor for inflation expectations. This can be accomplished in many ways, such as inflation targeting, money targeting, nominal income targeting or fixing the exchange rate to a country that imposes a nominal anchor. In the standard version of the model, there are options to impose fixed exchange rates or money targeting.

RE-ESTIMATING THE MODEL EQUATIONS FOR SWITZERLAND

This appendix briefly describes the results of the re-estimation of the money demand equation and the main trade equations in the model for Switzerland. Except in the case of the money demand function, the regression specifications are identical to those used for all other countries in MULTIMOD. A detailed description and derivation of the specifications can be found in Masson, Symansky, and Meredith (1990). All regressions were estimated using annual data from 1971 to 1995 obtained from the OECD Analytical Database.

A. The Money Demand Equation

The standard money demand specification is linear in the interest rate. Given Switzerland's current low level of short-term interest rates, it was necessary to constrain the interest rate responses in the simulations from going below the nominal interest rate floor of zero percent. Hence, the following simple nonlinear specification was estimated:

$$\log(MB/PGNPNO) = \underset{(0.806)}{1.687} + \underset{(0.157)}{0.345}*\log(GDP) + \underset{(0.157)}{(1-0.345)}*\log(MB(-1)/PGNPNO(-1)) - \underset{(0.028)}{0.051}*\log(IR) - \underset{(0.008)}{0.017}*TREND;\ Rbarsq = 0.313,\ DW = 2.11$$

where MB is the monetary base, PGNPNO is the non-oil GNP deflator, IR is the annualized three-month nominal interest rate, and TREND is a time trend. Standard errors are reported in parentheses below the estimated coefficients. The estimated elasticities appear reasonable and, when the equation was used in MULTIMOD, yielded acceptable model properties. Using the CPI instead of the output deflator did not change the results very much. However, given the limited span of the available data and the limited number of time periods with low levels of interest rates that could be used to identify nonlinearities, the results of this estimation should be treated with caution.

B. The Trade Equations

The trade equations were estimated using volumes and prices for exports and imports of manufactured goods. The volume equation for imports of manufactures is as follows:

$$\begin{aligned}\Delta\log(IM) = IM0 &+ IM1*\Delta(IM7*\log(A) + (1-IM7)*\log(XM)) + \\ &IM2*\Delta(\log(PIMA/PGNPNO)) + IM3*\log(PIMA(-1)/PGNPNO(-1)) \\ &+ IM4*(IM7*\log(A(-1)) + (1-IM7)*\log(XM(-1)) - \log(IM(-1))) + \\ &IM5*T + IM6*(T\hat{}2)\end{aligned}$$

where the operator *del* indicates the first difference, IM stands for imports of manufactures, A is real domestic absorption, XM is export volume, PIMA is the import price for manufactures,

PGNPNO is the non-oil GNP deflator, T is a time trend, and IM0-IM7 are the parameters to be estimated.

This specification permits a short-run effect of the change in the log of absorption that differs from its long-run effect, which is constrained to have a unit elasticity.[22] The current change in relative prices is included, as well as its lagged ratio. Note that a weighted average of domestic absorption and of exports of manufactures is included to account for the fact that imported inputs are used in producing export goods and that an increase in the latter may therefore be associated with higher imports. The estimates are presented below, with the previous MULTIMOD estimates for the full block of smaller industrial countries (SIC) included for comparison.

The estimation results indicate that the export volume equation for Switzerland does not differ substantially from the SIC parameters, although there are some differences (see Table A1). For instance, the short-run effect of activity on imports is smaller than the SIC average. The estimates are generally quite plausible, with price and activity elasticities having the correct signs.

Next, we turn to the export volume equation. This equation incorporates an error-correction specification, uses weighted foreign absorption as an explanatory variable, and the price variable takes into account the price of exports relative to prices in the importer's home market, as well as competition in third markets. The equation also allows for lagged real exchange rate effects and is written as follows:

$$\begin{aligned}\text{del(log(XM))} = {} & \text{XM0} + \text{XM1*del(REER)} + \text{XM2*del(log(FA))} + \\ & \text{XM3*log(XM(-1)/FA(-1))} + \text{XM4*REER(-1)} + \text{XM5*T} + \text{XM6*(T\^{}2)}\end{aligned}$$

where XM stands for the volume of exports of manufactures, REER is the real effective exchange rate, FA is the weighted average of foreign absorption, T is a time trend and XM0-XM6 are parameters to be estimated.

The estimation results for the export volume equation for Switzerland are also similar to the results for the SIC block as a whole (Table A1). The short-run elasticity of imports with respect to foreign absorption is 1.8, compared with a long-run elasticity that is imposed to be unity. The short-run price elasticity of exports is smaller than the long-run elasticity and all coefficients have reasonable signs.

Finally, the export price equation was also re-estimated using Swiss data. In the specification of this equation, the rate of change of export prices is assumed to be a linear combination of the rates of change of domestic and foreign non-oil export and output prices.

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[22]That is, for a given level of the real exchange rate, the share of imports in total domestic absorption is assumed to remain constant over the long run.

In addition, the specification includes a lagged difference between domestic and export prices, thereby forcing export prices to rise one for one with domestic output prices in the long run. The estimated equation is as follows:

$$\text{del(log(PXM))} = \text{PXM0} + \text{PXM1}*\text{del(log(PGNPNO))} + (1-\text{PXM1})*\text{del(log(PFM))} + \text{PXM2}*\text{log(PGNPNO(-1)/PXM(-1))}$$

where PXM is the export price for manufactures, PGNPNO is the domestic non-oil output deflator, and PFM is a weighted average of competitors' prices in foreign markets, and PXM0-PXM2 are parameters to be estimated. The coefficient estimates are presented in Table A1, along with the estimates for the full SIC block.

Table A1. Estimates of Trade Equations for Switzerland

Import Volume Equation			Export Volume Equation			Export Price Equation		
Coefficient	Switzerland	SIC	Coefficient	Switzerland	SIC	Coefficient	Switzerland	SIC
IM0	-0.757	-0.790	XM0	-2.861	-1.243	PXM0	0.001	-0.016
	(4.5)	(2.7)		(4.1)	(6.5)		(0.2)	(2.0)
IM1	1.977	2.104	XM1	-0.299	-0.242	PXM1	0.645	0.626
	(18.1)	(4.6)		(2.9)	(1.1)		(12.5)	(3.5)
IM2	-0.225	-0.670	XM2	1.795	2.003	PXM2	0.077	0.077
	(2.8)	(3.8)		(6.2)	(10.4)			(2.5)
IM3	-0.260	-0.597	XM3	0.772	-0.633			
	(3.0)	(2.9)		(3.9)	(8.8)			
IM4	0.483	0.511	XM4	-0.369	-0.447			
	(6.2)	(2.7)		(3.7)	(7.3)			
IM5	0.022	0.008	XM5	0.022	2.696			
	(4.1)	(1.6)		(3.4)	(2.0)			
IM6	0.000	0.000	XM6	0.000	-0.050			
	(5.5)	(0.0)		(2.8)	(1.4)			
IM7	0.760	0.770						
	(15.7)							
Rbarsq.	0.950	0.761	Rbarsq.	0.797	0.611	Rbarsq.	0.871	0.614
SER	0.015	0.035	SER	0.019	0.036	SER	0.018	0.036
DW	2.71	2.07	DW	2.03	1.94	DW	1.33	

Notes: Figures in parentheses are absolute t-ratios. The trade equations were estimated using annual data over the period 1971-95. SIC stands for the block of small industrial countries. The SIC equations were estimated using annual data over the period 1966-87 and represent pooled estimates across SIC and G-7 countries, with certain coefficients restricted to be the same across all countries. The regression diagnostics are from these pooled equations. The pooled coefficient estimate of 0.077 for PXM2 was used for Switzerland.

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