VI

Domestic and International Macroeconomic Consequences of German Unification

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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 eastern Germany—the former 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 western Germany will also be affected in a major way, through higher government deficits and increased exports to the east. The purpose of this chapter is not to quantify the effects of unification on the east itself, nor to quantify induced increases in government spending. Instead, taking as given estimates of those variables, the macroeconomic consequences for western Germany and other industrial countries are analyzed from a global perspective.[2]

The second section starts by considering the additional demand on world saving coming from increased investment and higher social spending in the east. The shift of the former 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. 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. 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 German output relative to that of other countries. Much of the investment in eastern Germany will probably be undertaken by firms from western Germany, because of former business ties, common language, and physical proximity. In addition, because western Germany has a comparative advantage in the machinery and equipment that is needed to retool the economy of eastern Germany, a good part of the investment demand is likely to be directed to western Germany, though no doubt imports of goods from other countries will also increase. In these circumstances, the relative price of German output (its 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 western Germany 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 east to the west. Migration occurred on a large scale in the latter months of 1989 and early in 1990 (see Chapter II for details) and is expected to continue, albeit at a much reduced rate. Migration increases potential

[1] See Chapter V.

[2] Other model simulation studies using a similar methodology include Alexander and Gagnon (1990), McKibbin (1990), and Netherlands, Central Planning Bureau (1990). The effects of German unification are also discussed in the Organization for Economic Cooperation and Development's 1989/1990 OECD Survey for Germany.

output in western Germany and eases capacity pressures there. The third section presents estimates of the effects on potential output of projected migration.

The fourth section 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; thus, the stance of monetary policy will influence the response of output and inflation in western Germany to increased demand from the east. In this section, simulations of the IMF'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 the saving-investment model discussed in the second section. 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 and additional shifts. 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 demand from eastern Germany and migration to western Germany are simulated under two scenarios: in the more optimistic scenario, investment in the east is sufficient to raise output per worker to 80 percent of the level in the west by 2001; in the less optimistic scenario, investment is lower, output per worker only reaches 60 percent of that level, and migration to the west is considerably higher. The MULTIMOD simulation of the more optimistic scenario takes as given an increase in net imports of goods and services by eastern Germany from the rest of the world (including western Germany) of about DM 60 billion in 1990 and DM 130 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 western Germany by about 2 percent in the short term (by 1991), and temporarily raise inflation by ½ of 1 percentage point. By 2001, the combined output of eastern and western Germany would rise by 14½ percent relative to a baseline without unification. These effects would be associated with an initial rise in real long-term interest rates of about ¾ of 1 percentage point, an exchange rate appreciation of about 4 percent against the U.S. dollar, and a reduction of the combined German current account surplus by about 2½ percentage points of GNP for several years. In the more pessimistic scenario, combined output would be higher than in the baseline, but by only 8 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 3 to 4 percent of combined GNP relative to baseline for a number of years.

The fifth section explores two policy issues related to German unification. First, given the possibility of persistent deficits, the issue arises as to whether increases in tax rates are desirable. Simulations of an increase in the value-added tax (VAT) are presented. Second, the question of a possible realignment of the currencies participating in the exchange rate mechanism (ERM) of the European Monetary System (EMS) is considered. The scenarios of the previous section suggested that the GEMSU shock, accompanied by a non-accommodating monetary policy by the Deutsche Bundesbank, might lead to appreciation of the deutsche mark in real terms. This would occur via a nominal appreciation against non-ERM currencies (the U.S. dollar, the Japanese 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. While a realignment could, in and of itself, lower inflation in Germany and strengthen economic activity in other ERM countries, account should also be taken of the effect on the credibility of the "hard-currency" policies pursued by the ERM countries.

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

A Global Saving-Investment Perspective

The approach in this chapter is to treat the excess of spending over output in eastern Germany 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 former GDR that might result from GEMSU.[3] In the first one, which will be termed the "reference case," investment proceeds at a rapid enough rate to raise output per worker in eastern Germany to 80 percent of the level in the western part by 2001. In the second, less optimistic scenario, investment in the east is lower but saving is also lower, and output per worker only reaches 60 percent of western Germany's level in 2001. It is assumed that in the absence of GEMSU, the

[3] Estimates taken from Chapter V, Tables 3 and 6.

Table 1. Demands on Global Saving Due to GEMSU: Increased Net Imports of Eastern Germany[1]

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

	Reference Scenario (A)		Less Optimistic Scenario (B)	
	In deutsche mark	In U.S. dollars[2]	In deutsche mark	In U.S. dollars[2]
1990	58	34	58	34
1991	127	75	122	72
1992	112	66	110	65
1993	100	59	104	61
1994	92	54	96	56
1995	82	48	88	52
1996	72	42	79	46
1997	60	35	74	44
1998	46	27	67	39
1999	31	18	59	35
2000	17	10	51	30
2001	5	3	43	25

Source: see Chapter V, Tables 3 and 6.

[1] Change in investment-saving balance.

[2] At the deutsche mark–U.S. dollar rate prevailing at the end of 1989.

external position of the GDR would have been roughly in balance, so the figures in Table 1 constitute additional demands on world saving.[4] Table 2 gives estimates of global saving-investment flows for 1989. The latter serve to put the figures for eastern Germany 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 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 investment in eastern Germany from the point of view of a simple two-region model, where the two regions are Germany and the rest of the world (*ROW*).[5] 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 western Germany also apply to the eastern part. The model is based on three simple hypotheses: (1) saving net of investment depends positively on the (real) interest rate, R; (2) the goods produced in the two regions are imperfect substitutes, hence the demand for each good depends on the relative price, that is, 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 Chart 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*. The *SI* 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,[6] 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 $N = -N^*$.

Chart 1 can be used to analyze the outward shift in the German investment schedule corresponding to increased profit opportunities in the east related to GEMSU; shifts in the saving schedule are ignored for simplicity, though increased consumer spending in eastern Germany might also reduce the German saving rate. 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.[7] 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

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

[5] The analytical model is discussed in Masson and Knight (1986). In its empirical implementation, discussed below, there are in fact three countries and one remaining region (which implicitly includes the former GDR).

[6] Private saving may also depend on the government deficit—see the discussion below of Ricardian (non)equivalence.

[7] In Chart 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.

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	1,268	1,172	180	−83
Developing countries	783	691	104	−12
World totals	4,194	3,831	459	−96[3]

Sources: International Monetary Fund, *International Financial Statistics, Government Finance Statistics Yearbook*, 1989 and *World Economic Outlook: A Study by the Staff of the International Monetary Fund*, April 1989.

[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.

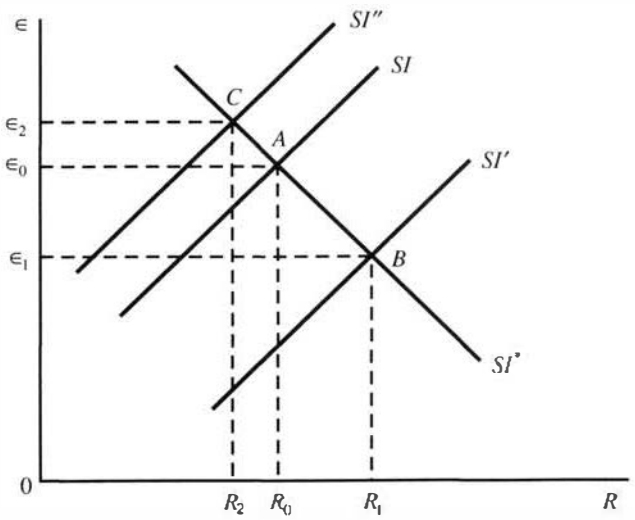
counter-intuitive, since it is associated with a decline in a united Germany's current account surplus. It comes about because the increase in investment leads to excess demand for German goods, and a real appreciation is one mechanism by which this excess demand is satisfied, via a crowding out of foreign demand for German goods.[8] Of course, increases in interest rates tend to crowd out investment and stimulate saving within western Germany, also making room for the increased investment in eastern Germany, but western Germany is not made explicit in this simple two-country framework.

A second aspect of GEMSU is the increase in social transfer payments made to residents of eastern Germany. 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.[9]

[8] If the increased spending fell on other countries' goods to some extent, then the real appreciation of the deutsche mark would be smaller.

[9] 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.

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



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 Chart 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 Germany, 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

Table 3. 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 Unified German Current Account Balance (*In billions of deutsche mark at 1990 prices*)	Memo: Increase in U.S. Real Interest Rate (*In percentage points*)
		(With static exchange rate expectations)		
1990	0.4	2.8	−25	0.4
1991	1.3	8.2	−63	1.3
1992	2.0	11.2	−77	2.0
1993	2.0	5.6	−73	2.0
1994	2.1	5.4	−71	2.1
1995	2.0	4.7	−67	2.0
1996	1.9	3.7	−62	1.9
2000	1.4	0.9	−30	1.4
		(With regressive exchange rate expectations)		
1990	0.7	2.5	−24	0.3
1991	2.2	7.6	−60	1.0
1992	3.5	10.6	−73	1.6
1993	2.9	6.2	−71	1.8
1994	2.8	5.7	−70	1.8
1995	2.6	4.8	−66	1.8
1996	2.4	4.0	−62	1.8
2000	1.3	1.1	−32	1.4

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; (4) the distribution of increased demand in eastern Germany 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 east 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 net imports of eastern Germany given for the reference case in Table 1.[10] The model does not include the east explicitly; consequently, the simulation analyzes the effects of increased demand for the exports of other countries, as well as increased current transfer payments from western Germany to the *ROW* (which implicitly includes the former GDR). These transfers are assumed to cover all noninvestment government spending in eastern Germany. The simulations assume that two thirds of the increase in imports of eastern Germany is directed to western Germany, with the rest going to the remaining countries on the basis of their historical shares in the imports of the FRG.[11] 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 U.S. 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 second year of the shock, 1992)—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).[12] In this simulation, since after the initial shock the deutsche mark is expected to depreciate (which it actually does in the model simulation after 1992), 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 0.4 percentage points in 1990 and a further rise of 1½ percentage points

[10] 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 (FRG), and a residual rest of the world region; see Masson and Knight (1986).

[11] Data from the GDR's past trade patterns are not considered relevant here.

[12] 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.

in 1991–92, while the real effective exchange rate of the deutsche mark would appreciate by 11 percent by 1992, and subsequently depreciate. As a result of this appreciation, the current account surplus of eastern and western Germany combined would decline substantially.[13] Under regressive expectations, real interest rates increase somewhat more in Germany, peaking at 3.5 percentage points above baseline, while in the United States, rates rise more gradually, and to a peak of 1.8 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 intra-German migration on potential output in the west, while the fourth section of this chapter will simulate both increased investment demand in the east and migration from the east to the west, in a model that allows for stickiness of prices and hence does not constrain actual and potential output to be the same.

Effects of Migration on Potential Output in Western Germany

Another significant aspect of GEMSU has been the re-establishment of free mobility between east and west Germany, resulting in substantial westward migration. The last few months of 1989 saw large population flows from the GDR, and substantial migration continued early in 1990.[14] In scenario A, net migration from eastern to western Germany is assumed to be 320,000 in 1990, 100,000 in 1991, 70,000 in 1992, 40,000 in 1993, and 20,000 a year thereafter.[15] In the less optimistic scenario with lower investment in the east, net migration is assumed to be the same in 1990–91, but to be considerably higher from 1992 onward: 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 western Germany; the corresponding declines in the east are embodied in higher projected net imports, which are the balance between aggregate supply and demand in that region.[16] Here, the aggregate supply 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 percent increase of potential output is the labor share times the percent 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. Therefore, potential output should also increase proportionately. 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. 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 1¼ percent higher in western Germany by the year 2001 than it would have been in the absence of migration. In the less optimistic scenario, it is projected to be 3½ percent higher, as a result of the larger migration.

Simulations Using MULTIMOD

MULTIMOD is a global macroeconomic model that includes separate submodels for each of the Group of Seven countries,[17] 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 eastern Germany shows up partly as an increase in demand for German goods, which will to some extent increase output in

[13] The joint balance nets out intra-German trade and unilateral transfers between west and east, and hence reflects reduced net exports of western Germany to third countries as well as increased net imports of the east from third countries.

[14] See the discussion in Chapters II and VIII.

[15] 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.

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

[17] The German model is, however, based on data for the FRG before unification; the former GDR is not explicitly included in the model.

western Germany, as well as lead to lower combined 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.[18]

Clearly, the conduct of monetary policy may be affected by currency union because (among other reasons) the income velocity of money may not be the same in the two parts of Germany. 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 east (see the previous section), which tends to increase output capacity.

As the discussion of the GEMSU shock in the section "A Global Saving-Investment Perspective" makes clear, its effects depend importantly on the interest elasticities of saving and investment. The Mark II 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. The MULTIMOD simulations reported below have been performed using revised equations for consumption and investment that embody lower interest-rate effects than in the original Mark II model, making the results more consistent with this empirical evidence and making the results more comparable to those from the saving-investment model discussed earlier.

The Reference Scenario

The reference case simulation of GEMSU assumes that net imports into eastern Germany 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 western Germany (two thirds of the amount) and by other countries (the remaining one third, allocated on the basis of historical shares in imports of the FRG). The combined government deficit as reported here includes all GEMSU-related government expenditures, as well as increased interest payments due both to a larger debt stock and to higher interest rates. 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.[19] The simulations also include the projections of migration from the east to the west described above, and the resulting increases of potential output in the west.

The results (Table 4, column 1 and Chart 2) suggest that the stimulus to demand leads to an increase in the rate of growth in western Germany of 0.6 percentage points in 1990 and 1.3 percentage points in 1991. In subsequent years, output *growth* is lower than baseline, because the rate of change of net imports from the east is negative and because of lagged effects of higher interest rates and appreciation of the deutsche mark. Nevertheless, the *level* of output in the west remains above baseline because of favorable supply effects; and output growth of the east and west combined is persistently higher.[20]

Inflation pressures increase, and the rate of change of output prices is higher than in the baseline by about ½ of 1 percentage point on average over 1990–92. Output effects on other ERM countries are negative, but relatively small, while they are slightly positive on non-ERM countries. Both sets of countries are affected to some extent by higher interest rates,[21] while the ERM countries, because of the assumed fixity of their central parities, also experience a real effective appreciation which, combined with a larger interest rate increase, offsets the stimulus from higher exports to eastern Germany. On balance, the reference case suggests that the international effects of GEMSU are not very large, and that increased demand does not put unmanageable strains on German productive capacities. However, higher government spending leads to an increase of 16 percentage points in the combined government debt-GNP ratio by 1999, which thereafter tends to decline 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

[18] Details concerning sensitivity of the results to these structural factors are presented in the Appendix.

[19] In addition, the fiscal position benefits over the medium term because of reduced expenditures on West Berlin and other border areas.

[20] In the non-GEMSU baseline, potential output, which assumes no migration from the GDR, grows by about 2¾ percent a year in the FRG and 2 percent in the GDR.

[21] The size of these interest rate effects is of course an important issue; estimates are discussed in the Appendix.

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

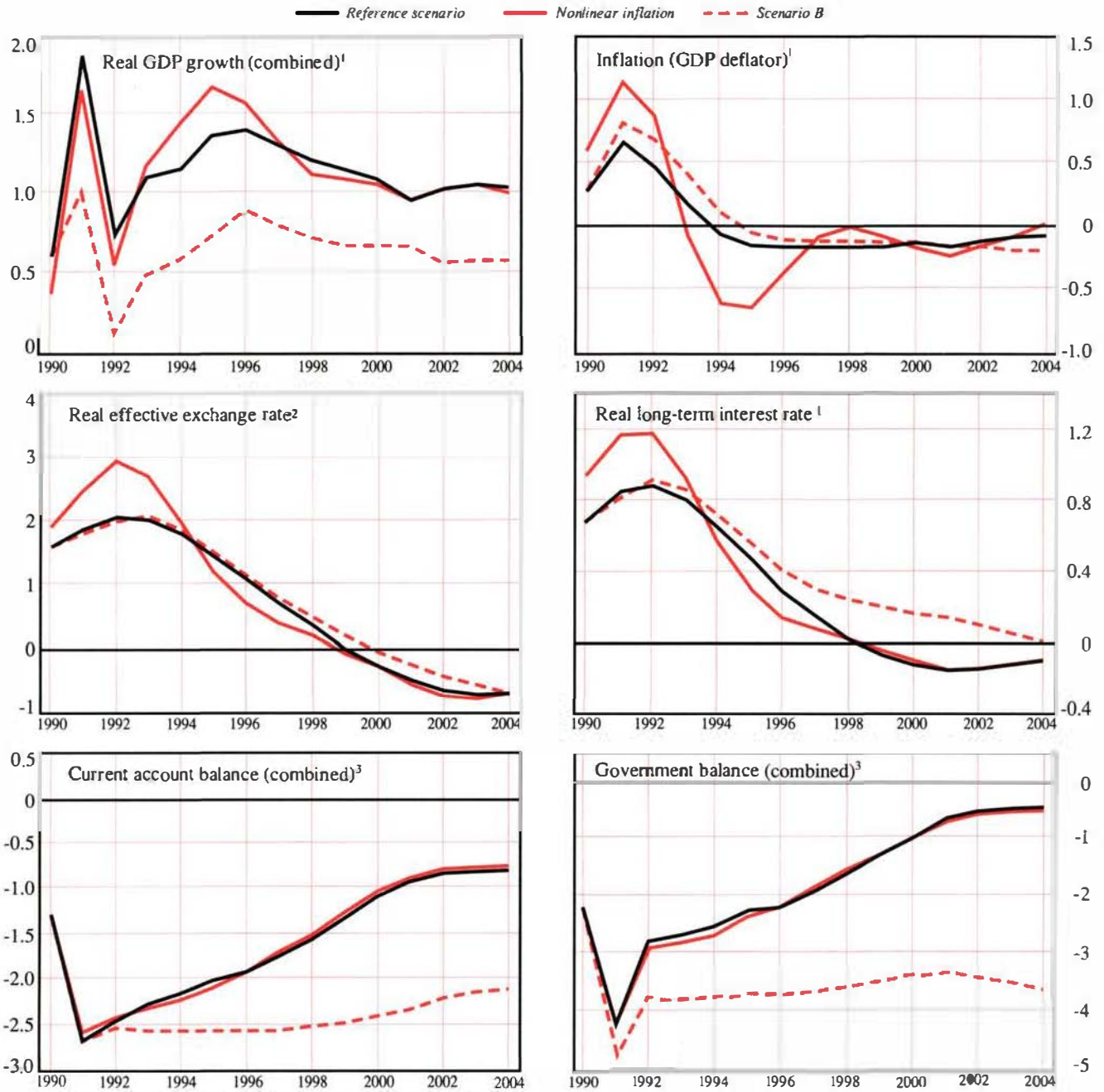
(Deviations from baseline in percent)

	Reference Scenario	Nonlinear Inflation Trade-Off	Scenario B
Combined real GDP			
1990	0.6	0.3	0.6
1991	2.4	2.0	1.6
1992–94	4.2	3.8	2.2
1995–97	8.3	8.4	4.4
2001	14.5	14.5	8.1
Real GDP (western Germany only)			
1990	0.6	0.4	0.6
1991	1.9	1.4	2.0
1992–94	0.7	0.1	1.1
1995–97	0.6	0.8	1.4
2001	0.8	0.8	2.5
Inflation: GDP deflator (percentage points)			
1990	0.2	0.6	0.2
1991	0.7	1.1	0.8
1992–94	0.2	0.1	0.4
1995–97	−0.2	−0.4	−0.1
2001	−0.2	−0.2	−0.1
Real effective exchange rate			
1990	1.5	1.9	1.5
1991	1.8	2.5	1.8
1992–94	2.0	2.5	2.0
1995–97	1.1	0.8	1.2
2001	−0.5	−0.5	−0.2
Real long-term interest rate (percentage points)			
1990	0.7	0.9	0.7
1991	0.8	1.2	0.8
1992–94	0.8	0.9	0.8
1995–97	0.3	0.2	0.4
2001	−0.1	−0.1	0.2
Combined current account balance (percent of GNP)			
1990	−1.3	−1.3	−1.3
1991	−2.7	−2.6	−2.6
1992–94	−2.3	−2.3	−2.6
1995–97	−1.9	−1.9	−2.6
2001	−0.9	−0.8	−2.3
Combined government balance (percent of GNP)[1]			
1990	−2.2	−2.2	−2.2
1991	−4.4	−4.4	−4.8
1992–94	−2.7	−2.8	−3.8
1995–97	−2.1	−2.1	−3.7
2001	−0.6	−0.6	−3.3
Real GDP: other ERM countries			
1990	−0.2	−0.3	−0.2
1991	−0.1	−0.2	−0.0
1992–94	−0.4	−0.4	−0.3
1995–97	−0.2	−0.1	−0.2
2001	0.2	0.2	0.1
Real GDP: other industrial countries			
1990	0.0	0.0	0.0
1991	0.1	0.1	0.1
1992–94	−0.0	−0.0	−0.0
1995–97	0.0	0.0	−0.0
2001	−0.0	−0.0	−0.0

[1] General government, including the Unity Fund and the Trust Fund, on a national accounts basis.

Chart 2. Alternative Scenarios of German Unification: Results for Germany, 1990–2004

(Deviation from baseline)



[1] Percentage point difference.
[2] Percentage difference.
[3] Percent of GNP.

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 4 percent against the U.S. dollar in nominal terms in 1990, and by 1½ percent in real effective terms. The real effective appreciation subsequently widens to 2 percent, but both interest rate and exchange rate effects are ultimately reversed.

The reference scenario is broadly consistent with other model simulation studies of GEMSU. Alexander and Gagnon (1990), McKibbin (1990), and Netherlands, Central Planning Bureau (1990), all estimate that GEMSU would raise output in western Germany by about 1 percentage point in the initial year or two, accompanied by only a small rise in inflation.[22] As in MULTIMOD, after the first few years, output *growth* in western Germany is actually somewhat lower as a result of GEMSU. The deutsche mark appreciates in each of these studies, by more than in MULTIMOD in the first two cited above. In McKibbin (1990), the effect on output in other ERM countries is negative, resulting from the combination of higher interest rates and a joint appreciation with the deutsche mark against third currencies. Similarly, in Alexander and Gagnon (1990) output effects in all other industrial countries taken together are negative.

A Less Favorable Output-Inflation Trade-Off

The MULTIMOD scenario discussed above does not embody any serious inflation pressures, as the demand increase can be accommodated smoothly by increased output in western Germany 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, an alternative specification was estimated using historical data for the FRG (see Appendix); there is some support for a nonlinear specification in which inflation pressures increase markedly as capacity utilization approaches peak levels.[23] This relationship between output and inflation 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 2 as "Nonlinear Inflation").

Even with the steeper output/inflation trade-off, inflation pressures are not too much greater, and output in western Germany still is higher by 1.4 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.[24] Of course, if the current margin of productive capacity is overestimated, it is possible that inflation pressures could be even greater than implied by this scenario.

An Alternative Scenario with Slower Growth in Eastern Germany

In an alternative, less optimistic scenario for GEMSU (scenario B), investment is assumed to be less buoyant in east Germany. As a result, productivity growth converges less quickly, and by the year 2001, the productivity gap between eastern and western Germany is still about 40 percent. Net imports by the east are not very different initially from those in the reference case (see Table 1), but the east's trade deficit persists longer because output does not rise as much in the medium term. Correspondingly, income and saving are also lower there.

In scenario B, real incomes are lower in eastern Germany, and emigration is higher than in the reference scenario: there is extra net emigration from the east to the west 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 west 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), but revenues are also higher since income has increased.

The results of such a scenario are summarized in column 3 of Table 4 and in Chart 2 (as "Scenario B"). They present a less favorable picture for Germany as a whole, though not for western Germany alone, which experiences increased output growth due to inward migration increasing demand and employment. The combined fiscal balance deteriorates as a percent of GNP, primarily due to higher unemployment benefits, slower revenue growth, and lower output in the east. In this scenario government debt has reached a level 19 percent of combined GNP above baseline by 1995, and 30 percent by 2001. Despite this, effects on financial markets and on other countries are little changed compared to the reference scenario, and inflation effects are also similar.

[22] The assumptions behind the various scenarios may differ somewhat, however.

[23] 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.

[24] For a discussion of alternative estimates of potential output and capacity utilization, see Chapter VII.

Alternative Policy Scenarios

The above simulations are conditional on several assumptions concerning the stance of policy and the economic environment in Europe. In particular, tax rates in Germany were assumed to be unchanged, and existing central parities within the ERM were assumed to be maintained. In this section, possible alternative assumptions are considered: (1) an increase in VAT rates in Germany; and (2) a downward realignment of other ERM currencies against the deutsche mark that also affects the credibility of the commitment of those countries to hard-currency policies.

An Indirect Tax Increase in Western Germany

In the light of the possibility of persistent government debt accumulation in Germany (see, for instance, the less optimistic scenario described above) it is of interest to examine the effects of a tax increase. Because of the comprehensive reform of direct personal taxes, it might be counterproductive to attempt to raise additional revenue from that source to finance GEMSU. Raising VAT rates in Germany would appear to be a more attractive alternative, especially since this would help to harmonize VAT rates in the European Community (EC), German 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 (about ¾ of 1 percent of GNP), corresponding to increases in VAT rates by a little under 2 points;[25] results are summarized in column 2 of Table 5 (and in Charts 3 and 4 as "Indirect tax increase"). For the purposes of the simulation, the VAT increase is assumed to be imposed only in western Germany, though additional revenue (some DM 3 billion) would also be collected in eastern Germany. 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). 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.

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 16 percent of GNP in the year 1999, it increases by only 10 percent in this simulation. However, the tax increase has unfavorable effects on the rate of change of prices. Relative to baseline, the GNP deflator rises 1.7 percentage points faster in 1991 (1 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.

[25] Additional revenue is less than DM 20 billion a year initially, since economic activity is weaker.

An EMS Realignment

The reference case scenario suggests that an initial appreciation of the deutsche mark of about 4 percent against the U.S. dollar might result from GEMSU. With fixed central parities with respect to other currencies participating in the ERM, real appreciation of the deutsche mark 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 realignment vis-à-vis the deutsche mark, also in principle permitting a smoother allocation of the increased demand from eastern Germany among European countries.

Such a scenario, by permitting those countries' currencies to be delinked temporarily from the deutsche mark, would allow them to avoid a short-run real appreciation against non-ERM currencies. The upward realignment of the deutsche mark would also tend to remove some of the short-run pressure on existing capacity in Germany. These favorable effects, however, would 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.

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 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

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

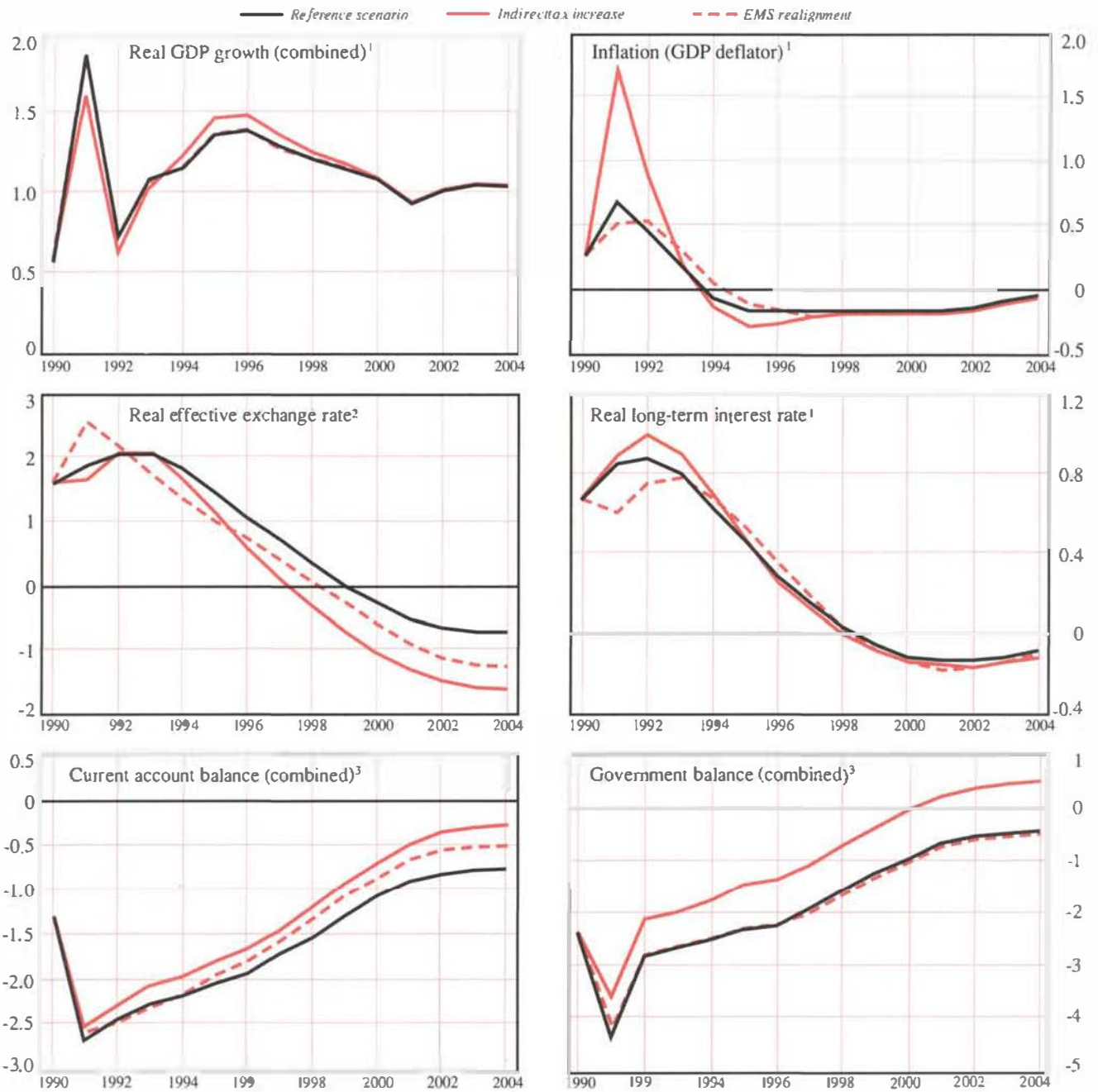
(Deviations from baseline in percent)

	Reference Scenario	Indirect Tax Increase	EMS Realignment with Credibility Loss
Combined real GDP			
1990	0.6	0.6	0.6
1991	2.4	2.2	2.4
1992–94	4.2	3.9	4.2
1995–97	8.3	8.1	8.2
2001	14.5	14.5	14.5
Real GDP (western Germany only)			
1990	0.6	0.6	0.6
1991	1.9	1.6	1.9
1992–94	0.7	0.3	0.7
1995–97	0.6	0.4	0.5
2001	0.8	0.7	0.8
Inflation: GDP deflator (percentage points)			
1990	0.2	0.2	0.2
1991	0.7	1.7	0.5
1992–94	0.2	0.3	0.3
1995–97	−0.2	−0.3	−0.2
2001	−0.2	−0.2	−0.2
Real effective exchange rate			
1990	1.5	1.5	1.5
1991	1.8	1.6	2.6
1992–94	2.0	1.9	1.8
1995–97	1.1	0.6	0.7
2001	−0.5	−1.3	−0.9
Real long-term interest rate (percentage points)			
1990	0.7	0.7	0.7
1991	0.8	0.9	0.6
1992–94	0.8	0.9	0.7
1995–97	0.3	0.3	0.4
2001	−0.1	−0.2	−0.2
Combined current account balance (percent of GNP)			
1990	−1.3	−1.3	−1.3
1991	−2.7	−2.6	−2.6
1992–94	−2.3	−2.1	−2.3
1995–97	−1.9	−1.6	−1.8
2001	−0.9	−0.5	−0.6
Combined government balance (percent of GNP)[1]			
1990	−2.2	−2.2	−2.2
1991	−4.4	−3.7	−4.4
1992–94	−2.7	−2.0	−2.6
1995–97	−2.1	−1.3	−2.2
2001	−0.6	0.3	−0.7
Real GDP: other ERM countries			
1990	−0.2	−0.2	−0.2
1991	−0.1	−0.1	0.6
1992–94	−0.4	−0.3	−0.1
1995–97	−0.2	0.1	−0.4
2001	0.2	0.3	0.2
Inflation: other ERM countries (percentage points)			
1990	−0.0	−0.1	−0.1
1991	−0.0	−0.1	1.3
1992–94	−0.1	−0.1	1.0
1995–97	0.0	0.2	0.0
2001	0.3	0.3	0.4

[1] General government, including the Unity Fund and the Trust Fund, on a national accounts basis.

Chart 3. Scenarios of German Unification Under Alternative Policy Response: Results for Germany, 1990–2004

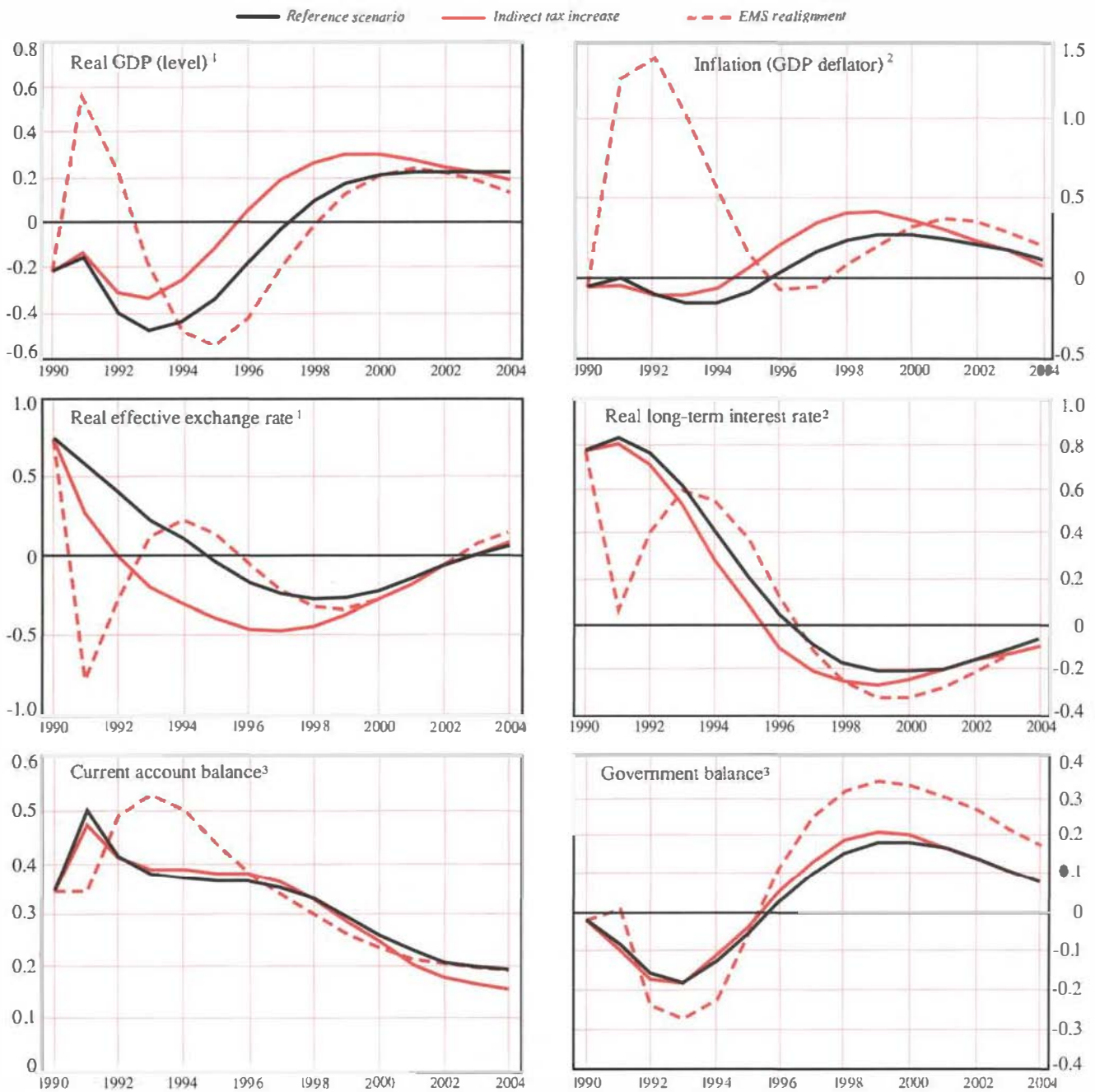
(Deviation from baseline)



[1] Percentage point difference.
[2] Percentage difference.
[3] Percent of GNP.

Chart 4. Scenarios of German Unification Under Alternative Policy Response: Results for Other ERM Countries, 1990–2004

(Deviation from baseline)



[1] Percentage difference.
[2] Percentage point difference.
[3] Percent of GNP.

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

(Percentage points, annual rates)

	1987	1988	1989	July 1990
France vs. Germany, Fed. Rep. of				
Short-term rate[1]	4.3	3.5	2.5	2.1
Long-term rate	3.6	3.0	1.7	1.9
Inflation[2]	4.1	3.1	2.2	1.8
Italy vs. Germany, Fed. Rep. of				
Short-term rate[1]	7.8	7.3	6.1	3.7[3]
Long-term rate	3.8	4.1	3.6	3.0
Inflation[2]	7.4	5.0	4.9	—
Netherlands vs. Germany, Fed. Rep. of				
Short-term rate[1]	1.9	0.7	0.4	−0.2
Long-term rate	0.5	0.2	0.1	−0.3
Inflation[2]	−0.1	−0.1	−0.6	−0.6

Source: International Monetary Fund, *International Financial Statistics*.

[1] Money market rate.

[2] Average increase in the consumer price index over the previous five years. For July 1990, calculation is relative to the average price level for 1985.

[3] Treasury bill rate for Italy.

since they would be limited by exchange rate movements within the band of admissible fluctuations.[26]

These data raise two questions: (1) does the differential relative to German interest rates reflect expectations of a future exchange rate realignment? and (2) 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. For example, 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 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 five-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. At one extreme, agents might 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.

Here a realignment scenario is presented in which a depreciation of 4 percent of the other ERM currencies vis-à-vis the deutsche mark occurs in 1991, and 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 effecton 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 3 and 4. Following their initial depreciation in 1991, other ERM currencies are expected to depreciate by a further 1½ percent a year versus the deutsche mark. 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 into their expectations, the unfavorable initial shock is gradually unwound and these economies return to the full credibility path. The realignment combined with the temporary loss of credibility of their anti-inflationary policies produces higher rates of inflation in the short term: the differences relative to the reference scenario average 1.2 percentage points from 1991 to 1993. At the same time, output is above the level in the reference scenario.

[26] At present, for all ERM currencies except the Spanish peseta and the pound sterling, 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 parities). 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.

Concluding Remarks

Given the uncertainties involved in the transition from a centrally planned to a market economy in the former 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 economic policies and the behavior of agents in the 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 eastern Germany more widely across EC countries, since other countries' goods would be more easily substitutable with German goods. 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 eastern Germany 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 eastern Germany would put upward pressure on capacity in western Germany, 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 former GDR were smaller, unemployment remained persistently high, and migration from east to west was substantial. Though budget deficits persist in this scenario and the combined output growth of a united Germany 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 the increased supply of government debt.

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 ¾ of 1 percentage point. This is smaller than the increase that occurred in the first few months of 1990, 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 in western Germany 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 deutsche mark is likely to appreciate in real terms against other currencies as a result of GEMSU. As the value of the deutsche mark relative to the U.S. dollar and the yen has increased since early November 1989 (especially against the former), the market may already have discounted some part 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 higher imports of eastern Germany roughly offset.

Appendix

Changes to MULTIMOD and Sensitivity of the Results to Structural Features

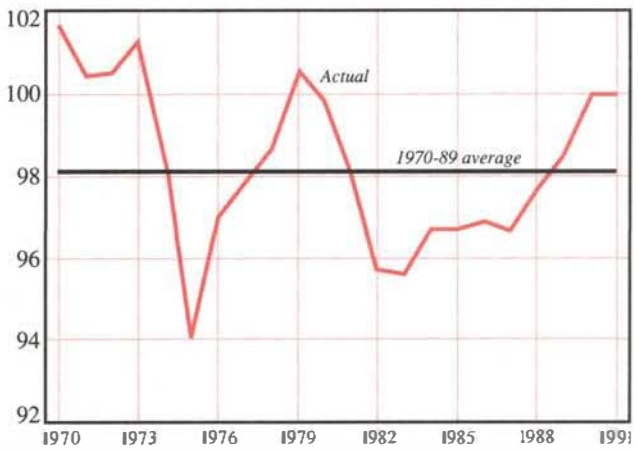
This appendix examines the sensitivity of the simulation results to some aspects of the structure of MULTIMOD; it also gives details concerning the way German monetary policy is modeled. The extent to which higher investment demand in eastern Germany can be accommodated in world output markets without 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 western Germany 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.

The Price Equation for Germany in MULTIMOD

In MULTIMOD, 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), that is, a 1 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. One implication is that there is no absolute constraint on output in the short run: increasing the size of a demand shock will raise effects on output and inflation by proportional amounts.

The linearity of the trade-off 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 trade-off must become rather steep as output approaches this maximum level. Since the tradeoff changes slope, the response of inflation to an increase in demand will depend on the initial level of capacity utilization. Chart 5 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 GEMSU, suggesting that inflationary pressures could be greater than shown in the reference scenario if the steepness of the price-output trade-off increases as capacity utilization rises above normal levels.

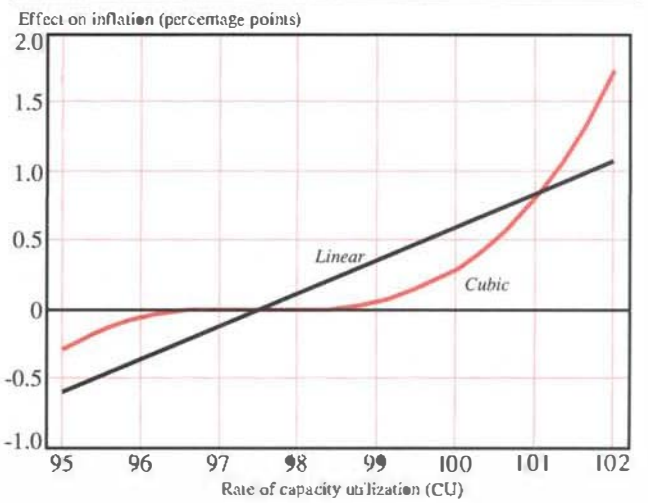
Chart 5. Capacity Utilization Rates in the Federal Republic of Germany, 1970–91[1]



Source: IMF staff estimates.
[1] Projections for 1990 and 1991.

A nonlinear alternative to the existing specification models inflationary pressures as depending on a cubic function of the rate of capacity utilization less a parameter that indicates the level of capacity utilization consistent with no pressure on inflation: $(CU - \beta)^3$. This cubic function was substituted into the equation for German price inflation and the relationship was re-estimated over the 1970–87 period, with the value of β being determined by minimizing the residual sum of squares. Chart 6 illustrates the relationship between inflation and capacity utilization with this cubic specification compared to the existing equation: the output/inflation trade-off with the cubic function is almost twice as steep at the levels of

Chart 6. Alternative Output/Inflation Trade-Offs



capacity utilization estimated to obtain in 1990–91. This increases the response of prices to a demand shock such as GEMSU, as discussed in the section "Simulations Using MULTIMOD" in the main text.

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.[27] As for investment, some studies indicate a stronger link to an accelerator mechanism than to relative factor prices.[28]

The version of MULTIMOD presented in Masson and others (1990) embodies relatively large negative real interest rate effects on consumption (consumption 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). Subsequent research on the determinants of consumption and investment in the model has lowered their responsiveness to real interest rates, and this revised version of MULTIMOD was used to perform the simulations in the main text. For investment, the changes involved replacing the existing Cobb-Douglas production function with a constant elasticity of substitution (CES) alternative. The elasticity of substitution between capital and labor is set to one half, compared to the value of unity implied by the Cobb-Douglas specification. This lowers the responsiveness of the capital stock to a rise in interest rates, as the initial decline in the capital-to-output ratio is moderated by an increase in the share of output going to the capital stock. A re-estimation of the consumption function for the industrial countries with updated data and an extended sample period also yielded lower short- and long-run interest-rate effects.

The impact of changes in interest rates on consumption and investment in the old and new versions of MULTIMOD are compared in Table 7: the ranges represent high and low values for the eight industrial regions. It is apparent that interest rate effects are uniformly lower in the new model, with the decrease in the sensitivity of consumption being more pronounced than that of investment.

Table 7. Effects of Changes in Interest Rates on Consumption and Investment in MULTIMOD

(Percent deviation from baseline)

	Effect of a 1 Percentage Point Increase in Real Interest Rates[1]	
	Mark II	New model
Temporary increase		
Year one impact:		
Consumption	−0.11 to −0.23	−0.05 to −0.06
Investment	−0.35 to −0.79	−0.30 to −0.78
Permanent increase		
Year one impact:		
Consumption	−0.56 to −0.58	−0.23 to −0.24
Investment	−1.45 to −4.66	−1.20 to −4.55
Year six impact:		
Consumption	−2.94 to −3.56	−1.33 to −1.97
Investment	−1.78 to −4.85	−1.47 to −4.18

[1] Partial effect holding output and prices constant.

By making global net saving less elastic with respect to the interest rate, the new model raises the effect on real interest rates, bringing them more in line with the results of the section on "A Global Saving-Investment Perspective." It also produces somewhat less crowding out of domestic demand in the FRG. Here we present an alternative scenario where the interest elasticities of consumption and investment are set at even lower values, defined as one quarter of the MULTIMOD values.

This alternative is compared to the reference scenario in columns 1–2 of Table 8 and in Chart 7. 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 German real interest rate peaks at 1.6 percentage points above control, almost twice the effect of the reference scenario. Impacts on output and inflation in Germany are 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 to produce more accentuated cycles in output and prices.

Trade Elasticities

The trade price elasticities in MULTIMOD are typically based on equations for aggregate trade flows estimated over the 1969–87 period; the results are shown in Table 9 for the industrial countries. Import price elasticities range from a low of 0.37 for the United Kingdom to 1.17 for the smaller industrial countries, 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

[27] 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.

[28] Clark (1979) is a widely cited study of U.S. evidence.

Table 8. Scenarios of German Unification with Alternative Model Parameter Values, 1990–2001

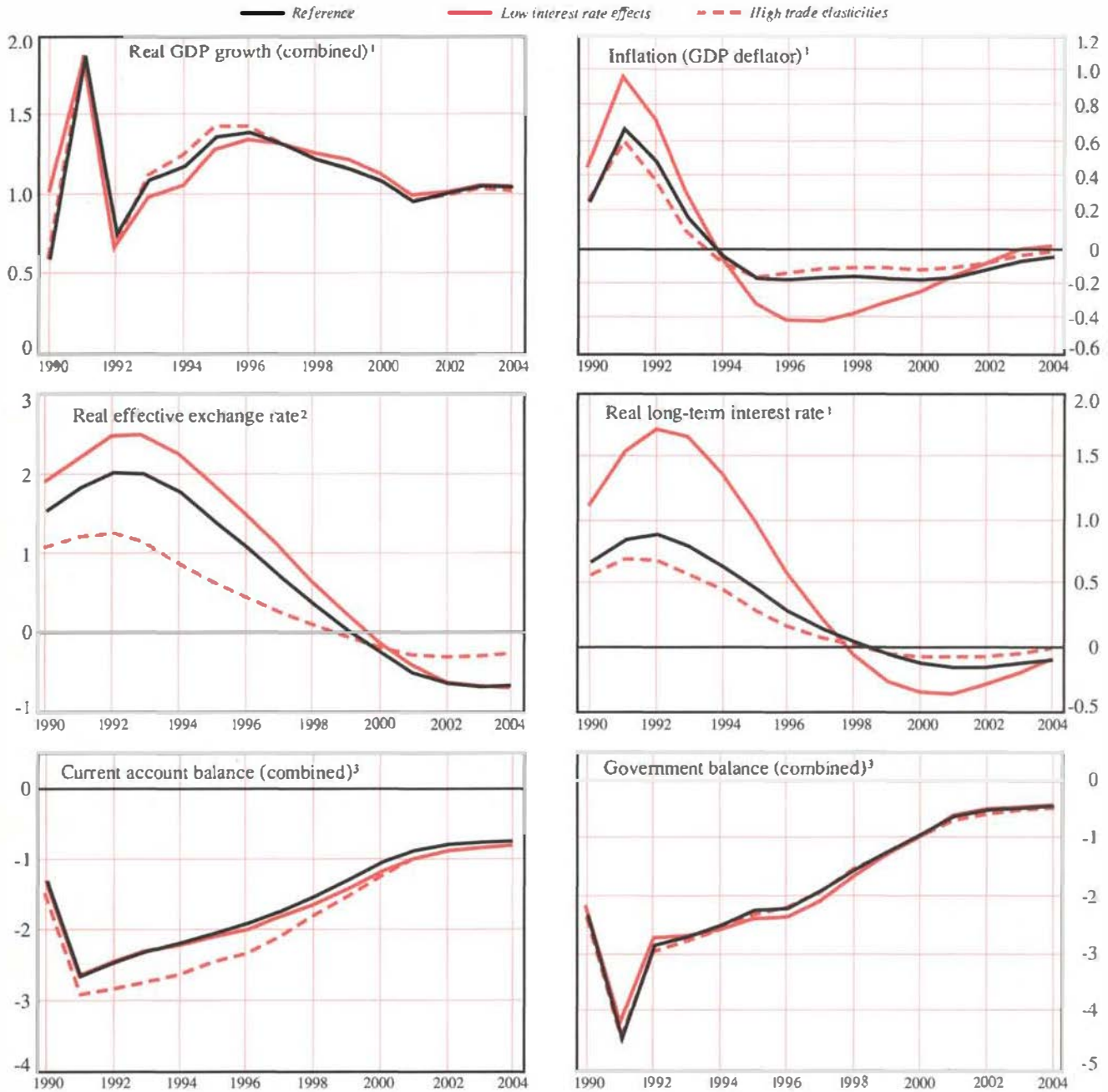
(Deviations from baseline in percent)

	Reference Scenario	Low Interest-Rate Effects	High Trade Elasticities
Combined real GDP			
1990	0.6	1.0	0.6
1991	2.4	2.8	2.3
1992–94	4.2	4.5	4.1
1995–97	8.3	8.2	8.3
2001	14.5	14.6	14.6
Real GDP (western Germany only)			
1990	0.6	1.1	0.6
1991	1.9	2.3	1.8
1992–94	0.7	0.9	0.6
1995–97	0.6	0.5	0.6
2001	0.8	0.9	0.9
Inflation: GDP deflator (percentage points)			
1990	0.2	0.4	0.2
1991	0.7	0.9	0.6
1992–94	0.2	0.3	0.1
1995–97	−0.2	−0.4	−0.1
2001	−0.2	−0.2	−0.1
Real effective exchange rate			
1990	1.5	1.9	1.1
1991	1.8	2.2	1.2
1992–94	2.0	2.3	1.1
1995–97	1.1	1.5	0.4
2001	−0.5	−0.4	−0.3
Real long-term interest rate (percentage points)			
1990	0.7	1.1	0.6
1991	0.8	1.5	0.7
1992–94	0.8	1.6	0.6
1995–97	0.3	0.6	0.2
2001	−0.1	−0.4	−0.1
Combined current account balance (percent of GNP)			
1990	−1.3	−1.3	−1.4
1991	−2.7	−2.7	−2.9
1992–94	−2.3	−2.3	−2.7
1995–97	−1.9	−2.0	−2.3
2001	−0.9	−1.0	−1.0
Combined government balance (percent of GNP)[1]			
1990	−2.2	−2.1	−2.2
1991	−4.4	−4.2	−4.5
1992–94	−2.7	−2.7	−2.7
1995–97	−2.1	−2.3	−2.1
2001	−0.6	−0.6	−0.7
Real GDP: other ERM countries			
1990	−0.2	0.1	−0.1
1991	−0.1	0.2	0.1
1992–94	−0.4	−0.1	−0.1
1995–97	−0.2	−0.1	−0.0
2001	0.2	0.2	0.0
Real GDP: other industrial countries			
1990	0.0	0.2	0.1
1991	0.1	0.4	0.2
1992–94	−0.0	0.1	−0.0
1995–97	0.0	−0.0	−0.0
2001	−0.0	0.0	−0.0

[1] General government, including the Unity Fund and the Trust Fund, on a national accounts basis.

Chart 7. Scenarios of German Unification with Alternative Parameter Values, 1990–2004

(Deviation from baseline)



[1] Percentage point difference.
[2] Percentage difference.
[3] Percent of GNP.

Table 9. Long-Run Relative Price Elasticities of Traded Goods in MULTIMOD[1]

(Absolute values)

	Manufactured Imports	Manufactured Exports
United States	1.10	0.71
Japan	0.76	0.71
Germany	0.90	0.71
France	0.72	0.71
United Kingdom	0.37	0.71
Italy	0.40	0.71
Canada	0.45	0.71
Smaller industrial countries	1.17	0.71

Source: Paul Masson, Steven Symansky, and Guy Meredith, *MULTIMOD Mark II: A Revised and Extended Model*, IMF Occasional Paper, No. 71 (Washington: International Monetary Fund, July 1990).

[1] Including nonfactor services, but excluding oil trade and commodity imports from developing countries.

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 proposed integration of Europe in 1992 may also raise the sensitivity of intra-European trade to relative price movements.

In a region with quasi-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 Germany caused by GEMSU would result in more of the demand stimulus from eastern Germany being directed to other European countries. In order to examine the sensitivity of the simulation results to this effect, the long-run trade price elasticities for the European countries were raised to 2 for both imports and exports.[29] The results for the GEMSU simulation with these parameter values are shown in column 3 of Table 8. Output in western Germany 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. With higher trade price elasticities, the demand stimulus is weaker in western Germany, limiting the increase in German interest rates and the appreciation of the deutsche mark. Because the other members of the ERM "import" these variables from Germany, monetary conditions in the aggregate ERM region are less contractionary than in the reference scenario.

[29] The adjustment is rather arbitrary. Sufficient data are not available in the MULTIMOD database to obtain estimates of the elasticities for a more recent subperiod. 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.

Money Supply and Demand

It is assumed in the model that Germany, 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 Germany, a simple demand equation for *M3* was estimated using data for 1964–88 as a function of real GDP, the three-month interest rate *RS*, and the GDP deflator *P*. The following estimates were obtained:

$$\ln(M3/P) = \underset{(2.6)}{-2.20} + \underset{(2.7)}{0.499}\ln(Y) - \underset{(3.4)}{0.0051}RS + \underset{(5.2)}{0.646}\ln(M3/P)_{-1} \qquad \text{(A.1)}$$

$$\bar{R}^2 = 0.997 \qquad SER = 0.018$$

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.

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