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Economic Implications of German Unification for the Federal Republic and the Rest of the World

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Abstract

The economic effects of German unification are first discussed in the context of a global saving/investment model. Next, simulations of MULTIMOD are presented, suggesting for the FRG an initial increase in long-term real interest rates equal to 3/4 of a percentage point, increased output, a temporary half-point rise in inflation, a modest real appreciation of the deutsche mark, and a reduction of the (combined GDR and FRG) current account surplus equal to 2 percent of GNP. Effects on the rest of the world seem to be relatively small. Different policies are examined within the EMS, and other simulation studies are surveyed.

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I. Introduction

German Economic, Monetary, and Social Union (GEMSU) is likely to have major implications in a number of areas, both for Germany and for its neighbors. The most dramatic effects are likely to occur in the economy of the German Democratic Republic (GDR), and a proper analysis requires detailed microeconomic information and assessment of the transition from a planned to a market economy. 1/ But the Federal Republic of Germany (FRG) will also be affected in a major way, through higher government deficits and increased exports to the GDR. The purpose of this paper is not to quantify the effects of unification on the GDR itself, nor to quantify increases in FRG government spending. Instead, taking as given estimates of those variables, the macroeconomic consequences for the Federal Republic and other industrial countries are analyzed from a global perspective.

Section II starts by considering the additional demand on world savings coming from increased investment and higher social spending in the GDR. The shift of the GDR economy to a market economy will have favorable supply-side effects over and above those that result from capital accumulation, since productivity should rise as a result of improved management, greater work incentives, and the transfer of modern technology to GDR firms. However, increases in productivity will also require increased government spending (for instance, on infrastructure) and substantial private capital accumulation (in order to replace obsolete equipment and to reorient production for western markets) and the increases in productivity from these sources will materialize only over time. An initial effect of GEMSU would therefore be to increase global investment relative to saving, since the GDR is unlikely to finance the increased expenditures solely through increased saving. Thus, in the first instance GEMSU would take the form mainly of a positive demand shock; in the medium to long run, in contrast, the supply effects should strengthen, and there is no reason to expect a permanent drain on global saving.

With a rise in global investment relative to saving, it is to be expected that real interest rates will rise in all countries to some extent. Some numerical estimates of effects on interest rates and exchange rates are given, using a simple global saving/investment model. GEMSU is also likely to increase the demand for the output of the FRG relative to that of other countries. Much of the investment in the GDR will probably be undertaken by firms from the FRG, because of former business ties, common language, and physical proximity. In addition, because the FRG has a comparative advantage in the machinery and equipment that is needed to retool the GDR economy, a good part of the investment demand is likely to be directed to the FRG, though no doubt imports of goods from other countries will also increase. In these circumstances, the relative price of German output (its

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1/ This is the subject of a separate background paper by Donogh McDonald and Gunther Thumann, "Scenarios for the German Democratic Republic under GEMSU" (unpublished), whose estimates are used here.

real exchange rate) can be expected to increase initially compared to the value it would otherwise have taken--at least on the presumption that goods from different countries are not perfectly substitutable and that output in the FRG is constrained by existing capacity. Expected real exchange rate changes would affect the distribution of real interest rate increases, which would likely be initially higher in Germany than elsewhere.

Another aspect of German unification is migration from the GDR to the FRG. Migration occurred on a large scale in the latter months of 1989 and early in 1990 and is expected to continue, albeit at a much reduced rate. Migration increases potential output in the FRG and eases capacity pressures there. Section III presents estimates of the effects on potential output of projected migration.

Section IV considers other factors that may be important for a complete analysis of the macroeconomic impacts of German unification. The above discussion ignored monetary phenomena and inflation--real variables were assumed to be independent of monetary policies and output to equal capacity output. Prices, however, are not perfectly flexible, and capacity limits not perfectly inflexible, in the FRG; thus, the stance of monetary policy will influence the response of FRG output and inflation to increased demand from the GDR. In this section, simulations of the Fund's macroeconomic model, MULTIMOD, are presented; this model includes effects of monetary policies and estimates of the degree of price stickiness.

The model used for these simulations thus incorporates several additional mechanisms compared with to the saving/investment model discussed in Section II. In MULTIMOD, there is no absolute constraint on output in the short run because the capacity limit is unlikely ever to be reached, barring exceptional circumstances, such as wartime. Additional demand can be satisfied by increasing the intensity of use of existing capacity, for example through overtime, additional shifts, etc. However, the higher is demand relative to normal capacity output, the greater are inflationary pressures. The interaction of monetary policy and inflation stickiness has important effects not only on the size of real interest rate and real exchange rate changes induced by GEMSU, but also on whether they are achieved through nominal interest rate and exchange rate movements or through price level effects.

Net goods demand from the GDR and migration to the FRG are simulated under two scenarios: in the more optimistic scenario, investment in the GDR is sufficient to raise output per worker to 80 percent of the FRG's level by 2001; in the less optimistic scenario, investment is lower, output per worker only reaches two thirds of the FRG's level, and migration to the FRG is considerably higher. The MULTIMOD simulation of the more optimistic scenario takes as given an increase in GDR net imports of goods and services from the rest of the world of DM 36 billion in 1990 and DM 73 billion in 1991, declining gradually thereafter. The MULTIMOD simulation of the effects of this demand shock suggests that it might increase the level of

output in the FRG by about 1 1/4 percent in the short-term (by 1991), and temporarily raise inflation by one-half percentage point. By 2001, the combined output of the FRG and GDR would rise by 10 1/2 percent relative to a baseline without unification. These effects would be associated with an initial rise in real long-term interest rates in the FRG of about 3/4 of a percentage point, exchange rate appreciation of about 3 1/2 percent against the dollar, and a reduction of the combined German current account surplus by about 2 percentage points of GNP for a number of years. In the more pessimistic scenario, combined output would be higher than in the baseline, but by only 6 1/2 percent by 2001. Government deficits as a percent of GNP would be considerably higher than in the first scenario, as increased unemployment payments, lower revenues, and lower output widen the deficit by 2 percent of combined GNP relative to baseline for a number of years. Given the possibility of persistent deficits, the issue arises as to whether increases in tax rates in the FRG are desirable. Simulations of a VAT increase are presented.

Section V explores the systemic implications of German unification in the context of the existing Exchange Rate Mechanism (ERM) of the European Monetary System and its possible evolution into a more formal monetary union (EMU). The scenarios of Section IV suggested that the GEMSU shock, accompanied by a non-accommodating monetary policy by the Bundesbank, might lead to appreciation of the deutsche mark in real terms. This would occur via a nominal appreciation against non-ERM currencies (U.S. dollar, the yen, etc.) and an increase in the price of German output relative to that of other ERM countries, whose central parities are assumed unchanged relative to the deutsche mark. An alternative scenario replaces the assumption that current ERM parities are fixed with the assumption of a currency realignment. This scenario results in lower inflation in Germany and stronger economic activity in other ERM countries. On the face of it, then, a realignment might be an attractive policy option should upward pressures on the deutsche mark appear within the ERM. However, an important feature of the recent ERM experience is that less frequent realignments have led to a narrowing of interest rate differentials relative to Germany, as the anti-inflationary commitment of other ERM countries has become manifest. Another realignment might reverse this progress; a simulation is presented that highlights the unfavorable effects of reduced credibility of "hard currency" policies.

Another systemic issue is the degree of symmetry in the operation of the ERM. This is especially relevant in the case of the "GEMSU shock," which is asymmetric since it affects one of the members of the ERM much more strongly than others. In current circumstances, developments in Germany have a disproportionate effect on European monetary policy, and this effect is embodied in the simulations of Section IV, where it is assumed that German demand for money and targeted growth of M3 determine the level of short-term interest rates in the ERM as a whole. In contrast, an alternative simulation assumes that rapid progress to EMU leads to a target for European monetary growth, implying that interest rates in EMU countries

respond to the average behavior of output and inflation in those countries jointly. Given the nature of the shock, interest rates rise less in this simulation than in the reference case.

Section VI surveys other model-based simulation studies of German unification. Available analyses using fully-specified multi-country models are relatively few. They differ in a number of respects, in particular as regards the output/inflation tradeoff, how "forward-looking" are financial asset prices, and on the extent that increased demand in the GDR is transmitted to partner countries instead of to the FRG.

A final subsection sketches some tentative conclusions and discusses some key unresolved questions.

II. A Global Saving/Investment Perspective

The approach in this paper is to treat the amount of GDR spending in excess of its output as the main "shock" to the global economy involved in GEMSU. Table 1 presents two sets of estimates of the net import demand in the GDR that might result from GEMSU. 1/ In the first one, which will be termed the "reference case," investment proceeds at a rapid enough rate to raise output per worker in the GDR to 80 percent of the FRG's level by 2001. In the second, less optimistic scenario, investment in the GDR is lower but saving is also lower, and output per worker only reaches two thirds of the FRG's level in 2001. It is assumed that in the absence of GEMSU, the external position of the GDR would have been roughly in balance, so the figures in Table 1 constitute additional demands on world saving. 2/ Table 2 gives estimates of global saving/investment flows for 1989. The latter serve to put the GDR figures in perspective; the increased demand placed on world saving in any one year is relatively small, less than 2 percent of the world total. In a world of high capital mobility, increased investment in the GDR can be seen as tapping a global pool of saving, rather than being restricted to a local capital market.

It is useful first to consider the shock to GDR investment from the point of view of a simple two-region model, where the two regions are Germany and the rest of the world (ROW). 3/ For purposes of illustration, Germany here is a united Germany, though it is clearly not appropriate to assume that econometric relationships estimated with data for the FRG also apply to the GDR. The model is based on three simple hypotheses: 1) saving net of investment depends positively on the (real) interest rate, R; 2) the

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1/ Estimates provided by McDonald and Thumann, op. cit.

2/ The baseline also assumes GDP growth of 2 percent in the GDR, and no government borrowing on world capital markets.

3/ The analytical model is discussed in Masson and Knight (1986), and estimated with data for the United States, Japan, the Federal Republic of Germany, and the rest of the world.

Table 1. Demands on Global Saving Due to GEMSU:
Increased Net Imports by the GDR 1/

(In billions of deutsche mark or U.S. dollars at 1990 prices)

	Reference Scenario		Less Optimistic Scenario	
	in deutsche mark	in U.S. dollars 2/	in deutsche mark	in U.S. dollars 2/
1990	36	21	36	21
1991	73	43	67	39
1992	70	41	66	39
1993	65	38	63	37
1994	61	36	58	34
1995	56	33	52	31
1996	51	30	51	30
1997	45	26	50	29
1998	38	22	50	29
1999	30	18	49	29
2000	23	14	48	28
2001	16	9	48	28

Source: *staff estimates*

1/ Investment net of increases in saving in the GDR.
2/ At the DM/$ rate prevailing at end 1989.

Table 2. Global Saving, Investment, and Government Deficits for 1989

(In billions of U.S. dollars)

	Private Saving 1/	Private Investment	Government deficit 2/	Current account position
United States	835	796	150	-111
Japan	989	917	15	57
Germany, Fed. Rep. of	319	255	11	53
Other industrial countries	1268	1172	180	-83
Developing countries	783	691	104	-12
World totals	4194	3831	459	-96 3/

Source: IMF, International Financial Statistics, Government Finance Statistics, and World Economic Outlook.

1/ Calculated residually, so it also includes financial balances of lower levels of government.

2/ Central government.

3/ Current accounts should sum to zero; the figure corresponds to the world current account discrepancy.

goods produced in the two regions are imperfect substitutes, hence the demand for each good depends on the their relative price, i.e. the real exchange rate, ϵ; and 3) prices are perfectly flexible so that output is always equal to potential output, which is constrained by the existing labor force and capital stock. These hypotheses imply that the equilibrium between world saving and investment is given by the intersection between curves SI and SI^* in Figure 1. The SI curve describes the combinations of interest rates and real exchange rates at which the desired domestic saving-investment balance equals net exports; SI^* describes the same relationship for the ROW. This curve corresponds to combinations of R and ϵ that satisfy the following equation, where S is private saving, I is private investment, N is net exports and DEF is the general government deficit:

$$S(R, DEF) - I(R) - DEF = N(\epsilon) \qquad (1)$$

Since net saving depends positively on R, 1/ and net exports N depend positively on the real exchange rate (where a higher ϵ indicates depreciation), SI is upward sloping. The SI^* curve slopes downward because ROW net exports N^* depend negatively on ϵ; moreover, N and N^* are not independent, since one country's exports equal the other country's imports, hence $N = -N^*$.

Figure 1 can be used to analyze the outward shift in the German investment schedule corresponding to increased profit opportunities in the GDR related to GEMSU. The initial equilibrium is at point A. In the short run, the SI curve will shift to the right, while the SI^* curve is unchanged. 2/ This will have two effects: it will raise world interest rates, and it will lead to an appreciation of Germany's real exchange rate (a fall in ϵ). The new short-run equilibrium is at point B. The appreciation may seem counter-intuitive, since it is associated with a decline in a united Germany's current account surplus. It comes about because the increase in investment leads to excess demand for German goods, and a real appreciation is one mechanism by which this excess demand is satisfied, via a crowding out of foreign demand for German goods. 3/ Generalized increases in interest rates also tend to crowd out other investment and stimulate saving, making room for the increased investment in the GDR.

1/ Private saving may also depend on the government deficit--see the discussion below of Ricardian (non)equivalence.

2/ In Figure 1, the same (world) interest rate is assumed to apply to net saving in Germany and in the ROW. This would be consistent with interest parity between the two regions and static real exchange rate expectations. More generally, if the real exchange rate is expected to depreciate (after an initial appreciation), open interest parity would imply lower interest rates in the ROW than in Germany, shifting the SI^* curve to the right.

3/ Of course, if GDR spending fell on other countries' goods to some extent, then the real DM appreciation would be smaller.

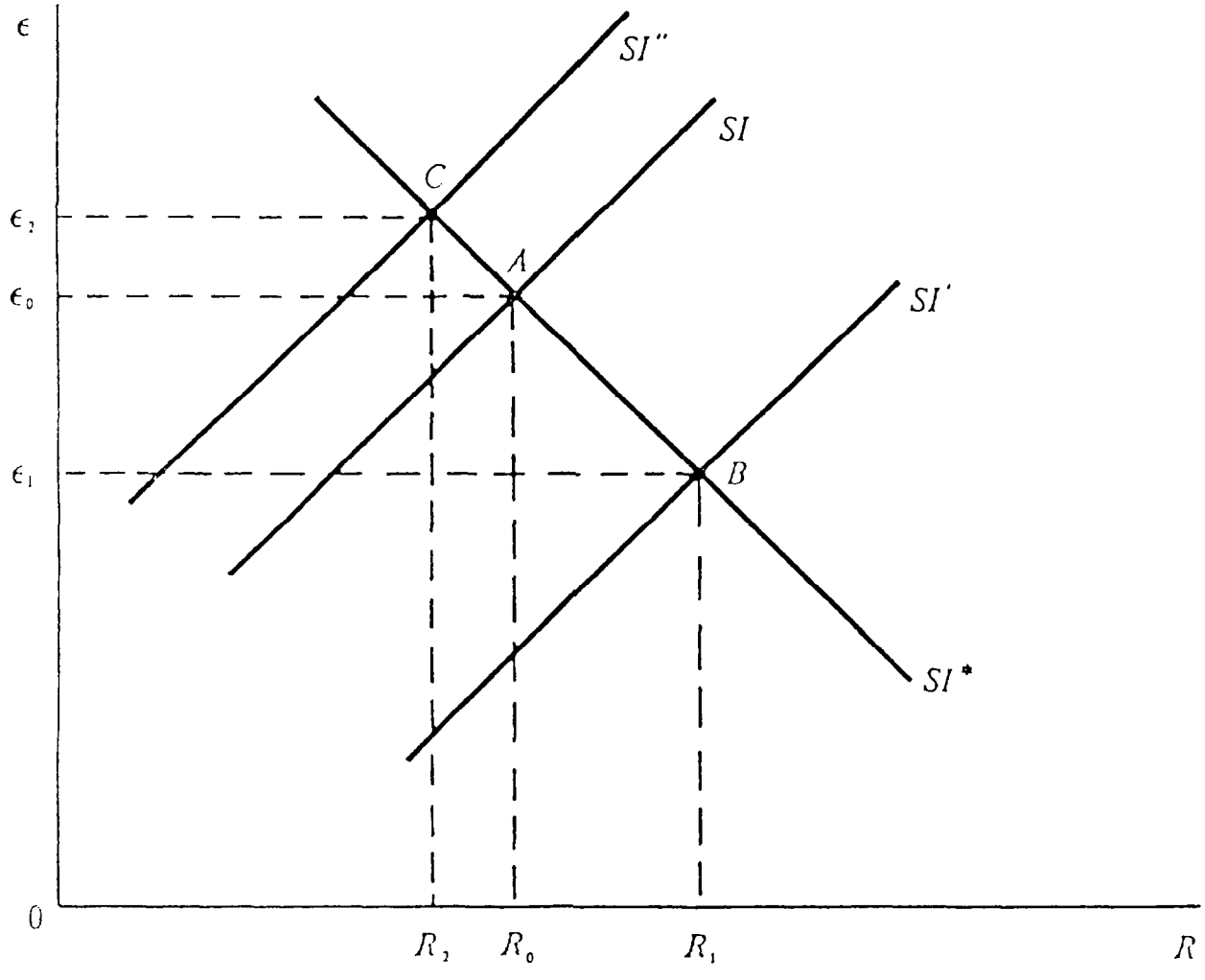
A second aspect of GEMSU is the increase in social transfer payments made by the governments of the FRG and the GDR to residents of the GDR. Such transfer payments may lead to a fall in national saving, unless private saving rises one-for-one with government dissaving. The case for the existence of an offset in private saving is that increased deficits today would require tax increases at some point in the future to service (or actually repay) the increased debt. The private sector may anticipate those future taxes and save today in order to provide for them. The existence of a complete offset on private saving--usually termed "Ricardian equivalence"--is unlikely, but evidence exists of at least a partial offset. In Masson and Knight (1986), the offset is 60 percent; in MULTIMOD, the offset is dependent on the baseline values for interest rates and real growth rates, and on the timing of expected future tax increases. In the simulations reported below, government deficits per se have little effect on national saving, interest rates, or output. 1/

The dynamics of adjustment depend on the speed with which capital accumulation proceeds; the adjustment process would be further complicated by migration of labor and by wealth accumulation. The curves in Figure 1 therefore are conditional on the values of those adjustment variables--capital stocks, labor supplies, and wealth stocks, and possibly on other variables. This dependence can be illustrated in a simple case in which the adjustment process only involves the accumulation of capital. Suppose that GEMSU raises the marginal product of capital (MPK) in the GDR, that the rate of investment responds to the gap between the marginal product of capital and the market real interest rate, and that the saving rate is constant. The initial shock will shift the SI schedule to the right, as described above, which raises the real interest rate. The interest rate will be below the MPK in Germany, but above it in the ROW. Higher investment will over time raise the capital stock in Germany, which will tend to shift the SI curve back to the left. Conversely, lower investment in the ROW will reduce the capital stock, shifting the SI^* to the right. These shifts will continue until full stock equilibrium is achieved, but the adjustment process may take a considerable amount of time. In general, the movements in interest rates and exchange rates can be expected to be largest in the early stages of GEMSU; as capital accumulation proceeds, exchange rates and interest rates move back to (or close to) their initial equilibrium values.

How much exchange rates move, the size of interest rate increases and how they are distributed globally depend on a number of features: (1) the size of the shock from a global perspective; (2) interest elasticities of saving and investment; (3) real exchange rate elasticities of net exports;

1/ In neither of the models does the supply of government debt (relative to supplies of other assets) directly affect relative rates of return, as it would do in a portfolio balance model. In portfolio balance models, increased government deficits, by adding to the debt stock, would directly increase the borrowing costs faced by the government because investors would have to be induced to add to their holdings.

Figure 1. *Determination of Real Exchange Rate* (ϵ) *and World Interest Rate* (R)



(4) the distribution of increased demand in the GDR across countries; (5) the formation of expectations of exchange rate changes; and (6) the speed of the capital accumulation process. The dynamics related to capital accumulation and productivity increases in the GDR are a crucial feature of the adjustment process, but their likely evolution is very difficult to gauge.

Table 3 presents the results for some variables of simulating in a simple saving-investment model the shock to GDR net imports given for the reference case in Table 1. 1/ The model does not include the GDR explicitly; consequently, the simulation analyzes the effects of increased demand coming from the GDR for the exports of other countries, as well as increased current transfer payments from the FRG to the ROW. These are *transfers from the Unity Fund and for social security, and total* DM 25 billion in 1990, DM 38 billion in 1991, DM 28 billion in 1992, DM 20 billion in 1993, and DM 10 billion in 1994 (all at current prices). The simulations assume that 2/3 of the increase in GDR imports is directed to the FRG, with the rest going to the remaining countries on the basis of their shares in world trade. Two alternative assumptions are made concerning exchange rate expectations. In the top panel of Table 3, exchange rate expectations are static, so that, since open interest parity holds in the model, interest rates increase by the same amount in all countries. It can be seen that the deutsche mark first appreciates against the dollar in real terms, and then gradually returns to its initial level. In the bottom panel, it is assumed that exchange rate expectations reflect this pattern of gradual regression to its initial level (starting after the first full year of the shock, 1991)--with a coefficient equal to 0.2 (that is, in each year the exchange rate is assumed to close 20 percent of the gap between its present level and its assumed constant, long-run equilibrium level). 2/ In this simulation, since after the initial shock the deutsche mark is expected to depreciate (which it actually does in the model simulation), interest parity requires real interest rates to be higher in Germany than elsewhere.

These two sets of results suggest similar qualitative conclusions, though they differ somewhat in their numerical estimates. Under static expectations, GEMSU would cause a rise in real interest rates by half of a percentage point in 1990 and a further rise of 1 percentage point in 1991-94 (1.6 percentage points above baseline by 1994), and subsequently decline, while the real effective exchange rate of the deutsche mark would appreciate by 9 percent in 1990-91, and subsequently depreciate. As a result of this

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1/ The parameters of this model were estimated using annual data over the period 1961-83 for the United States, Japan, the Federal Republic of Germany, and a residual rest of the world region; see Masson and Knight (1986).

2/ Knight and Masson (1988) also solve the model with fully model-consistent expectations, finding that for the shocks considered in that paper, the main difference relative to static expectations is the decoupling of interest rates in the various countries.

Table 3. Federal Republic of Germany: Reference Scenario
Effects of GEMSU in a Saving/Investment Model

(Deviations from baseline)

	Increase in Real interest rate (in percentage points)	Real effective exchange rate (percent appreciation)	Change in joint GDR/FRG current account balance (in billions of DM at 1990 prices)	Memo: Increase in U.S. real interest rate (in percentage points)
		(With static exchange rate expectations)		
1990	0.5	4.2	-20	0.5
1991	1.2	8.6	-48	1.2
1992	1.4	5.5	-51	1.4
1993	1.5	4.7	-50	1.5
1994	1.6	5.2	-52	1.6
1995	1.6	5.0	-52	1.6
1996	1.6	3.4	-48	1.6
2000	1.0	0.6	-23	1.0
		(With regressive exchange rate expectations)		
1990	1.0	3.8	-19	0.3
1991	2.3	8.1	-44	0.9
1992	2.2	5.7	-48	1.1
1993	2.1	5.0	-49	1.2
1994	2.3	5.3	-50	1.3
1995	2.3	5.2	-51	1.4
1996	2.0	3.7	-48	1.4
2000	0.9	0.8	-25	1.0

appreciation, the current account surplus of the Federal Republic and the GDR combined would decline substantially. 1/ Under regressive expectations, real interest rates increase somewhat more in Germany, peaking at 2.3 percentage points above baseline, while in the United States, rates rise more gradually, and to a peak of 1.4 percentage points above baseline. The exchange rate and current account paths are similar in the two cases.

The simulations incorporate only some of the mechanisms that may be important in the adjustment to GEMSU; in particular, they focus on the saving-investment aspects and related capital and wealth accumulation. Other aspects will be considered below: the next section will attempt to quantify the effects of migration on potential output in the FRG, while Section IV will simulate both increased GDR investment demand and migration from the GDR to the FRG, in a model that allows for stickiness of prices and hence does not constrain actual and potential output to be the same.

III. Effects of Migration on Potential Output in the FRG

Another significant aspect of GEMSU has been the reestablishment of free mobility between East and West, and the resulting emigration from the GDR to the FRG. The last few months of 1989 saw large population flows to the FRG, and substantial migration continued early in 1990. In Scenario A, net migration from the GDR to the FRG is assumed to be 280,000 in 1990, 100,000 in 1991, 70,000 in 1992, 40,000 in 1993, and 20,000 per year thereafter. 2/ In the less optimistic scenario with lower investment in the GDR, net migration is assumed to be the same in 1990-91, but to be considerably higher from 1992 onwards: 270,000 in that year, 220,000 in 1993, and declining to 90,000 in the year 2001.

Migration can be expected to lead to increases in both aggregate demand and supply in the FRG; the offsetting declines in the GDR are embodied in the projections for net exports of the GDR, which are the balance between aggregate supply and demand in that region. 3/ Here, the aggregate supply

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1/ The joint balance nets out intra-German trade and unilateral transfers from the FRG to the GDR, and hence reflects reduced net exports of the FRG to third countries as well as increased net imports of the GDR from third countries.

2/ Only the migration beginning in 1990 is taken into account in our simulations. During 1989, some 344,000 people emigrated from the GDR to the FRG, most of the emigration occurring between the opening of the border in November 1989 and the end of the year.

3/ It should be noted that effects on output are not offsetting, even if migration merely adds to employment in the FRG and reduces it in the GDR. Since productivity is considerably higher in the FRG, such migration increases combined output. Moreover, if migration is a reaction to unemployment in the GDR, and leads to increased employment in the FRG, there is a further reason for combined output to increase.

effects are sketched; the aggregate demand effects are included in the full MULTIMOD simulations discussed below, which include other influences on aggregate demand as well. It is assumed that potential output can be described by a production function that depends on capital and labor with constant returns to scale. For a given capital stock, migration would affect potential output through the induced increase in the labor force, times the marginal product of labor. The labor force increase is the population increase times the participation rate. If labor is paid its marginal product, then the proportionate increase of potential output is the labor share times the proportionate increase in the labor force.

Over a longer-term horizon, the capital stock can be expected to increase one-for-one with the labor force. Changes in relative factor prices will help to bring this about: increased labor supply will tend to moderate wage increases, and lead to higher employment; higher employment in turn will raise the marginal product of capital and raise investment. In equilibrium, both capital and labor can be expected to increase together, other things being equal. Therefore, potential output should also increase proportionately. Higher potential output can be expected to moderate the price pressures that result from increased demand generated by GEMSU. In the reference case, potential output calculated in this way is projected to be 1 1/4 percent higher by the year 2001 than it would have been in the absence of migration. In the less optimistic scenario, it is projected to be 4 percent higher, as a result of the larger migration.

IV. Simulations Using MULTIMOD

MULTIMOD is a global macroeconomic model that includes separate submodels for each of the Group-of-Seven countries, for the remaining industrial countries as a group, and for the developing countries (divided into capital-exporting and capital-importing countries). In this model, aggregate demand--which is built up from behavioral equations for consumption, investment, exports and imports, plus exogenous real government spending--determines output in the short run. Capacity utilization, the ratio of actual output to potential output (determined by a production function), can therefore vary. An increase of demand from the GDR will to some extent increase output in the FRG, as well as lead to lower German net exports. How much shows up in higher output and how much shows up as higher inflation, depend to a large extent on three factors: (1) the stance of monetary policy, (2) the influence of the level of capacity utilization on inflation, and (3) the interest elasticities of domestic components of demand. These aspects of the model are first briefly discussed; then MULTIMOD simulations of GEMSU are presented. 1/

1/ Details concerning sensitivity of the results to these structural factors are presented in the Appendix.

Clearly, the conduct of monetary policy may be affected by currency union with the GDR, because (among other reasons) the income velocity of money may not be the same as in the FRG. Rather than attempting to quantify those effects here, it is assumed for the purposes of the simulations discussed below that targets would be appropriately adjusted to take into account velocity shifts and other factors that would otherwise affect the relationship between interest rates and economic activity. In other words, the Bundesbank would continue to resist excess demand pressures in the same way as it has in the past, with some smoothing of short-run interest rate fluctuations.

Concerning the effects of an increase in demand on inflation and output, productive capacity is not an absolute constraint on output in *MULTIMOD*. *Instead, the higher is the rate of capacity utilization, the* greater are pressures on inflation. In the simulations presented below, the starting point for capacity utilization is high, but it is still well below historical peaks reached in 1972-73 and 1979-80. Moreover, the simulations of GEMSU assume further migration from the GDR (see Section III above), which tends to increase output capacity in the FRG.

As the discussion of the GEMSU shock in Section II makes clear, its effects depend importantly on the interest elasticities of saving and investment. The standard version of MULTIMOD (see Masson, Symansky, and Meredith (1990)) has quite high elasticities. Some other evidence on Germany and other countries suggests that saving and investment may not be as sensitive to interest rates. In the MULTIMOD simulations reported below, consumption and investment elasticities for all countries were lowered by a factor of two, making the results more consistent with this empirical evidence and making the results more comparable to those from the saving/investment model of Section II.

1. The reference scenario

The reference case simulation of GEMSU assumes that net imports into the GDR increase by amounts given in the first column of Table 1 above. This increase in demand shows up in the first instance in increased exports by the FRG (two-thirds of the amount) and by other countries (the remaining one-third, allocated on the basis of shares in world trade). Borrowing by the GDR government (but not of the GDR Trust Fund 1/) is assumed to increase the indebtedness of the Federal Republic, whose deficit as reported here therefore includes all GEMSU-related government expenditures, including disbursements of the Unity Fund and social security fund transfers to the

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1/ Trust Fund borrowing is assumed to be serviced by privatization receipts; moreover, excess privatization receipts are assumed to be used to reduce outstanding debt in the 1994-2001 period by annual amounts of DM 10-20 billion (cumulatively by DM 140 billion).

GDR. 1/ In the reference case, tax rates are assumed to be the same as in the baseline, which does not include GEMSU. However, tax revenues are elastic, and increase roughly in proportion to GNP. The simulations also include the projections of migration from the GDR to the FRG described above, and the resulting increases of potential output in the FRG.

The results (Table 4, column 1 and Chart 1 2/) suggest that the stimulus to demand in the FRG would lead to an increase in the rate of growth of half of a percentage point in 1990 and three-quarters of a percentage point in 1991. In subsequent years, output growth would be lower than baseline, because the rate of change of net imports from the GDR is negative and because of lagged effects of higher interest rates and DM appreciation. Nevertheless, the level of output in the FRG would remain above baseline due to favorable supply effects; and output growth of the FRG and GDR combined would be persistently higher. 3/

Inflation pressures would increase, and the rate of change of output prices would be higher than in the baseline by some one third of a percentage point on average over 1990-92. Output effects on other ERM countries are negative, but small, while they are slightly positive on non-ERM countries. Both sets of countries are affected by higher interest rates, while the ERM countries, because of the assumed fixity of their central parities, also experience a real effective appreciation which, combined with the interest rate increase, offsets the stimulus from higher exports to the GDR. On balance, the reference case suggests that the international effects of GEMSU are not very large, and that increased demand in the Federal Republic does not put unmanageable strains on productive capacities. However, higher government spending leads to an increase of 5 percentage points in the government debt/GNP ratio by 1995, which thereafter declines back toward its baseline path.

The size of financial market effects is smaller than in the saving/investment model, in good part because of the buffer role of capacity utilization, which permits aggregate demand to differ from potential output. The effects of GEMSU that result from MULTIMOD simulations are not exceedingly large. Long-term nominal interest rates increase by about 1 percentage point; the deutsche mark appreciates by 3 1/2 percent against the U.S. dollar in nominal terms in 1990, and by 1 1/2 percent in real effective terms. Both effects are ultimately reversed.

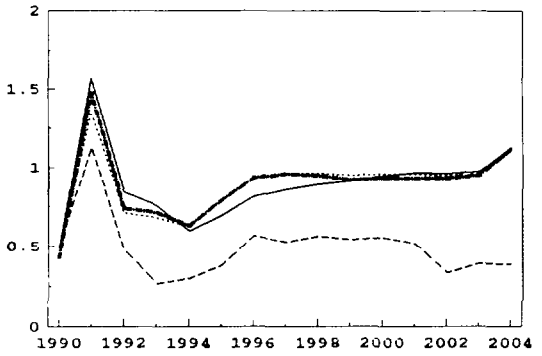
1/ This is purely for convenience of modeling; whether government debt is serviced by the government of the FRG or that of the GDR has no effect on their combined deficit or debt.

2/ More detailed tables of simulation output are available on request.

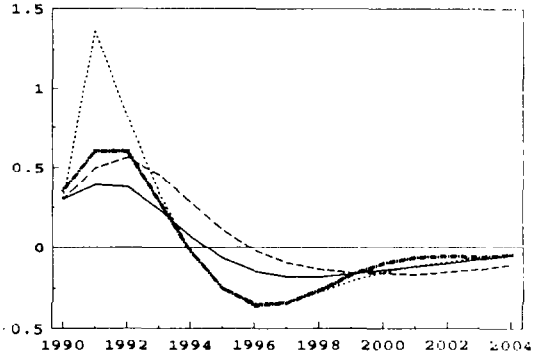
3/ In the baseline, potential output grows by 2 3/4 percent in the FRG and 2 percent in the GDR.

Chart 1
Alternative Scenarios of German Unification
(Deviation from baseline)

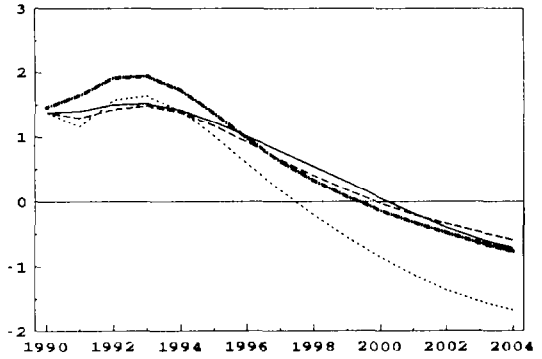
Real GDP Growth (Combined)
(percentage point difference)



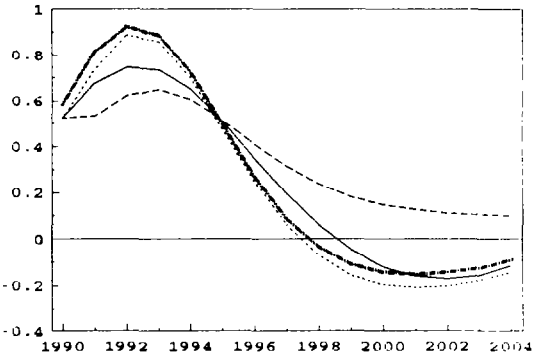
Inflation (GDP Deflator)
(percentage point difference)



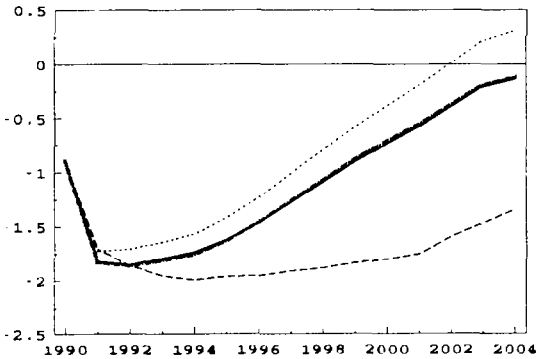
Real Effective Exchange Rate
(percent difference)



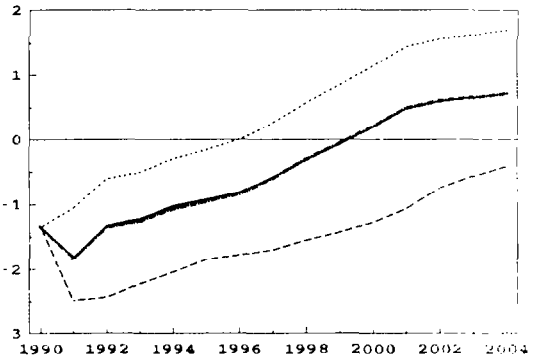
Real Long-Term Interest Rate
(percentage point difference)



Current Account Balance (Combined)
(percent of GNP)



Government Balance (Combined)
(percent of GNP)



Reference Scenario
Less Optimistic
Indirect Tax Increase
Non-Linear Inflation

Table 4. Germany: Scenarios of German Unification, 1990-2001

(Deviations from baseline in percent)

	Reference Scenario	Non-Linear Inflation Tradeoff	Indirect Tax Increase	Less Optimistic Scenario
Combined Real GDP				
1990	0.5	0.4	0.5	0.5
1991	2.0	1.9	1.8	1.6
1992-94	3.6	3.3	3.2	2.3
1995-97	5.8	5.7	5.6	3.6
2001	10.6	10.7	10.6	6.4
Real GDP (FRG Only)				
1990	0.5	0.5	0.5	0.5
1991	1.3	1.1	1.0	1.3
1992-94	0.6	0.3	0.1	1.0
1995-97	0.4	0.4	0.2	1.3
2001	0.7	0.8	0.8	2.5
Inflation: GDP Deflator (percentage points)				
1990	0.3	0.4	0.3	0.3
1991	0.4	0.6	1.4	0.5
1992-94	0.2	0.3	0.4	0.4
1995-97	-0.1	-0.3	-0.3	-0.0
2001	-0.1	-0.1	-0.1	-0.2
Real Effective Exchange Rate				
1990	1.4	1.5	1.4	1.4
1991	1.4	1.7	1.2	1.3
1992-94	1.5	1.9	1.5	1.4
1995-97	1.0	1.0	0.6	0.9
2001	-0.2	-0.3	-1.1	-0.2
Real Long-Term Interest Rate (percentage points)				
1990	0.5	0.6	0.5	0.5
1991	0.7	0.8	0.7	0.5
1992-94	0.7	0.8	0.8	0.6
1995-97	0.4	0.3	0.3	0.4
2001	-0.2	-0.1	-0.2	0.1
Combined Current Account Balance (percent of GNP)				
1990	-0.9	-0.9	-0.9	-0.9
1991	-1.8	-1.8	-1.7	-1.7
1992-94	-1.8	-1.8	-1.6	-1.9
1995-97	-1.4	-1.4	-1.2	-1.9
2001	-0.6	-0.5	-0.2	-1.7
Combined Government Balance (percent of GNP)1/				
1990	-1.3	-1.3	-1.3	-1.3
1991	-1.8	-1.8	-1.0	-2.5
1992-94	-1.2	-1.2	-0.5	-2.2
1995-97	-0.8	-0.8	0.0	-1.8
2001	0.5	0.5	1.4	-1.1
Real GDP: Other ERM Countries				
1990	-0.1	-0.2	-0.1	-0.1
1991	-0.2	-0.2	-0.2	-0.1
1992-94	-0.4	-0.5	-0.3	-0.2
1995-97	-0.3	-0.2	0.0	-0.3
2001	0.3	0.3	0.5	-0.1
Real GDP: Other Industrial Countries				
1990	0.1	0.1	0.1	0.1
1991	0.2	0.2	0.2	0.2
1992-94	0.0	0.0	0.0	-0.0
1995-97	-0.1	-0.1	-0.1	-0.2
2001	0.0	0.0	0.1	-0.0

1/ General government, including the Unity Fund and the Trust Fund.

2. A less favorable output/inflation tradeoff

The MULTIMOD scenario discussed above does not embody any serious inflation pressures, as the demand increase can be accommodated smoothly by increased output in the FRG and increased imports from other countries, without the need for large price changes. In order to examine the sensitivity of this conclusion to the model's inflation equation, some alternative specifications were estimated using historical data for the FRG (see Appendix). Estimation results suggest that there is some support for a non-linear specification in which inflation pressures increase markedly as capacity utilization approaches peak levels. 1/ This inflation equation was substituted for the existing one in MULTIMOD, and the shocks of the reference scenario were rerun. Results of this simulation are reported in column 2 of Table 4 (and plotted in Chart 1 as "Non-Linear Inflation").

Even with the steeper output/inflation tradeoff, inflation pressures are not markedly greater, and output in the FRG still is higher by about 1 percent than in the baseline in 1991. An important reason for this is that though capacity utilization is high in the baseline, it is still well short of levels attained in 1972-73 and 1979-80. Of course, if the current margin of productive capacity is over-estimated, it is possible that inflation pressures could be even greater that implied by this scenario.

3. An indirect tax increase in the FRG

In the light of the possibility of persistent debt accumulation by the governments of Germany (see, for instance, the less optimistic scenario described below) it is of interest to examine the effects of a tax increase. Because of the comprehensive reform of direct personal taxes in the Federal Republic, it might be counterproductive to attempt to raise additional revenue from that source to finance GEMSU. Raising value-added tax rates in the FRG would appear to be a more attractive alternative, especially since this would help to harmonize EC VAT rates, FRG levels being relatively low.

The reference scenario for GEMSU was therefore simulated in MULTIMOD accompanied by an increase in indirect tax receipts of DM 20 billion, corresponding to increases in VAT rates by a little under 2 points; results are summarized in column 3 of Table 4 (and in Chart 1 as "Indirect Tax Increase"). The increase in rates is assumed to occur in 1991, and not to have been anticipated beforehand (consequently, the results for 1990 are the same as in column 1 of Table 4). The Bundesbank is assumed to adjust upward its target for M3 to reflect the first-round effect on the GDP deflator of higher indirect taxes.

1/ The extent of inflation pressure may also depend on whether demand increases are diffused, or are concentrated in specific sectors where bottlenecks appear. Such effects are not captured in the aggregate specifications used here.

The additional revenue helps to limit the medium-run budgetary impact of GEMSU: instead of an increase relative to baseline in the government debt ratio of 5 percent of GNP in the year 1995, it increases by only 2 percent in this simulation. 1/ In the longer run, the indirect tax increase yields a budget surplus (relative to baseline) and a decline in the debt ratio in the year 2001. However, the tax increase has unfavorable effects on the rate of change of prices. Relative to baseline, the GNP deflator rises 1.4 percentage points faster in 1991 (one percentage point more than in the reference scenario). Such price increases might kindle fears that inflation would continue; MULTIMOD in fact embodies persistence related to overlapping wage contracts, and as a result inflation is higher in 1992 and 1993 as well. In the context of uncertainty about the effects of GEMSU on inflation, such an increase in indirect taxes would have to be weighed carefully.

4. An alternative scenario with slower growth in the GDR

In an alternative, less optimistic scenario for GEMSU, investment is assumed to be less buoyant, partly as a result of higher wage demands in the GDR. As a result, productivity growth converges less quickly, and by the year 2001, the productivity gap between the GDR and the FRG is still greater than one third. Net imports from the GDR are not very different initially from those in the reference case (see Table 1), but the GDR trade deficit persists longer because output does not rise as much in the medium term. Correspondingly, income and saving are also lower in the GDR.

In this scenario, unemployment persists longer, and emigration is higher than in the reference scenario: there is extra net emigration from the GDR to the FRG that amounts to 200,000 in 1992, 180,000 in 1993, and gradually declining amounts thereafter (in addition to the projected migration in the reference scenario). Government expenditures in the FRG are assumed to be higher as a result of the increase in population relative to the reference scenario (due to increased expenditure on housing and social services, for instance). Unemployment benefit payments are also higher in the GDR.

The results of such a scenario are summarized in column 4 of Table 4 and in Chart 1 (as "Less Optimistic"). They present a less favorable picture for Germany as a whole, though not for the FRG alone, which experiences increased output growth due to migration from the GDR--increasing demand and employment. The combined fiscal balance deteriorates, primarily due to higher unemployment benefits and slower revenue growth in the GDR. In this scenario government debt has reached a level 8 percent of combined GNP above baseline by 1995, and 11 percent by 2001. 2/ Despite

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1/ Additional revenue is less than DM 20 billion per year, however, since economic activity is weaker.

2/ The debt/GNP ratio is also higher than in the reference scenario because GNP is lower.

this, effects on financial markets and on other countries are little changed compared to the reference scenario, and inflation effects are also similar.

V. Alternative Scenarios for European Monetary Policies and Exchange Rates

The above simulations are conditional on several assumptions concerning the stance of policy and the economic environment in Europe. In particular, the Federal Republic was assumed to continue to target an (appropriately adjusted) M3 aggregate, and existing central parities within the ERM were assumed to be maintained. In this section, some possible alternative assumptions are considered: (1) a downward realignment of other ERM currencies against the deutsche mark; (2) the effects of credibility of monetary policies on domestic interest rates in other ERM countries; and (3) a reorientation of German monetary policy in the context of European monetary union, leading to targeting of a European monetary aggregate, rather than one for Germany alone.

1. An EMS realignment

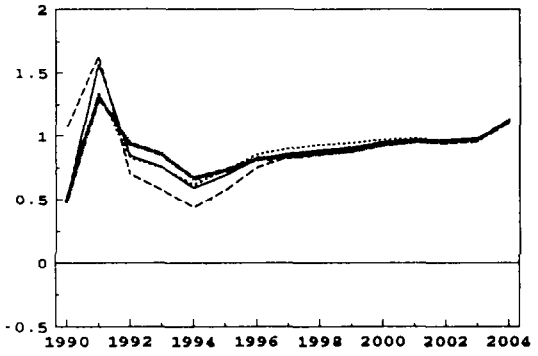
The reference case scenario suggests that an appreciation of the deutsche mark of about 3 1/2 percent against the dollar might result from GEMSU. With fixed central parities with respect to other currencies participating in the ERM, real DM appreciation results from a combination of nominal appreciation against non-ERM currencies (principally the U.S. dollar and the yen), increases in prices in Germany, and a tendency to deflation in other ERM countries. The tightening of monetary conditions in other ERM countries might be avoided by a credible "one-shot" realignment vis-à-vis the deutsche mark, also permitting a smoother allocation of the increased demand from the GDR among European countries.

Column 2 of Table 5 illustrates this scenario, which is also plotted in Charts 2 and 3. A realignment is assumed to occur in 1991 in which the central rate of the deutsche mark appreciates by 4 percent against other ERM currencies. In this scenario, output is higher in other ERM countries, rather than being lower as in the reference scenario, which is repeated for convenience in Table 5 and Charts 2 and 3.

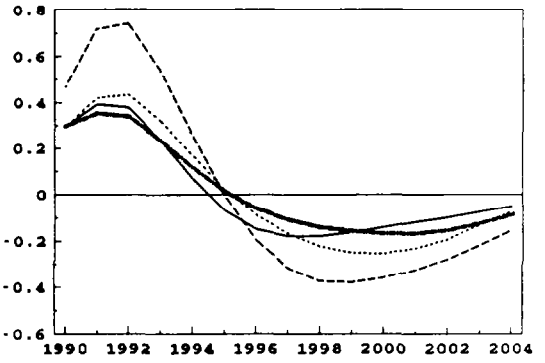
This scenario, by permitting those countries' currencies to be delinked temporarily from the deutsche mark, allows them to avoid a short-run real appreciation against non-ERM currencies. The deutsche mark appreciation also removes some of the short-run pressure on existing capacity in Germany. These favorable effects, however, have to be balanced against the negative effects of higher inflation in the short run in other ERM countries, and consequently a possible loss of credibility of their commitments to price stability and to "hard currency" policies, not captured in the simulation. This is the subject of the next subsection.

Chart 2
Scenarios of German Unification Under Alternative European Policies: Results for Germany
(Deviation from baseline)

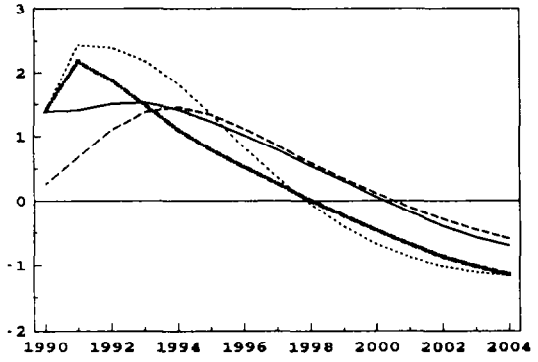
Real GDP Growth (Combined)
(percentage point difference)



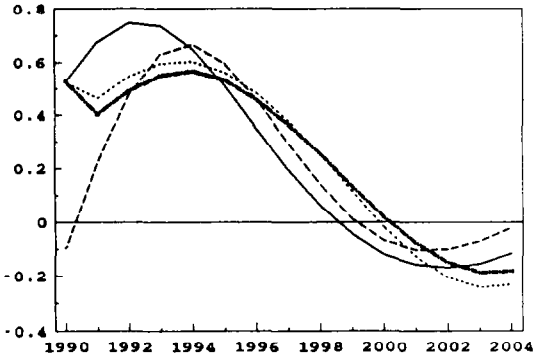
Inflation (GDP Deflator)
(percentage point difference)



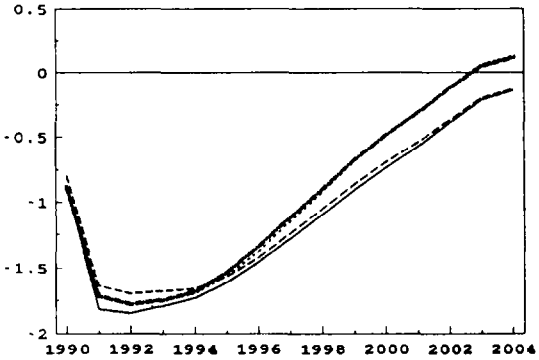
Real Effective Exchange Rate
(percent difference)



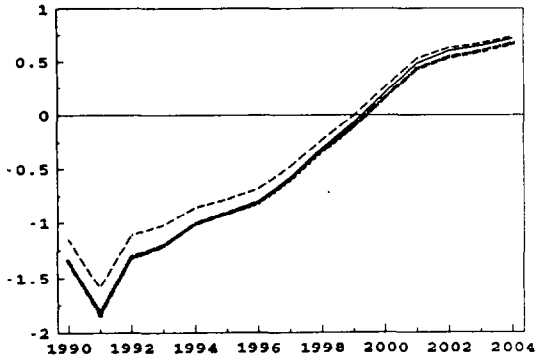
Real Long-Term Interest Rate
(percentage point difference)



Current Account Balance (Combined)
(percent of GNP)



Government Balance (Combined)
(percent of GNP)



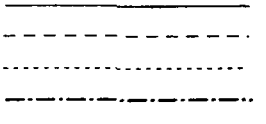
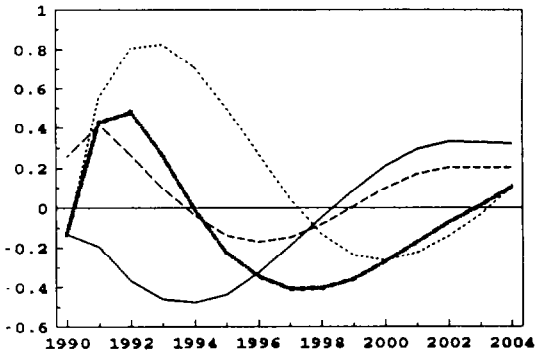
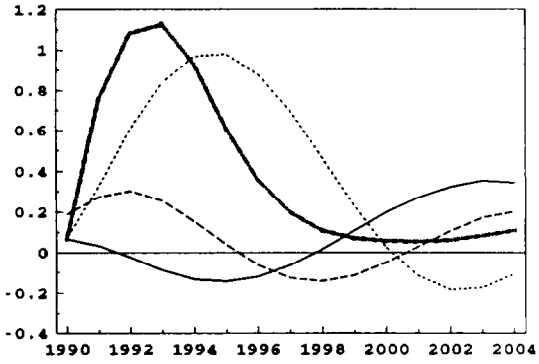


Chart 3
Scenarios of German Unification Under Alternative European Policies: Results for Other ERM Countries
(Deviation from baseline)

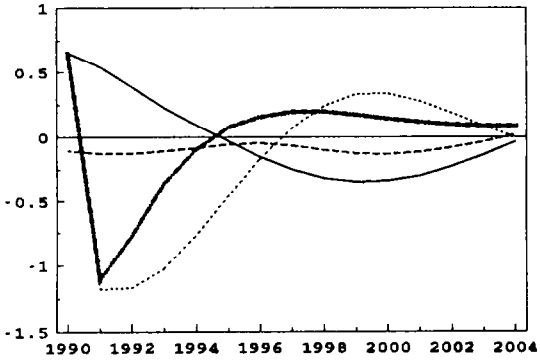
Real GDP (Level)
(percent difference)



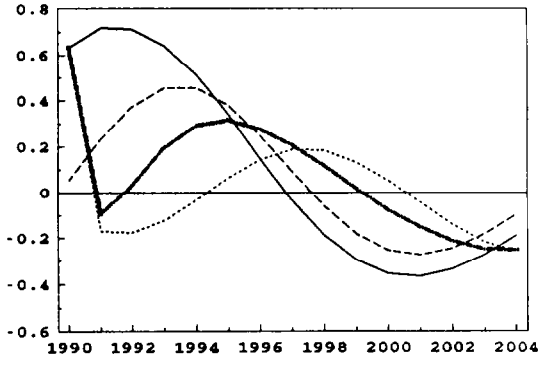
Inflation (GDP Deflator)
(percentage point difference)



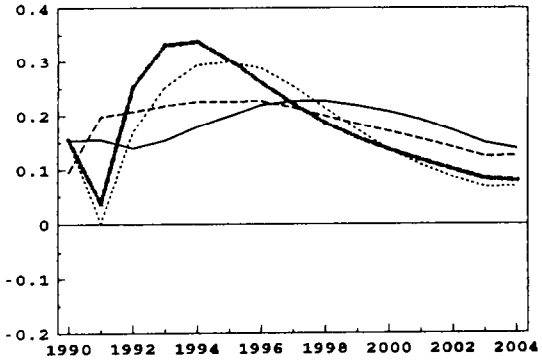
Real Effective Exchange Rate
(percent difference)



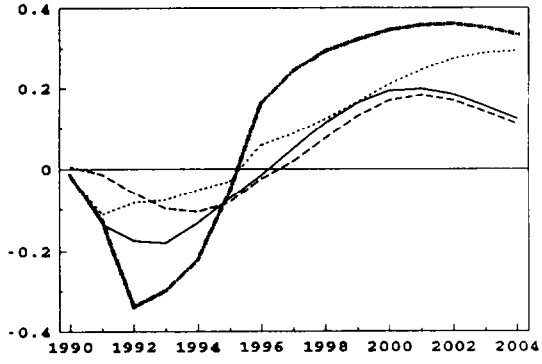
Real Long-Term Interest Rate
(percentage point difference)



Current Account Balance
(percent of GNP)



Government Balance
(percent of GNP)



Reference Scenario
European Monetary Policy
EMS Realignment
EMS Realignment with Credibility Loss

Table 5. Scenarios of German Unification Under Alternative European Policies, 1990-2001

(Deviations from baseline in percent)

	Reference Scenario	EMS Realignment	EMS Realignment with Credibility Loss	European Monetary Policy
Combined Real GDP				
1990	0.5	0.5	0.5	1.0
1991	2.0	1.8	1.8	2.6
1992-94	3.6	3.3	3.5	3.9
1995-97	5.8	5.6	5.8	5.8
2001	10.6	10.6	10.5	10.5
Real GDP (FRG Only)				
1990	0.5	0.5	0.5	1.2
1991	1.3	1.0	1.0	2.0
1992-94	0.6	0.3	0.5	0.9
1995-97	0.4	0.3	0.5	0.4
2001	0.7	0.7	0.6	0.6
Inflation: GDP Deflator (percentage points)				
1990	0.3	0.3	0.3	0.5
1991	0.4	0.4	0.4	0.7
1992-94	0.2	0.3	0.2	0.5
1995-97	-0.1	-0.1	-0.1	-0.2
2001	-0.1	-0.2	-0.2	-0.3
Real Effective Exchange Rate				
1990	1.4	1.4	1.4	0.3
1991	1.4	2.4	2.2	0.7
1992-94	1.5	2.1	1.5	1.3
1995-97	1.0	0.8	0.5	1.1
2001	-0.2	-0.9	-0.7	-0.1
Real Long-Term Interest Rate (percentage points)				
1990	0.5	0.5	0.5	-0.1
1991	0.7	0.5	0.4	0.2
1992-94	0.7	0.6	0.5	0.6
1995-97	0.4	0.5	0.5	0.5
2001	-0.2	-0.1	-0.1	-0.1
Combined Current Account Balance (percent of GNP)				
1990	-0.9	-0.9	-0.9	-0.8
1991	-1.8	-1.7	-1.7	-1.6
1992-94	-1.8	-1.7	-1.7	-1.7
1995-97	-1.4	-1.4	-1.3	-1.4
2001	-0.6	-0.3	-0.3	-0.5
Combined Government Balance (percent of GNP)1/				
1990	-1.3	-1.3	-1.3	-1.2
1991	-1.8	-1.8	-1.8	-1.6
1992-94	-1.2	-1.2	-1.2	-1.0
1995-97	-0.8	-0.8	-0.8	-0.6
2001	0.5	0.4	0.4	0.5
Real GDP: Other ERM Countries				
1990	-0.1	-0.1	-0.1	0.3
1991	-0.2	0.6	0.4	0.4
1992-94	-0.4	0.8	0.2	0.1
1995-97	-0.3	0.3	-0.3	-0.2
2001	0.3	-0.2	-0.2	0.2
Inflation: Other ERM Countries (percentage points)				
1990	0.1	0.1	0.1	0.2
1991	0.0	0.3	0.8	0.3
1992-94	-0.1	0.8	1.0	0.2
1995-97	-0.1	0.9	0.4	0.0
2001	0.3	-0.1	8.1	0.0

1/ General government, including the Unity Fund and the Trust Fund

2. Credibility of anti-inflationary commitment associated with no realignments

In recent years there have been persistent differentials between German interest rates and those of the other members of the ERM, as indicated in Table 6 for France and Italy. It is also apparent that movements in short-term interest differentials have been correlated with the past inflation performance of these countries vis-à-vis the FRG. While the short-term differentials between Germany and other ERM countries have fallen somewhat in recent months, they remain on the order of 2 percentage points for France and 4 1/2 percentage points for Italy. This gap runs contrary to what one might expect given a high degree of international capital mobility: if assets denominated in different currencies are otherwise identical, interest rates will differ only to the extent that exchange rates are expected to change over time. In a system of fixed parities where no future realignments are anticipated, nominal interest-rate differentials should be small since they would be limited by exchange rate movements within the band of admissible fluctuations. 1/

These data raise two questions: (i) does the differential relative to German interest rates reflect expectations of a future exchange-rate realignment? and (ii) to the extent that this is the case, what would be the impact of a change in market expectations that eliminated the interest rate differential vis-à-vis Germany? Concerning the first issue, there are a number of factors other than expected exchange rate movements that can explain gaps between national interest rates. Examples are: differences in perceived default risk; tax considerations; and barriers to the flow of financial capital across national boundaries. To the extent that these factors dominate expected exchange-rate movements, one would expect the interest differential to move slowly over time consistent with institutional and structural changes. Instead, Table 6 indicates that in the case of France and Italy these differentials have declined over time in line with a narrowing in inflation differentials. Looked at from a cross-sectional point of view, the gap between the average interest differential for Italy compared to that for France over the last three years approximately equals the inflation gap vis-à-vis the FRG. These data are consistent with the

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1/ At present, for all ERM currencies except the Spanish Peseta, fluctuation margins of 2.25 percent around bilateral central parities apply. Such margins could in principle be consistent with very large three-month interest differentials (as much as 19 percentage points on an annual basis), if, for instance, one currency started at its lower intervention point and the other at its upper intervention point, but the two were expected to switch places over a three-month period (with all other currencies remaining at their central parties). In practice, the starting position inside the band and the position of other ERM currencies will greatly reduce possible bilateral exchange rate changes with unchanged central parities, and the longer the horizon, the smaller the annualized interest differential that is consistent with a given expected appreciation or depreciation.

Table 6. Recent Interest-Rate and Inflation Differentials in the ERM

(Percentage points, annual rates)

	1987	1988	1989	April 1990
France vs. FRG				
Short-term rate	4.3	3.5	2.5	2.1
Long-term rate	3.6	3.0	1.7	0.6
Inflation 1/	4.1	3.1	2.2	1.6
Italy vs. FRG				
Short-term rate	7.8	7.3	6.1	4.6
Long-term rate	3.8	4.1	3.6	...
Inflation 1/	7.4	5.9	4.9	...
The Netherlands vs. FRG				
Short-term rate	1.9	0.7	0.5	-0.7
Long-term rate	0.5	0.2	0.1	-0.1
Inflation 1/	-0.1	-0.1	-0.6	-0.7

Source: International Financial Statistics, July 1990 and 1989 Yearbook.
1/ Average increase in CPI over previous 5 years. For April 1990, calculation is relative to average for 1985.

view that the movement in interest differentials over time primarily reflects expected exchange rate changes, where the latter are influenced by inflation differentials. However, the example of the Netherlands (data for which are also reported in Table 6) also suggests that it may take time to establish credibility. Though Dutch inflation performance was better than Germany's (as measured by a 5-year moving average), interest rates continued to be higher than those in Germany for several years.

In considering the effects of a realignment, a key issue is the credibility of future exchange rate commitments and anti-inflation policies of other ERM countries. In the realignment scenario, it is assumed that agents believe that the exchange-rate realignment following GEMSU is a "once-and-for-all" event, so that the credibility of a commitment to no further realignments is not called into question. However, in the light of past assurances of several ERM countries that they would not realign, a realignment could seriously undermine the confidence of investors in their commitments to "hard-currency" policies.

How are the results affected by making credibility endogenous, that is, by making expectations of future policies depend on the initial reactions to GEMSU? Here we present a modified version of the realignment scenario in which the depreciation of the other ERM currencies vis-à-vis the deutsche mark in 1991 has unfavorable effects on expectations of future exchange rate movements and inflation differentials. Specifically, the other EMS currencies are expected to depreciate further against the deutsche mark in the years following the initial realignment, similar to the periodic realignments that were observed in the early years of the EMS. In other words, it is assumed that the hard-earned credibility gains are dissipated by the realignment. Anticipations of further realignments have an unfavorable effect on inflation expectations and price-setting behavior.

A realignment scenario that embodies a temporary loss of policy credibility is shown in column 3 of Table 5 and Charts 2 and 3. Following the change in exchange rates in 1991, other ERM currencies are initially expected to depreciate further versus the deutsche mark by an average of 1 1/2 percent per year. These expectations turn out to be counter-factual: in the actual simulation, the authorities maintain fixed parities beyond 1991. In subsequent years, as agents incorporate the actual policy stance in their expectations, the unfavorable initial shock is gradually unwound and these economies return to the same path as with no shock to policy credibility. The temporary loss of credibility of the anti-inflationary policy implies a higher rate of inflation in the short term: the differences relative to the realignment scenario with no loss of credibility average 0.3 percent from 1991 to 1993. At the same time, output is lower than in the case of a realignment with no loss of credibility, because higher prices in the face of constant exchange rate parities drive up the real exchange rate in the short run.

3. A European monetary policy

The Delors Committee Report of April 1989 recommended closer coordination among the monetary policies of member countries of the EMS, as part of the transition to a system of irrevocably fixed exchange rates and a joint monetary policy. The EC Commission made more precise proposals in March 1990 concerning a federation of central banks that would decide EMS monetary policy; an Intergovernmental Conference to discuss institutional changes is to begin in December 1990.

While it is premature to speculate on the precise institutions that might be set up to ensure greater coordination of monetary policies, it seems likely that the eventual achievement of monetary union would decrease the autonomy of the Bundesbank in responding to macroeconomic developments in Germany, because monetary policy would be set for Europe as a whole. Given the importance of the German economy, the credibility of its commitment to price stability, and the international role for the deutsche mark, the Bundesbank at present exerts a very strong influence over interest rates in Europe. In formulating its monetary policy, the Bundesbank is necessarily swayed primarily by events in Germany. In contrast, a European monetary policy would likely respond to aggregate developments among all member countries, and not to individual countries' variables. With further narrowing of exchange rate margins and the elimination of the possibility of realignments, the scope for different monetary policies in different countries would narrow further. Monetary policy would have to framed for its system-wide effect, rather than being targeted at particular regions. 1/

In these circumstances, the assumption that was made above that the Bundesbank continues to target the M3 money stock for the Federal Republic of Germany would no longer be appropriate. Instead, a variant of the model was constructed in which a European monetary aggregate is targeted jointly by all ERM countries, which are assumed to share the same value for the short-term nominal interest rate. 2/ The European monetary aggregate is assumed to be M3; moreover, to simplify the issues involved, the demand for European M3 is assumed to have the same form (and the same parameters) as the demand for M3 in the FRG. 3/ The sole difference here compared to the reference scenario lies therefore in the more symmetric operation of European monetary policy.

The results of simulating GEMSU with a target for the European money supply that is equal to its baseline path are presented in column 4 of

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1/ The evolution of the EMS has been surveyed by Guitián (1988).

2/ The operation of the ERM with a joint monetary target is considered by Russo and Tullio (1988).

3/ Kremers and Lane (1990) estimate a European money demand equation directly, and find that it seems to be more stable than equations for individual countries.

Table 5. They imply more moderate increases in German interest rates (as well as in interest rates of other ERM countries), and less real DM appreciation in 1990, than in the reference scenario. Stimulus to output in Germany is greater initially, but pressures on German inflation are also significantly higher: the GDP deflator is higher than in the reference scenario by 1/4 of a percentage point on average over 1990-94. As a result, by 1992 the real DM appreciation is similar to that in the reference case, but it results more from German price level increases and less from nominal DM appreciation against non-ERM currencies than in the earlier simulation. Negative output effects in other ERM countries are reduced because more of the adjustment of relative prices occurs in Germany. The amount of demand satisfied through crowding out of FRG net exports is, however, similar to the reference case.

Though overall European inflation is also higher in this scenario, this feature is not inherent in a European monetary policy. Instead, it results from the fact that in the reference scenario, the Bundesbank exports deflation to the countries through higher interest rates, and in order to maintain their ERM parities they undershoot their monetary targets. In contrast, in the European money target scenario, the overall stance of European monetary policy remains neutral (relative to baseline) rather than becoming contractionary. Of course, a joint decision might be taken in these circumstances to tighten European monetary policy to attenuate the rise in inflation.

As illustrated by this scenario, the key feature of a European monetary policy (accompanied by the maintenance of fixed ERM parities) would be its more symmetric response to shocks. This might have the disadvantage of not permitting a sufficient tightening of German monetary conditions in response to excess demand pressures. On the other hand, it might mitigate deflationary pressures on other ERM countries coming from a shock that primarily affected Germany and induced monetary tightening there.

One aspect of the question that has not been incorporated in these simulations is the possible pooling of risks inherent in a European as opposed to a German monetary aggregate. Currency union in Germany is likely to make the demand for money in Germany more uncertain, implying a risk that monetary policy in Germany would be inappropriately tight or easy. Targeting a European monetary aggregate--the demand for which may already be more stable, according to evidence in Kremers and Lane (1990)--could have the advantage of providing a more stable anchor for monetary policy.

VI. A Survey of Other Simulation Studies

This section compares three published model-based macroeconomic scenarios of German unification, isolating differences in assumptions and in outcomes. Only those scenarios that give details for a reasonably complete

set of variables are discussed; their results are summarized in Table 7. A list of sources is given in the bibliography.

1. Assumptions

a. Separate economies?

The first basic question is how to treat the GDR: as a separate country or as a fledgling FRG. There seems to be near unanimity, born of necessity (given great uncertainty about the structure of the GDR economy), to assume that output per worker in the GDR approaches the FRG level in a specified number of years (typically 10 years). Working back from this constraint and assumptions about productivity growth gives a path for investment in the GDR. There remains the issue of what to assume about the structure of the rest of the GDR economy. In Alexander and Gagnon (1990), the GDR is treated as being the same as the FRG in all respects except production, and FRG behavioral equations apply; in McKibbin (1990), the GDR economy is ignored since unification is treated as a fiscal shock to the FRG. In the other study, a rudimentary GDR model is implicit, keeping that economy quite separate from the FRG. The Alexander and Gagnon study has the advantage of making all variables in the GDR economy endogenous but is not able to give separate results for each of the two economies after unification.

b. Fiscal implications

The range of estimates for the increase in FRG government expenditure is wide. This is largely the result of uncertainty about how GDR spending is to be financed: by higher taxes or private saving in the GDR, by privatization receipts, or by transfers from the FRG. If the last, does the issuance of additional bonds by the Federal Republic lead to significant effects in credit markets, through increases in the supply of DM-denominated debt? In 1991 and afterwards, net additional expenditure in the FRG in the form of transfers to the GDR is estimated to be 1-3 percent of GNP, though for McKibbin, the estimated increase in government spending really includes increased private demand as well, which is assumed to operate in the same way as a fiscal spending shock.

c. Trade patterns

In most cases, it is assumed that net imports of the GDR will show up as increased aggregate demand in the FRG (100 percent in the case of both McKibbin (1990) and Alexander and Gagnon (1990)). Differences here matter a lot for induced output effects on other countries, especially for other EMS countries. In Alexander and Gagnon, all GDR demand is domestic demand within the FRG/GDR, though some spills over into imports directed at other countries and some is satisfied by increased production in the new Germany. They do not have sufficient country coverage to identify the effects on EMS countries linked to the DM, however.

Table 7. Simulation Studies of German Unification

(Average deviation from baseline in 1991/92, or in one of the two years) 1/

Study	Model used	Assumptions: FRG government spending	Assumptions: GDR net imports from the FRG	FRG Variables: nominal long-term interest rate	FRG Variables: current account	FRG Variables: GDP	FRG Variables: inflation rate	FRG Variables: nominal effective exchange rate	GDP of other ERM countries
1. Alexander and Gagnon	MX3	+1.6%Y	+$125b 2/	0.6	-$10 b 3/	1.8% 3/	0.2	7.3%	-0.1%
2. Dutch Central 4/ Planning Bureau	CPB-WM	+DM40 b	+DM60 b	1 3/4 5/	-1 1/4%Y	1%	1/2 - 1	gradual appreciation	1/2%
3. McKibbin									
(0) no realignment	MSG	+3.3%Y		1.3	-3%Y 3/	1.1%	-0.2	9%	-1%
(1) with realignment	MSG	+3.3%Y		1.1	-3%Y 3/	1.1%	-0.2	7 1/2%	-0.4%

1/ In percent (%), percent of GDP/GNP (%Y), billions of DM, or billions of dollars, where indicated.

2/ Includes increased spending on GDR production.

3/ GDR and FRG combined.

4/ 1991 values.

5/ Remaining at March 1990 level.

2. Outcomes for macroeconomic variables

a. Increased FRG output versus higher inflation

As shown in Table 7, there is a range of estimates of the increased demand that can be satisfied with increased FRG production. Presumably, all models start from baseline projections in 1991-92 of GDP growth of 2.5-3.5 percent and an inflation rate of 1.5-3 percent. Despite the current level of capacity utilization, all scenarios involve some increase in GDP: on average, it is one percent above baseline in 1991-92 (Table 7 gives the level of output, not annual rates of growth). The Alexander and Gagnon study is not really an outlier, because it is output of the united Germany that is reported, and potential output in the GDR grows by some 7 percent per year faster as a result of unification. In none of the scenarios either is there much support for the inflation fears that are sometimes voiced, though this follows no doubt from the assumption that the Bundesbank keeps money supply growth appropriately tight.

b. Exchange rates and interest rates

Models with adaptive expectations generally do not produce much immediate movement in interest rates and exchange rates in response to increased aggregate demand; in contrast, rational expectations models (e.g. MX3, MSG) tend to have quite lively asset prices in response to a path of demand and government spending that is assumed known in advance. In these latter two models, the DM appreciates substantially, by 7-9 percent, though long-term interest rate are only 0.6-1.3 percentage points higher than in the baseline.

c. Current balance effects

The divergence here among the scenarios derives from differences in the treatment of the GDR and also from differences in projected fiscal transfers from the FRG to the GDR. In Alexander and Gagnon, figures for the FRG consolidated with the GDR are reported, so that both the transfer and intra-German trade wash out. Since the exchange rate appreciates in real terms, net exports to other countries are crowded out. For McKibbin, since the shock is treated as a domestic fiscal shock, there are no first-round net export changes for the FRG, except to the extent that there is an imported component to government spending. The current account position therefore implicitly consolidates FRG and GDR. The size of the current balance deterioration nevertheless seems very large.

d. Effects on other ERM countries

The net effect on other ERM countries' output depends on the balance between negative interest rate effects on domestic demand, positive external demand effects from the GDR and the FRG, and negative effects from real appreciation (since, in the absence of realignment, ERM currencies

appreciate with the DM). In the rational expectations models, the net effects are negative, as financial effects--through interest rates and exchange rates--dominate. The reverse is true of the Dutch Central Planning Bureau, which uses an adaptive expectations model.

VII. Concluding Remarks

Given the uncertainties involved in the transition from a centrally-planned to a market economy in the GDR, the model simulations presented above must be seen as only rough quantifications of possible spillover effects of GEMSU onto other countries. In addition to uncertainties concerning the structure of a united Germany, there are other structural changes underway that may modify these results.

One major structural change is that the economies of EC countries will become increasingly integrated with the achievement of a single market for goods and financial services in 1992. It is likely that with increasing integration, the response of both exports and imports to changes in competitiveness would increase. In effect, goods in different countries become better substitutes, as barriers to trade diminish. This change would tend to distribute increases in demand emerging from the changes in the GDR more widely across EC countries, since other countries' goods would be more easily substitutable with those of the FRG. In order to gauge the sensitivity of the simulation results to this development, the import and export elasticities of EC countries with respect to relative prices were increased by roughly a factor of two. Though this distributed demand from the GDR more evenly and reduced the magnitude of the real exchange rate response, differences with the reference scenario were relatively slight. It therefore seems reasonable to conclude that the macroeconomic consequences of GEMSU are unlikely to be affected in a major way by increased European integration.

The general picture that emerges from the scenarios is that while additional stimulus from the GDR would put upward pressure on capacity in the Federal Republic, with some danger of inflationary tendencies, inflation is unlikely to accelerate markedly and for an extended period of time provided the stance of monetary policy is adjusted appropriately by the Bundesbank. In this respect, the results presented here are similar to those in other studies that use macro models. However, in none of the model simulations has an allowance been made for increased uncertainties in financial, labor, and goods markets. To that extent, then, they may all be too sanguine. A less optimistic scenario was simulated in which productivity gains in the GDR were smaller, unemployment remained persistently high, and migration to the FRG was substantial. Though budget deficits persist in this scenario and output growth of FRG and GDR combined is lower, German inflation and effects on other countries are not markedly different. The effects might, however, be considerably more severe if

interest rates were directly responsive to actual or anticipated credit demands.

As for interest rates, simulation of the reference scenario in MULTIMOD suggests that GEMSU might produce an increase of long-term real rates equal to 3/4 of a percentage point. This is smaller than the increase that has already occurred in the first few months of this year, raising the question of whether the market has already discounted these effects of German unification. An alternative tax policy that involves an increase in VAT rates of about 2 percentage points leads to a very similar path, with only slightly lower real interest rates--but higher inflation for a few years.

Turning to exchange rates and effects on other countries, the MULTIMOD simulations suggest that the DM should appreciate in real terms against other currencies as a result of GEMSU. As there has been some increase in the value of the deutsche mark relative to the U.S. dollar and the yen since early November 1989, the market may already have discounted some of the expected exchange rate effects of unification. All-in-all, effects on other industrial countries (both ERM and others) would not be large. Again, other studies surveyed reach similar conclusions, as the negative demand effects of higher interest rates and positive stimulus from GDR imports roughly offset.

Changes to MULTIMOD and Sensitivity of the Results to Structural Features

This Appendix examines the sensitivity of the simulation results to some aspects of the structure of MULTIMOD: it also gives details concerning the way FRG monetary policy is modeled. The extent to which higher investment demand in the GDR can be accommodated in world output markets without putting upward pressure on prices and interest rates depends in large part on two factors: the short-run trade off between higher output and higher prices, and the sensitivity of private-sector spending to changes in real interest rates. These two factors are discussed in turn. The impact of the shock on both the FRG and its trading partners will also be affected by the responsiveness of trade flows to relative price movements. A simulation is presented in which intra-European trade elasticities are assumed to be larger than in the reference case, reflecting the possible effects of greater European economic integration on trade flows. Finally, money demand and the reaction function of the Bundesbank are discussed.

1. The price equation for Germany in MULTIMOD

Conceptually, growth in the aggregate output price for an industrial country in MULTIMOD is determined by growth in average wages. The latter, in turn, is based on a Taylor-Calvo model of overlapping wage contracts: wage increases depend on both past and expected future inflation, as well as the degree of pressure in output markets. In practice, wages are not explicitly represented in the model; output price inflation depends directly on the determinants of wage growth. Pressure in output markets is measured by the ratio of actual output to its capacity level. It is assumed that inflation responds linearly to the degree of capacity utilization (CU), i.e. a one percent increase in CU raises inflation by the same amount relative to its baseline level regardless of the initial amount of slack in the economy. 1/ One implication is that there is no absolute constraint on output in the short run: increasing the size of a demand shock will raise the effect on output and inflation by proportional amounts.

The linearity of the tradeoff between output and inflation in response to a demand shock has, however, been questioned. For instance, if there is a maximum level of output that can be produced in the short run, by implication the tradeoff must become rather steep as output approaches this maximum level. Since the tradeoff becomes steeper, the response of inflation to an increase in demand depends on the initial level of capacity utilization. Chart 4 shows historical estimates for capacity utilization in the FRG, along with staff projections for the 1990-91 period. The projected utilization rate rises above its historical average in the initial years of

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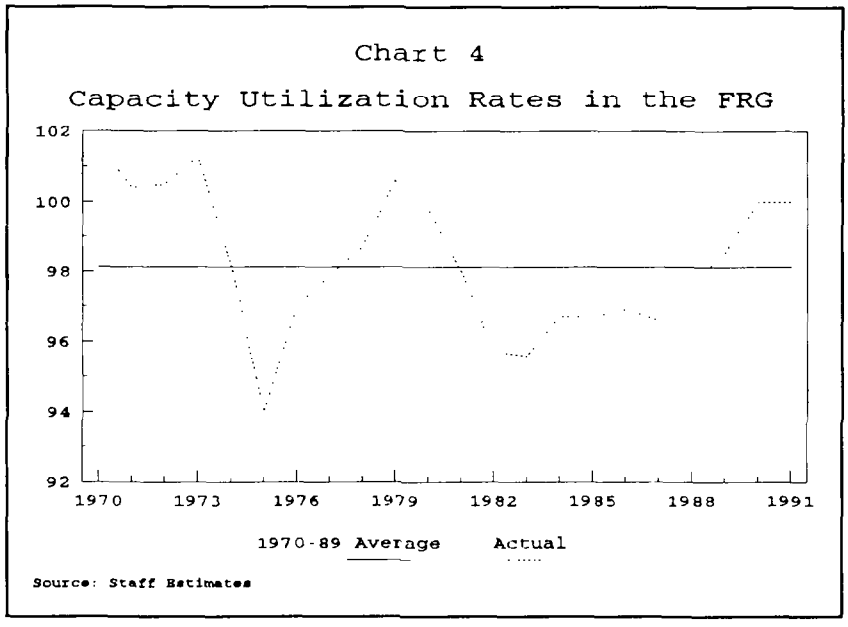
1/ In fact the expression is non-linear since it depends on the logarithm of capacity utilization; however, since variations in CU are small relative to its mean, it is effectively linear.



GEMSU, suggesting that inflationary pressures could be greater than shown in the reference scenario if the steepness of the price-output tradeoff increases as capacity utilization rises above normal levels.

Here we present estimates of a non-linear alternative to the existing price equation in MULTIMOD.

The existing equation is:

$$\Delta \ln(P) = \kappa + (1-\delta)\Delta \ln(P_{-1}) + \delta \pi^{e} + \alpha[\ln(CU/100)+\ln(CU_{-1}/100)]/2, \quad (A.1)$$

where P is the GDP deflator, π^{e} is the expected rate of change of the absorption deflator, and CU is capacity utilization (i.e. the ratio of actual GDP to potential GDP, as a percent). The degree of nominal flexibility of inflation is measured by δ, which is related to the average contract length: today's inflation depends on the expected change in the absorption deflator, with coefficient δ, and on the lagged rate of change of output prices, with coefficient $1-\delta$. Expected absorption prices matter because workers are affected by expected consumption, not product, real wages. The output gap affects inflation as well: in the current model it enters linearly (in logarithms).

In estimation, expected inflation is replaced by the value of inflation next period and instrumental variables are used for both π_{+1} and CU. The instruments are the ratio of government spending to GDP, the rate of change of the monetary base and of the oil price, and lagged values of capacity utilization and the rate of change of output prices. Table 8 gives estimates in line 1 for the parameters of this equation; they are close to those in the published version of MULTIMOD, though there are slight

differences since they use the modified capacity utilization series presented in Chart 4 above and they are based on data for the FRG only, as opposed to pooled data for the industrial countries.

Table 8. Federal Republic of Germany: Alternative Equations for the Rate of Change of the GDP Deflator

(Absolute t-ratios in parentheses)

Equation	Coefficients				R^2	SER	DW
	constant	δ	α	β			
1. linear	0.0043	0.541	0.197	--	0.415	0.010	1.73
	(1.6)	(3.2)	(1.8)				
2. cubic	--	0.447	0.00029	-3.5	0.510	0.009	1.82
		(3.0)	(2.4)				

A non-linear alternative to (A.1) is the following equation, where prices depend on a cubic function of the rate of capacity utilization:

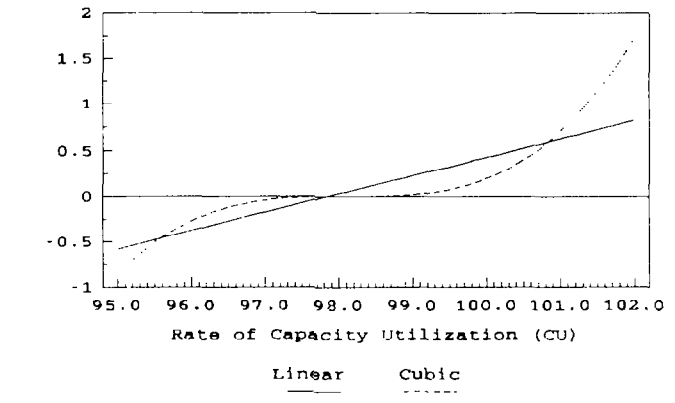
$$\Delta\ln(P) = (1-\delta)\Delta\ln(P_{-1}) + \delta\pi^e + \alpha(CU - \max(CU) - \beta)^3 \qquad (A.2)$$

where max(CU) is the maximum value of capacity utilization in the sample, equal to 101.6. Equation (A.2) was estimated using OLS to obtain values for δ and α conditional on alternative values for β: the preferred value of β minimized the residual sum of squares. The results are shown in line 2 of Table 8. In this specification, $\max(CU)+\beta$ is an estimate of the non-accelerating-inflation rate of capacity utilization, analogous to the NAIRU (at least if the constant term is omitted from the equation, as in line 2). The estimate of β shown here yields a NAIRU of about 98, close to the sample mean for CU. This equation fits the data better than the linear one, probably because CU is highest in the 1972-73 and 1979-80 periods, when inflation was also high. It should be noted that the change in the terms of trade was added to the equation to see if these inflationary episodes can be attributed to imported inflation. The contribution of this variable was small and statistically insignificant, however, so it was dropped.

The two equations have quite different properties, as can be seen from Chart 5, which shows the pressure on inflation for different values of CU. The additional pressure from a one percent increase in CU in the linear specification is invariant to the level of capacity utilization, and equals

Chart 5

Alternative Output/Inflation Tradeoffs



about 0.2 percentage points. In the non-linear specification, the response is much higher when CU is close to its historical maximum (101.6). In both specifications, the inflation pressure is zero around CU=98. For the capacity utilization rate of about 100 that is projected for the 1990-91 period, the slope of the cubic function is 0.31, compared to that of the linear function of 0.20. As a result, the pressure on prices of an increase in the rate of capacity utilization from this baseline value is about 50 percent higher with the non-linear specification. The implications of this non-linear output/price relationship for the effects of GEMSU are shown in Section IV in the main text.

2. Interest elasticities of consumption and investment

A lively debate continues as to the influence of higher interest rates in raising saving, on the one hand, and reducing investment on the other. Some go so far as to deny that there are any significant effects. Indeed, since increases in interest rates cause income and substitution effects on consumption that go in opposite directions, higher interest rates may even reduce saving. 1/ In terms of investment, some studies indicate a stronger link to an accelerator mechanism than to relative factor prices. 2/

In the context of other empirical studies, MULTIMOD embodies relatively large negative real interest rate effects on consumption (consumption

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1/ Contributions to defined-benefit pension plans are an example of a component of saving where income effects dominate; higher interest rates, by increasing earnings from existing assets, allow the payment of given pension benefits at lower contribution rates. See Bernheim and Shoven (1985). The Knight/Masson model used above embodies a negative saving elasticity.

2/ Clark (1979) is a widely cited study of U.S. evidence.

declines in the long run by 6 percent in response to a 1 percentage point increase in real long-term rates) and on investment (consistent with the Cobb-Douglas production function, the elasticity of the desired capital stock with respect to the cost of capital equals -1). However, if investment is considered in the framework of a more general production function than the Cobb-Douglas function used in MULTIMOD with the elasticity of substitution estimated (as is usually the case) to be closer to one-half than to unity (the latter implied by Cobb-Douglas), effects of interest rates on investment are correspondingly lower. The results in Masson and Knight (1986), presented in Section II, also embody considerably smaller interest-rate effects on net saving for the United States, Japan, and the Federal Republic of Germany than those of MULTIMOD (albeit in a different theoretical framework that is not strictly comparable).

In performing the simulations of GEMSU in MULTIMOD, therefore, interest-rate effects on both consumption and investment were reduced for industrial countries by a factor of two. By making global net saving less elastic with respect to the interest rate, this raised the effect on real interest rates, bringing them more in line with the results of Section II: it also produced somewhat less crowding out of domestic demand in the Federal Republic. Here we present the results of two alternative scenarios: in the first, the interest elasticities of consumption and investment are set at their original (higher) MULTIMOD values, and in the other they are set at "very low" values, defined as 1/10 the MULTIMOD values.

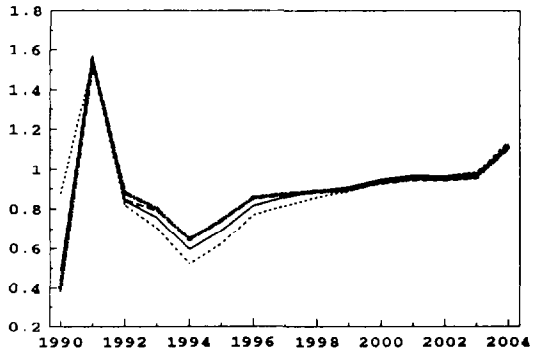
These alternatives are compared to the reference scenario in columns 1-3 of Table 9 and in Chart 6. The qualitative results are not surprising: both real output and real interest rates rise by more in the industrial countries the lower are the effects of real interest rates on spending. The differences between the reference scenario and the scenario with higher interest-rate effects are not dramatic. The real interest rate for the industrial countries as a group (not shown in the Table) peaks at 25 basis points above control compared to 50 basis points in the reference scenario. The appreciation of the deutsche mark is smaller when interest-rate effects are larger, as more of the external demand shock is offset by lower domestic absorption. When interest-rate effects are much smaller than in the reference scenario, the differences are more dramatic: the world real interest rate peaks at 1.4 percentage points above control, almost 3 times as high as in the reference scenario. The impact on output and inflation in the FRG is also magnified, causing a greater appreciation in the deutsche mark. While the initial rise in output in the industrial countries is larger with weaker interest-rate effects, the result over the longer term is more accentuated cycles in output and prices.

3. Trade elasticities

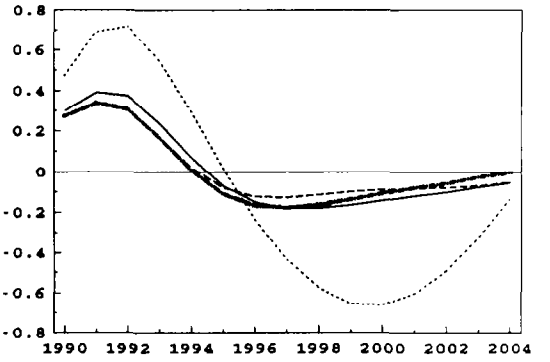
The trade price elasticities in MULTIMOD are typically based on equations for aggregate trade flows estimated over the 1969-1987 period: the results are shown in Table 10 for the industrial countries. Import price

Chart 6
Scenarios of German Unification for Alternative Parameter Values
(Deviation from baseline)

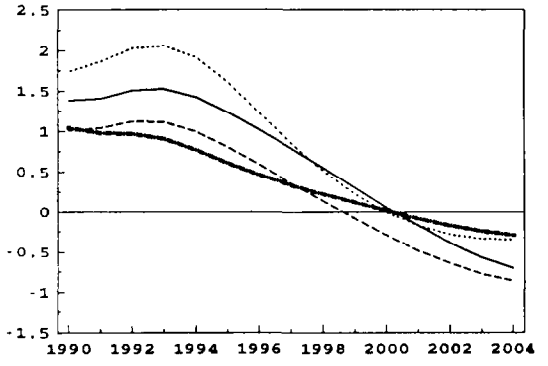
Real GDP Growth (Combined)
(percentage point difference)



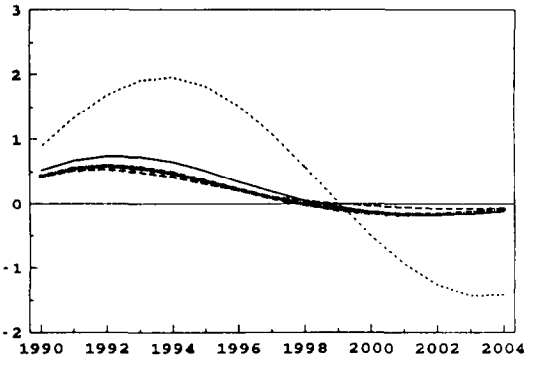
Inflation (GDP Deflator)
(percentage point difference)



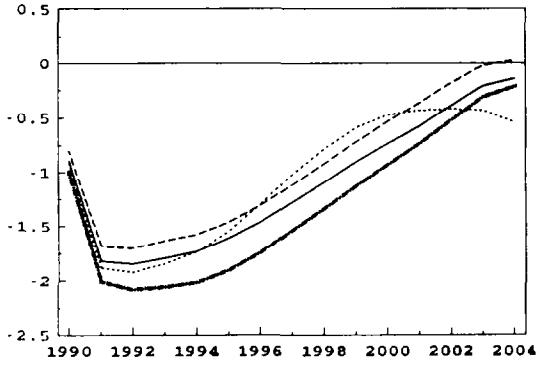
Real Effective Exchange Rate
(percent difference)



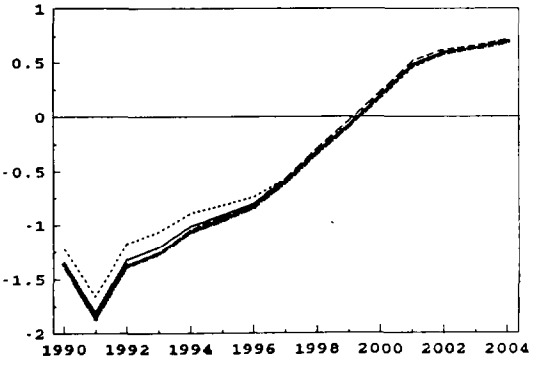
Real Long-Term Interest Rate
(percentage point difference)



Current Account Balance (Combined)
(percent of GNP)



Government Balance (Combined)
(percent of GNP)



Reference
High Interest-Rate Effects
Low Interest-Rate Effects
High Trade Elasticities

Table 9. Scenarios for German Unification With Alternative Model Parameter Values, 1990-2001

(Deviations from baseline in percent)

	Reference Scenario	High Interest-Rate Effects	Low Interest-Rate Effects	High Trade Elasticities
Combined Real GDP				
1990	0.5	0.4	0.9	0.4
1991	2.0	1.9	2.4	1.9
1992-94	3.6	3.5	3.8	3.5
1995-97	5.8	5.8	5.9	5.9
2001	10.6	10.6	10.5	10.7
Real GDP (FRG Only)				
1990	0.5	0.4	0.9	0.4
1991	1.3	1.1	1.6	1.1
1992-94	0.6	0.5	0.8	0.5
1995-97	0.4	0.5	0.5	0.5
2001	0.7	0.8	0.7	0.8
Inflation: GDP Deflator (percentage points)				
1990	0.3	0.3	0.5	0.3
1991	0.4	0.3	0.7	0.3
1992-94	0.2	0.2	0.5	0.2
1995-97	-0.1	-0.1	-0.2	-0.2
2001	-0.1	-0.1	-0.6	-0.1
Real Effective Exchange Rate				
1990	1.4	1.0	1.7	1.0
1991	1.4	1.0	1.9	1.0
1992-94	1.5	1.1	2.0	0.9
1995-97	1.0	0.6	1.2	0.5
2001	-0.2	-0.5	-0.2	-0.1
Real Long-Term Interest Rate (percentage points)				
1990	0.5	0.4	0.9	0.4
1991	0.7	0.5	1.3	0.6
1992-94	0.7	0.5	1.9	0.5
1995-97	0.4	0.2	1.5	0.2
2001	-0.2	-0.1	-0.9	-0.2
Combined Current Account Balance (percent of GNP)				
1990	-0.9	-0.8	-0.9	-1.0
1991	-1.8	-1.7	-1.9	-2.0
1992-94	-1.8	-1.6	-1.8	-2.1
1995-97	-1.4	-1.3	-1.3	-1.7
2001	-0.6	-0.4	-0.4	-0.7
Combined Government Balance (percent of GNP)1/				
1990	-1.3	-1.4	-1.2	-1.4
1991	-1.8	-1.9	-1.7	-1.9
1992-94	-1.2	-1.2	-1.0	-1.2
1995-97	-0.8	-0.8	-0.7	-0.8
2001	0.5	0.5	0.5	0.5
Real GDP: Other EMS Countries				
1990	-0.1	-0.2	0.2	-0.1
1991	-0.2	-0.2	0.2	-0.0
1992-94	-0.4	-0.5	-0.0	-0.1
1995-97	-0.3	-0.4	-0.1	-0.1
2001	0.3	0.3	0.2	0.2
Real GDP: Other Industrial Countries				
1990	0.1	0.0	0.3	0.1
1991	0.2	0.1	0.5	0.2
1992-94	0.0	-0.0	0.3	-0.0
1995-97	-0.1	0.0	-0.1	-0.2
2001	0.0	-0.0	-0.3	0.0

1/ General government, including the Unity Fund and the Trust Fund.

Table 10
Long-Run Relative Price Elasticities of Traded Goods in MULTIMOD[1/]
(absolute values)

	Manufactured Imports	Manufactured Exports
U.S.	1.10	0.71
Japan	0.76	"
Germany	0.90	"
France	0.72	"
U.K.	0.37	"
Italy	0.40	"
Canada	0.45	"
Small Industrial Countries	1.17	"

Source: Masson and others (1990).

1/ Including non-factor services, but excluding oil trade and commodity imports from developing countries.

elasticities range from a low of 0.37 for the U.K. to 1.17 for the Smaller Industrial region, while the long-run export price elasticity is constrained to a common value for all countries, estimated to equal 0.71. In light of the liberalization of European trade that has occurred over this period, these elasticities may understate the sensitivity of trade flows in Europe to relative price movements. Further integration of these markets in conjunction with the Europe-1992 initiative may also raise the sensitivity of intra-European trade to relative price movements.

In a region with fixed exchange rates such as the ERM, higher trade price elasticities will tend to increase the positive spillover effects of demand shocks in one country on the output of trade partners. Specifically, the rise in inflation in the FRG caused by GEMSU would result in more of the demand stimulus in the GDR being directed to other European countries. In order to examine the sensitivity of the results to this effect, the long-run trade price elasticities for the European countries were raised to 2 for both imports and exports.[1/] The results for the GEMSU simulation with these parameter values are shown in column 4 of Table 9. Output in the FRG

1/ The adjustment is rather arbitrary. Sufficient data are not available in the MULTIMOD database to obtain estimates of the elasticities for a more recent sub-period. The long-run elasticity of 2 was chosen to reflect the high end of values commonly found in other models that use aggregate trade data.

rises by slightly less with higher trade price elasticities, while the negative effect on output in the other ERM countries is almost eliminated. Output in the ERM region as a whole rises with higher trade price elasticities. The reason is that the demand stimulus is weaker in the FRG with higher trade price elasticities, which reduces the increase in interest rates and the exchange rate appreciation. Because the other members of the ERM "import" these variables from the FRG, monetary conditions in the aggregate ERM region are less contractionary than in the reference scenario.

4. Money supply and demand

It is assumed in the model that the Federal Republic, like the United States and Japan, sets short-term interest rates in order to target a monetary aggregate. Money demand determines the actual money stock, and the central bank moves interest rates to bring money demand in line with the money target. In order to accord with the currently targeted aggregate for the Federal Republic, a simple demand equation was estimated for M3 as a function of FRG real GDP, the three-month interest rate RS, and the GDP deflator P. The following estimates were obtained:

$$\ln(M3/P) = \underset{}{-2.20} + \underset{(2.6)}{.499}\ \ln(Y) - \underset{(3.4)}{.0051}\ RS + \underset{(5.2)}{.646}\ \ln(M3/P)_{-1} \qquad (A.3)$$

$$R^2 = .997 \qquad SER = .018$$

The equation passes stability tests starting in 1974, and though there is evidence of residual serial correlation (a Lagrange-Multiplier test is significant at the 5 percent level), this equation was selected because of its simplicity and dynamic stability.

It is assumed that the Bundesbank moves the short-term interest rate, RS, in order to hit a target for M3, but may not achieve it exactly if the gap between money demand and the target is too large. This is consistent with the existence of a target band, rather than a single value. The Bundesbank's current target is for 4-6 percent growth of M3: in the reference scenario, the deviations of M3 growth from its baseline value peak at 0.7 percent in 1991, which would leave M3 within the announced target band assuming that the baseline scenario represents growth at the mid-point of the band.

Equation (A.3) was also used as the basis for the simulation presented in Section V of the effects of GEMSU when monetary policy is based on European variables as opposed to those in the FRG only. Specifically, European money demand was assumed to be a function of European output, prices, and interest rates. The output and price variables are defined as logarithmically-weighted aggregates of the individual country data, with weights equal to 1980 output shares. To simplify comparison with the reference scenario, it was assumed that the response of European money demand to changes in output, prices, and interest rates was the same as in

the FRG as shown in equation (A.3). The response of interest rates to deviations in the European money supply from its target level was also assumed to be the same as for the FRG in the reference scenario. While these assumptions may be unrealistic in practice, they have the advantage of implying the same degree of responsiveness of monetary conditions to economic developments as in the reference scenario. Economic developments, however, are evaluated in terms of Europe-wide aggregates as opposed to FRG data only.

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