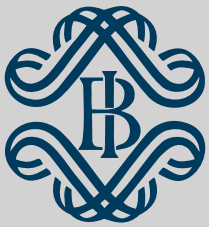
BANCA D'ITALIA

Temi di discussione

del Servizio Studi

The adjustment of the US current account imbalance: the role of international policy coordination

by G. Gomel, G. Marchese and J.C. Martinez Oliva



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The purpose of the «Temi di discussione» series is to promote the circulation of working papers prepared within the Bank of Italy or presented in Bank seminars by outside economists with the aim of stimulating comments and suggestions.

The views expressed in the articles are those of the authors and do not involve the responsibility of the Bank.

Contents

I A premise and the genesis of the problem: the US current-account deficit in the 1980s [1]

I.1 The basic facts

The United States ran a small current account surplus on average in the 1970s as well as in the two preceding decades. The rapid deterioration in the external balance since 1982 to a massive deficit is thus an unprecedented event in post-war history. Even when normalized for output growth (in nominal terms), the current account appears to have worsened very significantly, well outside previous experience; as shown in Figure 1, it moved from a small surplus (equal to 0.1-0.2 per cent of GNP) in 1980-81 to a large and increasing deficit reaching 3.6 per cent last year.

Table 1 provides a breakdown of the current account balance into its major components. The movements in the current balance, especially since 1983, have closely

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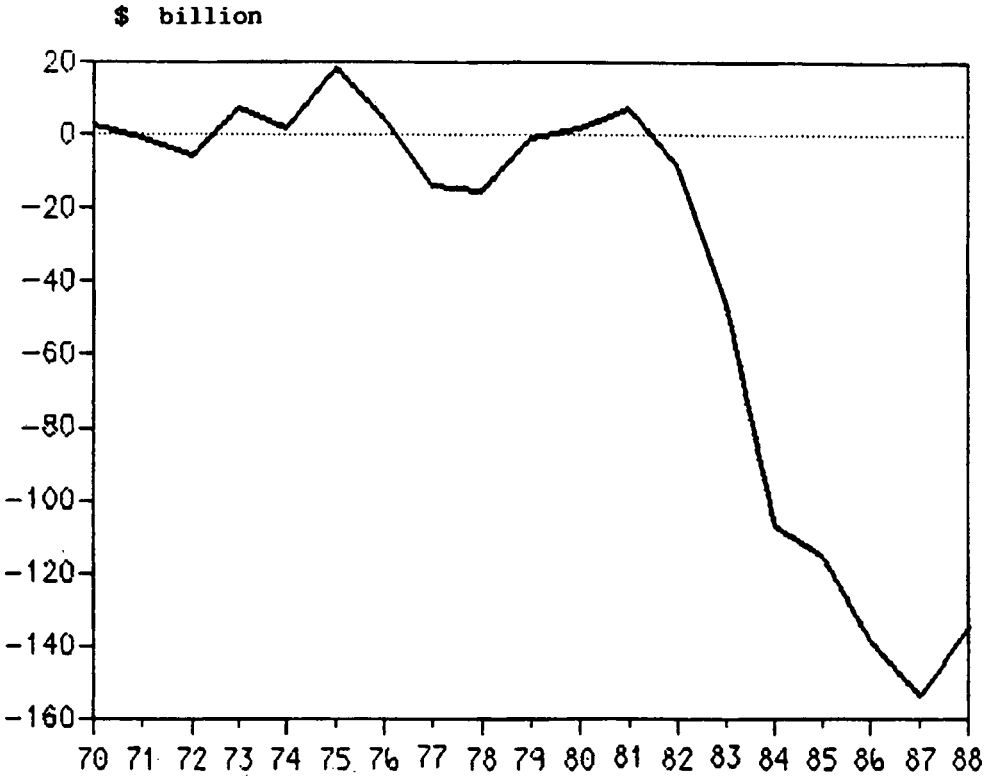
1. The present paper is the result of common research, but sections I and IV were drafted by G. Gomel, section II by G. Marchese, section III and the appendices by J. C. Martinez Oliva. The authors thank M. A. Antonicelli for valuable editorial help. They also thank Paul Masson and Pete Richardson for kindly providing Multimod and Interlink policy multipliers, respectively.

Figure 1

UNITED STATES CURRENT BALANCE



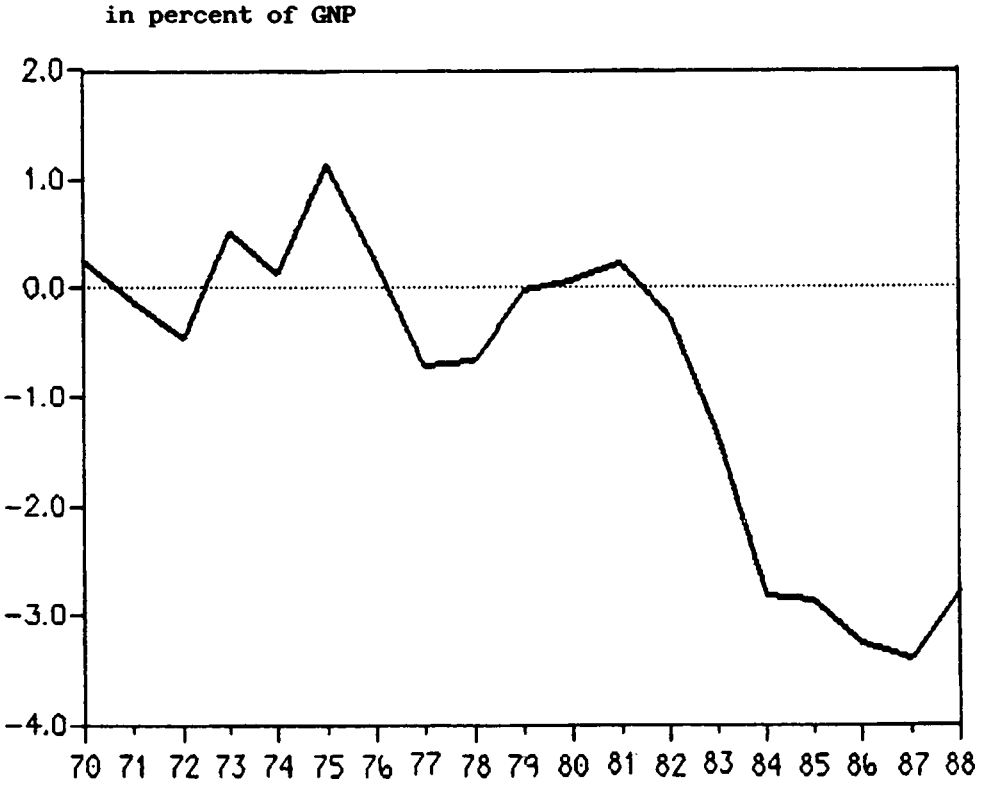


Table 1

United States
Current account balances: major items
(value, $ billion)

	1980	1981	1982	1983	1984	1985	1986	1987	1988
Merchandise									
Exports	224.3	237.1	211.2	201.8	219.9	214.4	224.0	249.6	320.2
Imports	-249.7	-265.1	-247.6	-268.9	-332.4	-338.9	-368.5	409.8	446.7
Balance	-25.5	-28.0	-36.4	-67.1	-112.5	-122.1	-144.5	-160.3	-126.5
Services and private transfers, net	35.0	41.7	36.2	30.0	18.2	18.7	19.7	18.6	3.9
of which Net investment income	30.4	34.1	28.7	24.8	18.8	25.9	23.1	20.4	2.6
Official transfers, net	-7.6	-7.4	-8.9	-9.5	-12.2	-15.0	-14.0	-12.2	-12.7
Current balance	1.9	6.3	-9.1	-46.6	-106.5	-118.4	-138.8	-153.9	-135.3

Source: U.S. Department of Commerce.

paralleled those of the trade balance. But changes in the other components also contributed to the sharp increase in the deficit. The net surplus in services and private transfers has decreased by over two thirds since 1980; in particular, net investment income has experienced a rapidly falling surplus as a consequence of the sharp deterioration of the US net external investment position[2].

The widening of the trade deficit since the beginning of the decade has been largely due to the decline of real net exports of goods. A pictorial evidence of the phenomenon and of the close relationship linking movements in the current balance to those in real net exports is provided by Figure 2. Two features stand out: i) the behaviour of the US current account has been dominated by movements in the volumes of imports and exports, and ii) relative trade prices changed little in spite of the wide oscillations in the dollar exchange rate.

We will draw attention to these issues further on.

Year-on-year growth rates of trade volumes and prices are presented in Table 2; it is shown that changes in quantities outweigh movements in unit values. Two more features deserve attention: the close association between volume changes of manufactures and those of total goods, and the predominance of changes in imports relative to those in exports in determining the trade balance.

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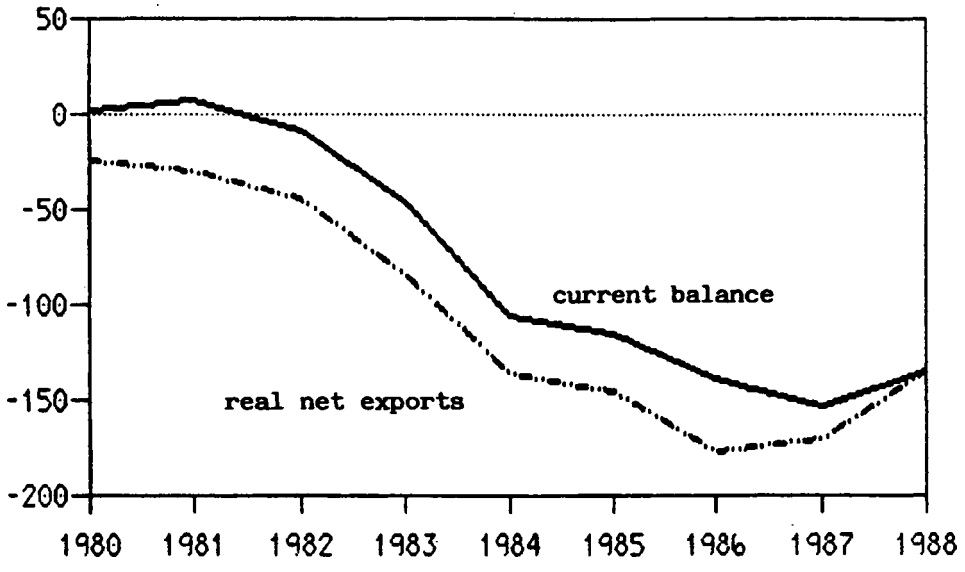
2. As a reflection of the accumulation of current account deficits, the US net investment position recorded a dramatic shift in recent years turning sharply negative in 1985 after being positive during all of the postwar period. Investment income still records an, albeit very small, surplus due to large net receipts from direct investment; this basically reflects the fact that US direct investment overseas is larger and of an older vintage than foreign investment in the U.S.. See Gomel (1989).

Figure 2

UNITED STATES: current balance (1) and real net exports (2)



(1) $ billion, current prices
(2) Goods. $ billion, 1980 prices

Table 2

United States
Trade balance: volumes and unit values
(percentage changes from previous year)

	Merchandise total				Manufactures			
	Exports		Imports		Exports		Imports	
	Volumes	Unit values	Volumes	Unit values	Volumes	Unit values	Volumes	Unit values
1980	6.7	13.5	-7.1	25.5	9.7	10.5	-1.8	15.4
1981	-3.1	9.2	2.5	5.3	-5.1	12.6	9.2	3.6
1982	-10.5	1.5	-5.0	-1.6	-15.1	5.9	-1.7	3.0
1983	-6.4	1.0	10.4	-4.1	-2.7	-2.2	14.8	-1.6
1984	6.8	1.3	23.9	1.8	7.8	0.8	30.1	2.9
1985	-1.8	-0.8	8.7	-2.5	-	1.7	12.1	-1.9
1986	-1.0	1.0	10.5	-3.4	-1.2	3.3	10.3	4.9
1987	12.0	1.7	2.6	7.2	12.2	3.1	2.5	6.5
1988	18.0	7.0	3.8	4.8	26.2	-	7.8	3.0

Source: IMF, OECD.

A decomposition of changes in the nominal trade balance between 1980 and 1987 shows that the rapidly rising volume of non-oil imports chiefly accounted for the increase in the deficit. The stagnation in non-agricultural exports and the decline in agricultural ones were contributing factors. Oil imports fell significantly in value terms, mainly due to sharp price declines, partly offsetting the movements in the other import components. Trade prices for manufactures were almost unchanged[3].

A geographic breakdown of US trade flows suggests that most of the deterioration was accounted for by the industrial countries, chiefly Japan and the EEC. Imports from Japan nearly trebled, from the EEC more than doubled: within the European countries, German sales to the US market recorded some of the sharpest increases. Among the developing countries, Asian shipments to the US rose sharply. US exports showed modest increases during the period with no distinguishable trend as to the direction of those flows to particular countries or areas.

Industrial countries'shares in total US trade increased; the share of exports moved up from 61 per cent in 1980 to 63 in 1987, the import share rose from 51 to 61 per cent. Among the industrial countries, Japan and Germany recorded substantial increases; Japan alone contributed in 1987 to about one fifth of total US imports and one tenth of its exports.

These figures motivated our choice to focus our analysis and modelling strategy on the two major surplus countries. There is an important "distributional" dimension

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3. For an analysis of the contribution of trade volumes and prices, see Mastropasqua and Vona (1988).

in the pattern of the US trade adjustment at the present juncture and over the medium term; since the reduction in the US deficit should occur (to further overall welfare for the world economy) through a "rebalancing" between deficit and surplus countries, Japan and Germany should be prominent counterparts to the improvement of US net exports. In addition, these two countries represent major competitors of the U.S. in world markets for manufactures and it is against their currencies that the dollar has depreciated most since 1985.

I.2 The proximate determinants of the deficit: can the deficit be "explained"?

The emergence of a large external imbalance for the U.S. is no surprise or unexplained event; the contribution of its proximate determinants (relative prices, growth differentials, etc.) can indeed be identified with a sufficient degree of accuracy. In fact, a number of macroeconomic models which have been used to "predict" retrospectively or "explain" the external deficit for the period 1980-86 have generally exhibited a good tracking record, linking the deficit chiefly to the appreciation of the dollar and to stronger GNP growth in the United States relative to its major trading partners[4]. Additional factors which are not adequately captured by trade models are the international debt crisis and the resulting slowdown in

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4. For a review of comparative simulations of a number of econometric models, see Bryant and Holtham (1987). A Workshop on the US current-account imbalance was organized by the Brookings Institution in January 1987. The materials reporting the results of historical -tracking experiments and sensitivity analyses performed on the basis of the participating models, together with some accompanying papers, have now been assembled in Bryant et al. (1987).

activity in developing countries which were prominent markets for US exports.

The proximate sources of the deficit can be measured by simple accounting exercises, comparing the model predictions based on the actually observed values for the relevant variables with the predictions based on their 1980 average values assumed constant.

For instance, according to the results reported by the Federal Reserve Board's Multicountry Model[5], relative GNP growth (and capacity utilization rate) accounted for about 1/4 of the widening of the trade imbalance (in real terms) between 1980 and 1986. As the authors note, in spite of almost identical income elasticities for US imports and exports (2.1 and 2.2, respectively) and of the relatively narrow differential in GNP growth between the United States and other countries (about 2 percentage points during the period), growth contributed significantly because of the increasing gap between the levels of imports and exports[6]. The dominant contribution, however, came from changes in relative prices, associated with the rise of the dollar: the shift in relative prices of non-oil imports and non-agricultural exports alone contributed to over 3/4 of the

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5. See Helkie and Hooper (1987).

6. The authors recognize that the "growth" factor may be underestimated to some degree due to the selection of GNP rather than domestic demand as the activity variable in trade equations. If relative domestic demand growth were used in the calculations, the estimate of its contribution would be much larger since the gap between US and foreign domestic demand growth was significantly greater than the gap between GNP growth rates. For example, according to the OECD (1988) simulations on the basis of the Interlink model, relative price factors accounted for a little over one half of the increase in the real trade deficit between 1980 and 1985, while a further one half was due to the domestic demand differential and a number of other factors.

total deterioration of the trade balance.

However, Krugman and Baldwin (1987) conducted a similar exercise, but found that the deficit was "underpredicted". According to their estimates, if the US and foreign domestic demand had grown at the same rate between 1980 and 1986, the trade deficit would have been lower than its actual level by about one third; if the dollar had not appreciated from its 1980 level, about one half of the deficit in real terms and a third in nominal terms would not have occurred. Finally, under a combined assumption of equal growth of demand in the U.S. and abroad and no dollar appreciation, about 20 per cent of the real trade imbalance and one third of the nominal one would be left "unexplained". The result suggests a larger and more persisting deficit than demand and relative prices would warrant and leads the authors to formulate a set of explanatory hypotheses. First, adjustment lags of trade flows to exchange rate movements could be longer than conventionally estimated implying a continuously rising deficit as a cumulative effect of the dollar's appreciation. Second, US industry may be beset by problems of "competitiveness", notably a decline in its technological and productivity primacy, thus requiring a secular downward trend in the real exchange rate of the dollar. Third, the sustained period of dollar appreciation may have done irreversible damage to the US trade position by inducing some degree of "deindustrialization".

I.3 The persistence of the deficit

Since the dollar's peak in early 1985 and through the end of 1986 both the nominal and the real trade deficits (net of agriculture and oil) rose significantly. Only in 1987 while the nominal imbalance widened somewhat ($ 20 billion, year-on-year), it narrowed in real terms (by approximately $

15 billion) as the growth rate of export volumes largely outstripped that of imports. Interestingly enough, as Krugman and Baldwin (1987) suggest, "this joint rise reflects the fact that the United States has not, or at least not yet[7], experienced a J-curve, in which sluggish adjustment of the real trade deficit is offset at first by a worsening of the terms of trade. The real deficit has moved the wrong way, while, because of the asymmetrical behavior of import and export prices, there has been little change in the terms of trade". In other words, the persistence of the deficit and the slowness of the turnaround in the trade figures do not seem to present us with an unsolvable puzzle.

Historical relationships, as estimated by most macromodels, tend indeed to support the expectation of sluggish adjustment: first, trade prices respond with a lag to exchange-rate changes; second, volume flows react slowly to changes in relative prices; hence, in the short run volume effects are outweighed by terms-of-trade effects leading to J-shaped curves for nominal trade figures.

During 1985 and through the end of 1986 the real trade deficit, as we noted earlier, had moved the wrong way, further widening: in particular, import growth had been sustained by continuing strong domestic demand which expanded in 1986 at the rate of almost 4 per cent in real terms (slightly in excess of the other OECD countries). In addition to the demand pull, other factors slowed down the adjustment in trade volumes in response to the dollar depreciation. First, even though the fall of the dollar in real terms since its peak in early 1985 reversed all of its rise from 1980, even when the currencies of developing-country trading partners are included in the calculation, it indeed remained

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7. The authors are referring to the rise in both the nominal and the real deficit through the end of 1986.

fairly stable against the currencies of some Asian NICs which are large exporters to the U.S. (see Table 3). Second, the dollar rose sharply just before it started to decline and its rise had been long sustained implying that trade flows in 1986 possibly still responded with a normal lag to the appreciating dollar. Third, and most important, the pass-through of the dollar depreciation into import prices has been slower and less complete than in previous cycles of falling dollar. The pricing behavior by foreign exporters to the US market willing to absorb a significant part of the dollar decline in lower profit margins has thus slowed the needed adjustment in import volumes[8].

Only by 1987, not earlier, a J-curve started to take effect. The persistence of the nominal current deficit (even its increase) in 1987 can thus be attributed to the "price" effect on the trade account, in addition to the influences arising from the further decline in the net investment income surplus and from the continuing gap between import and export levels (over 60 per cent).

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8. For this argument and the relevant empirical evidence, see Mastropasqua and Vona (1988). A detailed discussion of microeconomic and industry-specific factors associated with the persistence of the deficit, including trade restrictions, can be found in Hooper and Mann (1987).

Table 3

Real bilateral exchange rates (1)
(units of foreign currency per $, indexes 1980=100)

	feb. 1985	1986	1987
Industrial countries			
Canada	104.7	102.5	97.8
Japan	133.4	88.6	80.4
Germany	179.6	118.2	100.9
France	182.1	118.2	103.1
United Kingdom	182.1	123.7	109.7
Italy	163.2	113.4	97.6
Latin America			
Brazil	110.8	102.8	106.7
Mexico	107.8	152.7	149.8
Asian NICs			
Hong-Kong	131.6	109.6	105.6
Korea	128.3	131.4	125.6
Singapore	123.7	146.2	134.6
Memorandum items			
Real effective exchange rate of the dollar			
Bank of Italy index	139.7	104.4	94.4
Morgan (2) ("traditional")	147.1	113.5	91.3
Morgan (3) ("broad")	145.3	118.9	97.6

Sources: Bank of Italy, IMF.
(1) Based on wholesale prices. For Hong-Kong consumer prices.
(2) Against 15 industrial countries.
(3) Against 18 industrial countries and 22 developing countries.

II Some illustrative scenarios for international adjustment.

II.1 Introduction.

The problems posed by the large and persisting external deficit of the U.S. as discussed in the previous section have elicited attention and analysis by academics and policy-making institutions alike. In recent years, in particular, international organizations have formulated medium-term scenarios to analyze possible strategies for adjusting the external imbalances of the U.S. and the other major countries. The scenario analysis is usually based on a simplified and rather "mechanistic" structure taking no account of policy makers' strategic behavior. This type of behavior will be explored in the next section and will allow more realistic insights into the process of policy formation.

Two sets of simulations, derived from the IMF and the OECD, are discussed here. They consist of: 1) reference scenarios derived from macroeconometric models (MULTIMOD and INTERLINK[9], respectively for the IMF and the OECD)[10]; 2) alternative scenarios simulating the effects of a dollar depreciation or of unilateral and/or coordinated policy actions aimed at reducing payments imbalances.

The alternative scenarios illustrate four different kinds of impulses: 1) an exogenous dollar depreciation

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9. See Masson et al. (1988); Richardson (1987 b, 1987 c).

10. The reference scenarios (or baselines) assume: i) no change in current or announced policies; ii) some predicted path for key exogenous variables (es. oil and commodity prices); iii) unchanged real exchange rates from the beginning of the simulation period. Both for the IMF and the OECD, the time-horizon of the simulation is five years, starting in 1988.

(scenario 1); 2) a fiscal restriction in the U.S. (scenario 2); 3) a fiscal expansion outside the U.S. (scenario 3); 4) a globally concerted fiscal action with some downward dollar movement (scenario 4). Since the scenarios designed by the IMF and the OECD generally differ in several respects (length of the simulation period, variables for which results are presented, amounts of policy impulses, etc.), we have tried to make them comparable at least with regard to the simulation period and the relevant variables. Furthermore, since the simulations performed by the IMF and the OECD relate to different baselines, we have "updated" and homogenized the results by computing the deviations from the original baselines and then applying them to the most recent baselines of each institution. Also, some of the variants (scenarios 3 envisaging no policy change in the United States and fiscal expansion abroad) have been computed directly by us as transformations of other cases, assuming linearity in the models used.

For purposes of illustration four variables (real GNP, private consumption deflator, current balance and real bilateral exchange rates) have been selected for the three major actors in current world disequilibria (United States, Japan and Germany). The reference scenarios are not reported here, while results for the simulations of the alternative scenarios are presented for the second year after imparting the shock (1989) and the last (1992).

II.2 Some prominent features of the baselines

The main feature of both the IMF and the OECD projections is the persistence of large external imbalances over the medium term. In particular, a slow decline of the US current deficit is predicted through 1990; after this date it widens again in absolute terms, although it remains constant

as a ratio to GNP at about 2 per cent. A similar behavior is envisaged for Japan, whose external surplus in current dollars increases again starting from 1990. For Germany the IMF predicts only a modest reduction of the surplus in nominal terms until 1989 and a renewed increase thereafter; the OECD forecasts a considerable fall in 1989 and a levelling off in the following years. For both countries the imbalances remain large as a proportion to GNP at the end of the simulation period, in a range of 2-2.5 per cent for Japan and 2.2-3 per cent for Germany.

The differences in the projected current balances between the IMF and the OECD reflect in part diverging estimates for growth with the IMF forecasting higher growth than the OECD, by about 0.5 percentage points. A common feature of both sets of simulations is that Japan's expansion outpaces that of the U.S. and of Germany during the simulation period. According to both baselines, inflation remains subdued in the three countries through 1992; this is in part a consequence of the assumption that monetary growth is restrained sufficiently to maintain downward pressure on prices. A persistent and, in most cases, widening inflation differential against the U.S. is predicted; this contributes to the renewed tendency for current imbalances to deteriorate in the 1990s.

II.3 Alternative scenarios

II.3.1 Dollar depreciation

The pure dollar depreciation case is described in Tables 4A and 4B (scenario 1). The basic assumptions are

IMF: Alternative Scenarios

	1 PURE DOLLAR DEPRECIATION				2 FISCAL RESTRICTION IN USA				3 FISCAL EXPANSION IN JAPAN AND GERMANY; ENDOGENOUS DOLLAR DEPRECIATION				4 FISCAL RESTRICTION IN USA, EXPANSION IN JAPAN, GERMANY AND ENDOGENOUS DOLLAR DEPRECIATION			
	1989		1992		1989		1992		1989		1992		1989		1992	
	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)
United States																
Real GNP	3.2	-1.5	2.9	-0.8	3.1	-0.4	2.8	-0.4	2.8	0.0	2.8	0.0	3.0	-0.4	2.8	-0.4
GNP Deflator	3.9	0.4	3.2	0.2	3.5	0.0	3.3	-0.2	3.6	0.1	3.6	0.3	3.6	0.1	3.4	0.1
Current Balance																
- $ billions	-91.8	36.6	-41.9	86.1	-118.2	10.2	-91.3	36.7	-128.4	0.0	-121.9	6.1	-118.2	10.2	-85.2	42.8
- in perc. of GNP	-1.8	0.7	-0.7	1.4	-2.3	0.2	-1.5	0.6	-2.5	0.0	-2.0	0.1	-2.3	0.2	-1.4	0.7
Japan																
Real GNP	3.3	-1.6	4.1	0.7	3.5	-0.6	3.7	0.0	3.8	0.5	3.6	-0.2	3.6	-0.1	3.7	-0.2
GNP Deflator	-0.3	-2.9	0.8	-6.6	1.1	-1.0	1.2	-2.3	1.9	0.0	1.6	0.2	1.2	-1.0	1.3	-2.1
Current Balance																
- $ billions	70.2	-4.4	64.0	-11.0	68.7	-5.9	75.9	0.9	73.4	-1.2	77.9	2.9	67.5	-7.1	78.7	3.7
- in perc. of GNP	2.2	-0.2	1.6	-0.4	2.2	-0.2	1.9	-0.1	2.3	-0.1	1.9	-0.1	2.1	-0.3	1.8	-0.2
Real exch. rate (Yen/$)	148.9	-7.1	155.9	-2.7	155.7	-2.8	149.6	-6.6	156.3	-2.5	149.7	-6.5	151.8	-5.3	139.1	-13.2
Germany																
Real GNP	0.8	-2.9	2.8	0.5	1.4	-0.9	2.5	0.1	2.1	0.7	2.3	0.5	1.8	-0.2	2.5	0.6
GNP Deflator	0.3	-2.8	1.7	-5.3	1.4	-0.9	2.1	-1.8	1.9	-0.3	2.4	-0.2	1.3	-1.2	2.2	2.0
Current Balance																
- $ billions	37.5	-4.0	50.7	3.1	38.8	-2.7	50.0	2.4	40.2	-1.3	42.5	-5.1	37.5	-4.1	44.8	-2.8
- in perc. of GNP	2.7	-0.4	3.0	0.0	2.8	-0.3	2.8	-0.2	3.0	-0.1	2.7	-0.3	2.7	-0.4	2.5	-0.5
Real exch. rate (DM/$)	1.71	-8.0	1.78	-4.2	1.78	-4.3	1.7	-11.1	1.87	0.4	1.87	0.4	1.79	-3.9	1.66	-10.7

Source: Our calculations on IMF simulations.
(A) Percentage growth rates except otherwise marked.
(B) For GNP, deflator and exchange rate, percentage deviations from levels in the reference scenario; for current account balance, absolute deviations.

Table 4B

OECD: Alternative Scenarios

	1 PURE DOLLAR DEPRECIATION				2 FISCAL RESTRICTION IN USA				3 FISCAL EXPANSION IN JAPAN; EXOGENOUS DOLLAR DEPRECIATION				4 FISCAL RESTRICTION IN USA, EXPANSION IN JAPAN AND EXOGENOUS DOLLAR DEPRECIATION			
	1989		1992		1989		1992		1989		1992		1989		1992	
	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)
United States																
Real GNP	2.3	1.4	1.6	-1.0	1.1	-1.2	1.4	-3.5	1.8	0.7	3.3	2.9	1.2	-0.5	2.5	-0.6
Priv. Cons. Defl.	6.9	3.7	5.7	9.6	3.7	-0.2	3.4	-1.8	4.3	1.2	5.6	4.3	4.2	1.0	4.8	2.5
Current Balance																
- $ billions	-101.0	4.0	-79.0	37.0	-89.0	16.0	-66.0	50.0	-101.0	4.0	-97.0	19.0	-85.0	20.0	-47.0	69.0
- in perc. of GNP	-1.9	0.2	-1.2	0.7	-1.8	0.3	-1.1	0.8	-1.95	0.1	-1.5	0.4	-1.7	0.4	-0.8	1.1
Japan																
Real GNP	1.7	-1.6	3.3	-3.8	2.7	-0.4	3.0	-1.4	3.8	1.5	3.6	3.1	3.5	1.1	3.3	1.7
Priv. Cons. Defl.	0.8	-1.4	0.8	-3.8	1.8	-0.1	1.6	-0.8	1.9	-0.3	2.4	0.8	1.8	-0.4	2.1	0.0
Current Balance																
- $ billions	76.0	-3.0	71.0	-22.0	75.0	-4.0	79.0	14.0	75.0	-4.0	69.0	-24.0	71.0	-8.0	55.0	-38.0
- in perc. of GNP	2.2	-0.6	1.6	-1.0	2.7	-0.1	2.3	-0.3	2.6	-0.2	1.9	-0.8	2.4	-0.4	1.5	-1.1
Real exch. rate (Yen/$)	145.7	-15.9	145.7	-15.9	173.1	-0.1	171.5	-1.0	172.4	-0.5	176.0	1.6	172.2	-0.6	174.2	0.5
Germany																
Real GNP	1.1	0.0	2.4	-1.1	0.9	-0.4	1.9	-1.1	1.2	-0.1	2.1	0.1	0.9	-0.5	2.0	-1.0
Priv. Cons. Defl.	1.3	-0.5	0.8	-1.8	1.5	-0.1	1.1	-0.6	1.5	-0.2	1.1	-1.2	1.4	-0.3	0.8	-1.8
Current Balance																
- $ billions	37.0	5.0	30.0	-4.0	30.0	-2.0	26.0	-8.0	32.0	0.0	34.0	0.0	30.0	-2.0	26.0	-8.0
- in perc. of GNP	2.5	0.0	1.6	-0.4	2.4	-0.1	1.7	-0.5	2.5	-0.0	2.2	-0.0	2.3	-0.2	1.7	-0.5
Real exch. rate (DM/$)	1.75	-11.4	1.75	-11.4	1.98	-0.1	1.95	-1.2	1.97	-0.6	2.0	3.6	1.96	-0.7	2.02	2.3

Source: Our calculations on OECD simulations.
(A) Percentage growth rates except otherwise marked.
(B) For GNP, deflator and exchange rate, percentage deviations from levels in the reference scenario; for current account balance. absolute deviations.

Notes to Tables 4A and 4B

KEY ASSUMPTIONS FOR THE "PURE DOLLAR DEPRECIATION" SCENARIOS

IMF

Fiscal policy: unchanged with respect to the reference scenario.

Monetary policy

United States: monetary conditions tighten in order to avoid the inflationary consequences of the dollar depreciation.

Japan and Germany: interest rates decline somewhat with the appreciation of the currencies, as money growth rates remain unchanged.

Exchange rates: a constraint is imposed over US net foreign indebtedness as a ratio to GNP, which must not exceed 15 per cent in 1995, as against 22 per cent in the reference scenario. Therefore, the dollar is assumed to decline in a way consistent with the reduction of the US current account deficit such as to keep the foreign debt ratio at the desired level in 1995: the adjustment takes place in 1988, with the dollar depreciating by 15 per cent in nominal terms against the other major currencies.

OECD

Fiscal policy: unchanged with respect to the reference scenario.

Monetary policy: broadly non-accommodating. In particular:

United States: short-term interest rates are driven up to 9 per cent as a counter to inflation and then fall to 7 per cent as output weakens and inflation pressures ease; long-term rates rise over the projection period.

Japan and Germany: interest rates decline as inflation falls.

Exchange rates: during 1988,the US dollar depreciates by 20 per cent against the Yen and by 15 per cent against the DM in nominal terms. Then, exchange rates are constant in nominal terms in 1989, and broadly stable in real terms in the following years.

spelled out in the Notes attached to the Tables. A major difference between the two sets of simulation is to be noted: while the IMF model embodies endogenous exchange rate changes, in the OECD setting exchange rates are taken as exogenous for the whole period. The particular assumption adopted implies a further dollar depreciation in nominal terms from 1990 ownwards in order to compensate for relative price movements. On the contrary, in the IMF simulation, some of the initial nominal depreciation of the dollar is reversed by endogenous feedbacks.

Another difference between the two models relates to the domestic price response to exchange rate movements which is quicker in the IMF than in the OECD case. This has two main consequences: first, the reactions of monetary authorities aimed at stabilizing prices need to be stronger in the IMF case; second, in this latter case, the initial devaluation of the dollar is largely reversed towards the end of the simulation period.

The above differences have a strong influence on the projected outcomes for the main variables in the two models.

The initial impact of the dollar devaluation on US growth is negative in the IMF scenario, due to the rise in domestic interest rates brought about by monetary restraint; conversely, in the OECD simulation the stimulus from increased net exports outweighs the negative effects of monetary policy. In the medium term, US output remains below its baseline level in both models, but for different reasons: in the OECD case, because of the slowdown in activity abroad induced by the persistent dollar devaluation, despite the impulse coming from the latter to the US economy; in the IMF case, because of the initial losses caused by monetary restraint, as US competitiveness gains taper off (see the behavior of real exchange rates) and in spite of the stimulus

to US exports arising from stronger growth abroad.

Turning to inflation, the Yen and DM appreciation is passed on to domestic prices which decline, relative to baseline levels. For the U.S. the outcome is very different in size in the two simulations: in the IMF scenario, US prices remain almost unaffected at the end of the simulation period, while in the OECD case they increase considerably because of the greater and sustained dollar depreciation implied by the particular assumptions described above.

As for external imbalances, the IMF simulation predicts a larger reduction of the US deficit; a smaller correction of the Japanese surplus; almost no change in the German surplus, whereas in the OECD case it declines somewhat. For the U.S. the different outcomes can be largely explained on the basis of differing distributions of growth across countries: the IMF predicts both larger output losses in the U.S., at least initially, and a lower contraction abroad than the OECD; this allows for both greater import contraction and export expansion in the U.S..

II.3.2 Fiscal restriction in the U.S.

The fiscal restriction in the U.S. case is illustrated as **scenario 2.** The US restriction causes a more pronounced slowdown in activity in the OECD simulation than in the IMF's. The more favourable growth outcome in the latter case derives from three factors: 1) the less severe fiscal contraction; 2) the endogenous dollar depreciation, causing an increase in US exports; 3) the interest rate decline, sustaining activity both in the US and abroad. Due to the smaller output effects in the IMF case, the reduction of external imbalances is slower, notwithstanding the favourable

Notes to Tables 4A and 4B

KEY ASSUMPTIONS FOR THE "FISCAL RESTRICTION IN THE U.S." SCENARIOS

IMF	OECD
Fiscal policy	**Fiscal policy**
United States: the federal government's non-interest expenditures are reduced by amounts rising from $42 billion in 1988 to $91 billion in 1992 relative to the reference scenario.	**United States:** the federal government's expenditures are gradually reduced by about $70 billion and proceeds from income tax increase by about $50 billion by the end of 1992 relative to the reference scenario.
Japan and Germany: unchanged with respect to the reference scenario.	**Japan and Germany:** unchanged with respect to the reference scenario.
Monetary policy: interest rates decline in the US in order to keep money growth on target and, to a lesser extent, in Japan and Germany.	**Monetary policy:** US money supply growth decelerates broadly in line with nominal income leaving short-term rates unchanged; in Japan and Germany, interest rates also remain at the baseline level.
Exchange rates: endogenous changes.	**Exchange rates:** nominal exchange rates unchanged from their baseline levels.

impact of the dollar decline on the US current balance.

For the OECD, a comparison with scenario 1 reveals that, for the purpose of redressing external imbalances in the three leading countries, a fiscal contraction in the US is more effective than a dollar depreciation. For the IMF, the opposite is true; due to the endogenous nature of exchange rates, the real dollar depreciation in 1992 turns out in fact to be larger in scenario 2 than in scenario 1.

II.3.3 Fiscal expansion outside the U.S.

Again, in the fiscal expansion outside the US case (scenario 3), the policy assumptions differ somewhat between the IMF and the OECD. While in the IMF setting both Japan and Germany adopt a more expansionary fiscal stance, in the OECD case only Japan is acting but the size of the stimulus is larger, public expenditures being increased in Japan by an amount roughly equal to 1 per cent of GNP, as against 0.5 in the IMF case. In both scenarios, fiscal action is accompanied by some depreciation of the dollar. The OECD imposes an exogenous decline of the US currency equal to 2 per cent per annum in nominal terms; in the IMF exercise, the amount of the endogenous depreciation is larger vis-à-vis the Yen and almost nil against the DM.

The outcomes are rather different in the two sets of projections. The OECD scenario underscores the strong interactions between Japan and the U.S., because of the trade linkages between the two countries, while the German economy remains almost unaffected. In particular, the impact on growth of the Japanese stimulus is sizable both in Japan itself and in the U.S., while it has almost no effect in Germany. The correction of Japan's current surplus is also

substantial (almost 1 percentage point at the end of the simulation period). However, the US deficit is only slightly reduced, since the increase in US exports is balanced by the concomitant surge in imports brought about by stronger output growth; the reduction is the lowest as compared with scenarios 1 and 2 (see Table 4B).

In the IMF simulation, fiscal expansion in the main trading partners of the U.S. has almost no effect on the US current balance and growth; it imparts some stimulus to output, but only at a first stage, in Japan, but has no significant influence on its current surplus. In fact, given the large real depreciation of the dollar vis-à-vis the Yen, Japan's loss of competitiveness offsets the effect of fiscal expansion on domestic activity: the converse is true in the OECD scenario where the dollar shows a small real appreciation against the Yen.

II.3.4 Fiscal coordination and dollar depreciation

The coordinated fiscal action cum dollar depreciation case is illustrated as scenario 4. Fiscal policy settings in Japan and Germany are the same as in scenario 3 (see the attached Notes). The US restriction is assumed in the IMF case to be equal to that postulated under scenario 2; in the OECD case, the magnitude of the cuts is roughly the same, but since they are distributed over a longer time frame the government surplus turns out to be in 1992 slightly below that envisaged by the IMF. As in previous scenarios, the assumed exchange rate behavior differs between the two sets of simulations.

The outcomes largely confirm those obtained in scenarios 2 and 3, of which the present case is a linear

Notes to Tables 4A and 4B

KEY ASSUMPTIONS FOR THE "CONCERTED FISCAL ACTION CUM DOLLAR DEPRECIATION" SCENARIOS

IMF

Fiscal policy

United States: the same setting as in scenario 2.

Japan: higher expenditures in 1988-1990 by an amount equal to 0.5 per cent of GNP.

Germany: lower tax revenues by an amount growing from DM 7.6 billions in 1988 to DM 20 billions in 1991. As a ratio to GNP, the fiscal stimulus is roughly the same as in Japan.

Monetary policy: interest rates decline in the US and rise in Japan and Germany, in order to keep money growth on target.

Exchange rates: endogenous changes.

OECD

Fiscal policy

United States: starting from 1988, the general government deficit is reduced over four years by 2 percentage points of GNP, compared with the reference scenario.

Japan: starting from 1988, the general government deficit is increased over four years by 1 percentage point of GNP compared with the reference scenario.

Germany: the same setting as in the reference scenario.

Monetary policy: broadly non-accommodating. In particular:

United States: unchanged money growth and lower interest rates compared with the reference scenario.

Japan: interest rates are assumed to be initially slightly higher than in the reference scenario before falling towards the end of the projection period.

Germany: interest rates are lower than in the reference scenario reflecting weaker output growth and lower inflation.

Exchange rates: steady decline of the dollar against other OECD courrencies by 2 per cent per annum in nominal terms relative to the reference scenario.

combination.

In the IMF exercise, US growth is unaffected by budgetary expansion abroad, as scenario 3 has shown, and therefore turns out almost identical to scenario 2 (only fiscal contraction at home). For Japan and Germany, the output losses stemming from the US fiscal restriction and the large dollar depreciation are somewhat limited by domestic fiscal expansion; however, in the case of Japan, since the real Yen appreciation is almost twice as large as under scenario 2, some dampening effect on activity persists over the medium term, leaving output sligthly below its baseline level by 1992. The size of the US current-account adjustment helped by the larger dollar depreciation is bigger than under scenario 2 (nearly $43 billion or 0.7 percentage points of GNP relative to baseline levels). Germany's surplus is somewhat reduced due to stronger real domestic expansion, but Japan's is not despite the sizable Yen appreciation.

In the OECD simulation, while the results for Germany, which does not adopt stimulative measures on its own, are essentially the same as under scenario 2, the strong and beneficial interactions between the U.S. and Japan are highlighted by the adoption of the cooperative scenario. Budgetary expansion in Japan reduces output losses in the U.S. as compared with the case of a unilateral fiscal contraction in the U.S. (scenario 2), in addition to sustaining domestic growth. At the same time, no adverse effect on Japanese GNP arises from the behavior of the real Yen/dollar exchange rate, that remains virtually unchanged from its baseline level. Since the net effect of the coordinated fiscal action is to redistribute domestic demand and output growth from the "deficit" to the "surplus" country, external imbalances correspondingly decline; the change is of the order of magnitude of 1 per cent of GNP in both countries by the end of the projection period.

III Coordination of fiscal policies in a game-theoretic framework

III.1 Introduction

With the Louvre accord of February 1987 there was an attempt at stabilizing exchange rates through the pursuit of coordinated macroeconomic policies by the leading industrial countries, along the lines of the scenarios described in Section II. In the event, the action agreed upon in the Louvre partly fell short of its stated intentions and partly failed to convince the markets about the adequacy of the corrective domestic policies in place. On the fiscal front, in particular, the lack of support by Germany and the perception that the US budget would not improve enough in 1988 fed market skepticism about countries' ability and incentives to attune domestic priorities to the requirements of external adjustment, and to give full consideration to the international dimension of national policies. In the following months it was thus perceived that cooperation was breaking down and that a situation of sharper disagreement was emerging between the largest economies. This market sentiment unleashed fears of recession and contributed to the October stock market crash. In the aftermath some economists advocated that the U.S. explicitly abandon the international coordination of macroeconomic policies and be prepared to accept a further decline of the dollar vis-à-vis the Japanese yen and the German mark. In this proposal Japan and Germany "should concentrate on achieving domestic policies that will provide healthy growth in their own countries"[11].

The present section aims at comparing the advantages

11. Feldstein (1988).

resulting from opposite approaches to the correction of the US current-account imbalance.

The exercise described in Section II and based on simulating the outcomes of alternative policy settings assumed mechanically that policies were implemented as postulated by the different scenarios. However, in the real world policy makers are supposed to follow a strategic behavior by taking into account explicitly others' actions and reacting to these. For example, it is reasonable to believe that, following a policy change abroad or an exchange rate shock , the authorities will react in order to offset the destabilizing effects of exogenous disturbances.

In this section of the paper cooperative and non-cooperative actions are simulated and their effects compared with those resulting from a dollar depreciation[12]. The strategic responses by policy makers in the countries concerned are fully taken into account on the basis of alternative hypotheses about the shape of their target functions.

Concerning coordination, a conceptual distinction is proposed between the case in which the authorities agree on policy targets but try to achieve them through unilateral action and the case in which, having agreed on targets, the

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12. For an introductory outline of the method see Martinez Oliva (1987). Interesting applications are found, among others, in Canzoneri and Gray (1985) and Canzoneri and Henderson (1987). Valuable contributions are also included in the conference issue of the Economic Studies Quarterly, Vol. 3, No. 2, June 1986 ("Symposium on the Coordination of Economic Policies between Japan and the United States"), in Buiter and Marston (1985), and, more recently, in the provisional conference volume on "International Economic Policy Coordination", held in Aix-en-Provence, 24-25 June, 1988. Criticisms at the game-theoretic approach to policy coordination are to be found in Kenen (1987 and 1988).

authorities decide to pursue them through cooperative action. As for the case of an exogenous dollar depreciation, policy makers in the U.S. and in the other countries are assumed to react to the implied effects on output and the current account by changing their fiscal stance. It is shown that the individual country's optimizing response gives origin to a set of fiscal policies similar to those implemented under cooperation.

III.2 An exercise in policy optimization

The present subsection provides a numerical illustration based on the conceptual framework described in Appendix A. The purpose of the exercise is to compare different solutions to the problem of rebalancing the current account positions of the United States on one side, of Japan and Germany on the other.

The first alternative (Nash) assumes that starting from a "status quo" scenario, with constant (baseline) policies and exchange rates, the authorities choose a new path of adjustment, aiming at a lower deficit in the U.S. and lower surpluses in Japan and Germany, and take unilateral policy actions to that end. It should be stressed that this solution can be regarded as a particular form of coordination involving targets instead of instruments[13]. In this alternative, it is assumed that the authorities aim at correcting current imbalances while keeping their former output targets unchanged. As was mentioned in the previous section, given the scarcity of instruments, a situation of policy conflict is likely to occur. In the absence of coordination of instruments, the solution of the conflict is

13. See Martinez Oliva and Sinn (1988).

the Nash (non-cooperative) one.

In the second alternative (cooperation) the U.S., Japan and Germany implement a set of cooperative fiscal policies aimed at achieving the agreed new path of adjustment of current account imbalances. Since this solution is found by jointly optimizing the objective functions of the three countries it is optimal by definition. This cooperative policy set-up is expected to produce a larger external adjustment than under Nash.

The third alternative (dollar depreciation) assumes that the dollar is allowed to depreciate vis-à-vis the other two currencies, with favourable repercussions on the US economy and negative effects abroad in terms of output and the current balance. Policy makers' reaction functions are shifted by the dollar's movement[14]. In this exercise the dollar is assumed to depreciate to the extent necessary to improve the US current account by an amount comparable to that resulting from a concerted fiscal action. The ensuing reactions of the authorities in the three countries are also simulated, giving origin to a new set of policies and outcomes.

The numerical experiment involves the three countries and is based on the policy multipliers derived from the same multi-country econometric models used in Section II, i.e.

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14. A thorough explanation of this property is found in Martinez Oliva (1988b). The intuitive argument is that reaction functions are the loci of domestic and external policies fulfilling the requirement of individual optimization of national objective functions. An exchange rate depreciation, by changing the values of domestic (and foreign) target variables, will require different levels of the domestic policy instrument for every combination of foreign policy instruments, thereby shifting the position of the reaction function in the policy space.

Interlink (OECD) and Multimod (IMF)[15].

In order to better understand the numerical results we will first analyze the main features of the econometric models mentioned above.

Table 5 reviews Interlink and Multimod on the basis of four indicators: C1, C2, C3, and C4. The analytical derivation of these indicators is found in Appendix C.

Considering for illustration the case of the United States, C1 measures the output loss associated with a fiscal contraction generating a $1 billion reduction in the current deficit. The trade-off between output and the current balance for the U.S. is fairly similar in the two models: for example, a fiscal action aimed at reducing the current deficit by $10 billion in the second year of simulation implies an output loss equal to 0.4-0.5 percentage points with respect to the baseline.

C2 and C3 represent the effects on the output/current account trade-off in the U.S. (again in terms of percentage deviations from the baseline) arising from a one-percentage-point fiscal expansion in Japan and Germany, respectively. Multimod shows that a fiscal expansion in Japan has a stronger effect on the US economy than a German expansion (0.25 and 0.12, respectively). In Interlink C2 and C3 are equal. Following Interlink, an increase of government expenditure equal to 1 per cent of GNP in Japan would improve the output/current account trade-off in the U.S. by 0.10

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15. The policy multipliers are derived from flexible exchange rate simulations: in other words changes in policy instruments induce endogenous movements of the dollar, which are conceptually different from the "exogenous" movements assumed in the exercise below. See, among others, Helliwell and Padmore (1985), Amano (1986), Holtham (1986).

Table 5

Trade-off between output and current balance, cross-country gains and exchange rate gains

(a) United States

	C1	C2	C3	C4
Interlink	-0.044	0.100	0.100	1.076
Multimod	-0.050	0.246	0.120	1.888

C1= Output effect of a fiscal contraction in the U.S. generating a $ 1 billion increase in the US current account balance.
C2= Shift in the trade-off (C1) from an increase of government expenditure equal to 1% of GNP in Japan.
C3= Shift in the trade-off (C1) from an increase of government expenditure equal to 1% of GNP in Germany.
C4= Shift in the trade-off (C1) from a 10% effective depreciation of the U.S. dollar.

(b) Japan

	C1	C2	C3	C4
Interlink	-0.494	4.800	0.100	-4.949
Multimod	-0.098	0.896	0.913	-4.310

C1= Output effect of a fiscal contraction in Japan generating a $ 1 billion increase in Japan's current account balance.
C2= Shift in the trade-off (C1) from an increase of government expenditure equal to 1% of GNP in the U.S.
C3= Shift in the trade-off (C1) from an increase of government expenditure equal to 1% of GNP in Germany.
C4= Shift in the trade-off (C1) from a 10% effective depreciation of the U.S.

(c) Germany

	C1	C2	C3	C4
Interlink	-0.236	1.300	0.250	-1.246
Multimod	-0.134	0.623	0.307	-1.278

C1= Output effect of a fiscal contraction in Germany generating a $ 1 billion increase in Germany's current account balance.
C2= Shift in the trade-off (C1) from an increase of government expenditure equal to 1% of GNP in the U.S.
C3= Shift in the trade-off (C1) from an increase of government expenditure equal to 1% of GNP in Japan.
C4= Shift in the trade-off (C1) from a 10% effective depreciation of the U.S.

percentage points, implying an output loss of 0.3 instead of 0.4 for a $10 billion adjustment in the current account. A synchronized action in both Japan and Germany would improve the trade-off by 0.2 percentage points. In Multimod the improvement is even stronger: a joint fiscal expansion in Japan and Germany would produce a trade-off improvement equal to 0.37 percentage points.

C4 measures the effect on the output/current account trade-off in the U.S. from a 10 per cent effective depreciation of the dollar. The trade-off improvement ranges from 1.1 to 1.9 percentage points. In other words, in Interlink a 4 per cent effective depreciation of the dollar would bring about a $10 billion adjustment without any deviation in US output ((C1/C4)*10); in Multimod the same outcome can be obtained by a 2.7 per cent depreciation.

Finally, we note that the same trade-off improvement as with a 10 per cent depreciation of the dollar can be obtained according to Interlink through a fiscal expansion in Japan or in Germany equal to 10.8 percentage points of GNP or some combination of the two. The equivalent figures for Multimod are 7.7 and 15.7.

These figures suggest that an exchange rate depreciation is, for the purpose of the US current-account adjustment, a much more powerful tool than a fiscal expansion abroad. Analogous considerations can be developed for Japan and Germany (Table 5, part (b) and (c)).

Table 6 shows the effects of a sustained 10 per cent depreciation of the US dollar vis-à-vis the Yen and the DM. Very strong output effects are found in Multimod: there the dollar depreciation produces a 1.4 percentage point gain in US output and a 2.7 and 1.4 percentage-point loss in Japan and Germany, respectively. The corresponding current account

Table 6

Sustained 10% depreciation of the U.S. dollar against German mark and Japanese yen (deviations from baseline values in the second year of simulation (*))

	United States		Japan		Germany	
	Output	Current Balance	Output	Current Balance	Output	Current Balance
Interlink	0.1	22.0	-1.0	-8.0	-0.3	-4.0
Multimod	1.4	9.7	-2.7	-16.3	-1.4	0.8

(*) Percentage deviations for output; absolute deviations for the current balance (billion of U.S. dollar).

Table 7

Baseline and assumed target values in the second year

	Baseline (1)		Targets(2)	
	Output	Current Balance	Output	Current Balance
United States	100.0	-136.0	100.0	-68.0
Japan	100.0	80.0	100.0	40.0
Germany	100.0	42.0	100.0	21.0

(1) The baseline is a "consensus" view derived from IMF and OECD estimates. The output (q) figures are conventionally assumed equal to zero; the current balance (b) figures are in billions of dollars.
(2) Current account target values are reduced by 50% with respect to the baseline in absolute terms.

improvement for the U.S. amounts to $9.7 billion, and the loss for Japan amounts to $16.3 billion; in the case of Germany the dollar depreciation involves a small gain. In Interlink the output effects are smaller: a 0.1 percentage-point gain in US output and a 1 and 0.3 percentage-point loss in Japan and Germany. Conversely, the current account effects are much stronger: a $22 billion improvement in the U.S. and a $8 and 4 billion deterioration in Japan's and Germany's current balances.

Table 7 presents the baseline values which are assumed to represent the "status quo". It is derived from a "consensus" view based on IMF and OECD forecasts. The output targets are assumed to be equal to the baseline values, normalized to 100; the current account targets are set to be 50 per cent smaller than the baseline values in absolute terms.

The following tables show the results of a policy optimization exercise under alternative assumptions about the utility weights ¥[16], which are supposed to be all equal in the three countries.

Table 8 reports the optimization results under the extreme assumptions that ¥ be equal to infinity and zero respectively. The latter case is trivial because, since we have assumed that the output targets coincide with the baseline values, the optimal outcome is the baseline itself and fiscal policies remain unchanged.

The case in which ¥ is equal to infinity is more relevant. It shows that a full achievement of the

16. ¥ are the weights attached by policy makers to the various targets in the objective function. See Appendix A.

Table 8

Policy optimization in the different models with Y=∞ and Y=0

	Interlink					
	Y = ∞			Y = 0		
	G	Q	B	G	Q	B
United States	-3.3	97.9	-70.0	0.0	100.0	-136.0
Japan	5.2	105.6	37.5	0.0	100.0	80.0
Germany	2.7	102.0	21.0	0.0	100.0	42.0
	Multimod					
	Y = ∞			Y = 0		
	G	Q	B	G	Q	B
United States	-3.0	98.9	-70.0	0.0	100.0	-136.0
Japan	6.9	105.3	37.5	0.0	100.0	80.0
Germany	4.2	103.1	21.0	0.0	100.0	42.0

current-account targets, i.e. a 50 per cent reduction in each country's imbalance, would require a severe tightening in US fiscal policy (about 3 per cent of GNP) and an extremely large expansion in Japan (5-7 per cent) and Germany (3-4 per cent). As a consequence US output would be reduced by 1-2 points as a percentage of the baseline; in the meantime output would strongly increase in Japan (by more than 5 percentage points) and, to a lesser extent, in Germany (2-3).

Tables 9-10 report the results of policy optimization for the three countries on the basis of the Interlink and Multimod numbers. A grid of different values for ¥ is utilized for illustrative purposes[17]. The values of ¥ which have been chosen are consistent with those of other studies[18]

The exercise shows the outcomes in terms of both instruments and targets of the alternative solutions to the problem of the US current imbalance presented at the beginning of the present section.

If the authorities decide to halve their countries' current account positions by unilateral fiscal actions this would require a US fiscal contraction ranging from 1.7 to 2.4 percentage points according to Interlink and from 2 to 2.9

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17. This procedure has been chosen because it provides a larger amount of information about the way preferences affect final equilibria. A-priori welfare weights are used for example by Holtham and Hughes Hallett (1987). Other authors determine the utility weights on the basis of a particular procedure. See Oudiz and Sachs (1984), Oudiz (1985). For a critique of such a procedure see Martinez Oliva (1988a).

18. They range from 0.002 to 0.005. Holtham and Hughes Hallett (1987) in their analysis concerning the U.S. and the rest of the OECD have used current account weights ranging from 0.003 to 0.005, depending on the period considered.

Table 9

Policy optimization in Interlink (1)

	Y = 0.002			Y = 0.003			Y = 0.004			Y = 0.005		
	G	Q	B	G	Q	B	G	Q	B	G	Q	B
United States												
Nash	-1.7	98.6	-101.1	-2.0	98.3	-94.6	-2.3	98.2	-90.3	-2.4	98.0	-87.3
Cooperation	-2.0	98.4	-95.8	-2.3	98.1	-89.3	-2.5	98.0	-84.9	-2.7	97.9	-82.1
Exogenous dollar change	-1.5	98.8	-95.8	-1.7	98.7	-89.3	-1.8	98.7	-84.9	-1.8	98.6	-82.1
Japan												
Nash	0.8	100.1	63.2	0.9	100.1	60.0	1.0	100.2	58.0	1.1	100.2	56.5
Cooperation	1.0	100.3	60.2	1.2	100.4	57.0	1.3	100.4	54.9	1.4	100.4	53.5
Exogenous dollar change	1.0	100.1	60.9	1.2	100.1	57.7	1.3	100.1	55.7	1.4	100.2	54.4
Germany												
Nash	0.7	100.1	32.9	0.8	100.1	31.2	0.9	100.2	30.0	1.0	100.2	29.2
Cooperation	0.9	100.2	31.2	1.0	100.3	29.5	1.1	100.3	28.4	1.1	100.3	27.6
Exogenous dollar change	0.7	100.1	32.0	0.8	100.1	30.4	0.9	100.1	29.3	0.9	100.2	28.7
Memorandum item: exog. dollar change (Δ%) (2)		-4.2			-5.5			-6.7			-7.6	

(1) Second year effects.
(2) The sign (-) indicates depreciation.

Table 10

Policy optimization in Multimod (1)

	Y = 0.002			Y = 0.003			Y = 0.004			Y = 0.005		
	G	Q	B	G	Q	B	G	Q	B	G	Q	B
United States												
Nash	-2.0	98.7	-101.4	-2.4	98.5	-94.7	-2.7	98.4	-90.3	-2.9	98.3	-87.1
Cooperation	-2.5	98.4	-93.4	-2.9	98.2	-86.9	-3.1	98.1	-82.8	-3.3	98.0	-80.2
Exogenous dollar change	-2.3	99.1	-93.4	-2.6	99.0	-86.9	-2.8	99.0	-82.8	-2.9	99.0	-80.2
Japan												
Nash	1.3	100.6	64.7	1.7	100.7	61.3	1.9	100.9	58.9	2.1	101.0	57.0
Cooperation	1.8	100.8	56.5	2.1	100.9	53.5	2.3	101.0	51.7	2.4	101.1	50.6
Exogenous dollar change	2.0	100.4	56.3	2.4	100.4	52.1	2.7	100.5	49.5	2.9	100.5	48.0
Germany												
Nash	1.0	100.2	34.1	1.2	100.3	32.5	1.3	100.3	31.5	1.4	100.4	30.8
Cooperation	0.8	100.0	34.4	1.0	100.1	32.9	1.2	100.1	31.7	1.3	100.2	30.9
Exogenous dollar change	1.4	100.2	32.2	1.7	100.2	30.6	1.9	100.3	29.6	2.0	100.3	28.9
Memorandum item: exog. dollar change (A%) (2)		-2.7			-3.5			-4.0			-4.2	

(1) Second year effects.
(2) The sign (-) indicates depreciation.

according to Multimod. Correspondingly a fiscal expansion will be necessary in Japan (0.8-1.1 and 1.2-2.1, in Interlink and Multimod, respectively) and in Germany (0.7-1.0 and 1.0-1.4). As a consequence, US output will decline by 1.3-2 points as a percentage of baseline in both models and will increase in Japan (0.1-1.0 per cent) and Germany (0.1-0.4). The current account improvement is fairly large, ranging roughly from $35 to 50 billion.

Cooperation forces the authorities to more vigorous policy actions. The ranges for fiscal policies are now higher in absolute terms, by 0.3-0.5 percentage points for the U.S., and by 0.2-0.4 for Japan. In the sole case of Germany the cooperative outcome requires, according to Multimod, a slightly lower amount of fiscal activism. The cooperative solution implies only a small marginal change in output, as compared with the non-cooperative solution and some additional reduction in the US current deficit ($5-8 billion). It can be noted that the cooperative outcome yields bigger gains, in terms of current account adjustment, than the Nash equilibrium. Nonetheless, the largest part of the adjustment is achieved by simple agreement on targets by the three countries.

Lastly we consider the effects of a dollar depreciation such as to ensure an improvement in the US current account comparable to that resulting from cooperation. In the present exercise an iterative computing routine derives that value of r which ensures a US current deficit equal to that obtained by cooperation. Such a value is then used to derive the new international scenario. The dollar depreciation ranges from 4.2 to 7.6 per cent in Interlink and from 2.7 to 4.2 in Multimod. It is interesting to note that in both models a dollar depreciation allows for a milder fiscal contraction in the U.S. than under cooperation and, therefore, a smaller reduction of output. As

for the other countries the two models yield fairly different results. In Interlink, fiscal policies under depreciation are roughly equivalent to the cooperative case. Consequently output and current balance outcomes do not vary noticeably. On the contrary, in Multimod Japan and Germany are forced to implement more expansionary policies than under cooperation, in order to offset the strong contractionary impact of the dollar depreciation on output (see Table 7). The simulations of the fiscal policy reactions following a dollar depreciation show that in the absence of coordination a set of policy actions equivalent to a "cooperative scenario" can be enforced by exogenous exchange rate changes. It is worth noting that this solution turns out to be more advantageous for the U.S. than for the other countries involved in the game.

IV. Some concluding remarks

Having reviewed in Section I the macroeconomic origins of the US current-account deficit in the 1980s and discussed its key proximate determinants, we have analyzed in Section II a number of alternative policy scenarios for external adjustment designed by international organizations. The outcomes of simulations performed by the IMF and the OECD, using respectively their Multimod and Interlink models, were reproduced here as deviations from reference, or baseline, scenarios.

The main findings of the analysis presented in Section II can be summarized as follows.

i) If the sole macroeconomic policy objective were the restoration of a more balanced configuration of international payments, the optimal strategy would differ considerably according to the two models reviewed above. In the IMF simulation, the largest correction in external imbalances occurs under a "pure dollar depreciation" (scenario 1); in the OECD case, the "fiscal coordination" scenario (scenario 4) yields the best results. The different prescription can be attributed to the endogenous behavior of exchange rates in the IMF model: in this one the real depreciation of the dollar induced by fiscal policies (restriction in the U.S. and expansion abroad) is so large as to partially offset the desired redistribution of real activity from the deficit to the surplus countries;

ii) If macroeconomic policies are directed at redressing payments disequilibria while minimizing output losses worldwide over the whole relevant period, both models suggest that "fiscal coordination" is optimal. But an

important point needs to be underscored: in the IMF model, the concomitant market-determined (real) dollar depreciation is much larger in scenario 4 ("fiscal coordination") than in scenario 1 of no policy changes and exogenous dollar fall. Quite differently, in the OECD simulations real exchange rates hardly move because of a special - and unrealistic - assumption of exogenously fixed exchange rates. This suggests a note of caution in regard to the attitudes prevailing among policy makers and often expressed in public (G-7) pronouncements to the effect that fiscal action alone can be a substitute for exchange rate changes for the purpose of correcting external imbalances[19].

The framework presented in Section II for the purpose of analyzing alternative patterns of adjustment has, however, considerable deficiencies and pitfalls: most importantly, the implicit theoretical structure is rather simplified and "mechanistic" in nature since little attention is given to policy makers' preferences and reactions. The only, indeed rough, strategic hypothesis which underlies scenario 4 is that Japan and Germany respond to the US budgetary restriction by imparting some fiscal stimulus to their economies in order to support real output. A fuller consideration of policy makers' preference functions and strategic behavior is allowed by the game-theoretic framework proposed in Section III. There we have compared three alternative approaches to the problem of international adjustment, involving different degrees of cooperation among national authorities or no cooperation at all. These are:

1) Nash or non-cooperative solution;

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19. Krugman (1987b) and Branson (1988b) strongly argue that changes in fiscal policy would work to correct external imbalances through changes in real exchange rates.

2) cooperative solution;
3) dollar depreciation.

The analysis has been conducted in two different steps. First a general n-country conceptual framework based on a game-theoretic model has been developed, in order to derive the implications of the three alternatives depicted above. Subsequently, the model has been simulated for the U.S., Japan, and Germany, and numerically resolved on the basis of the crucial parameters of the two large multi-country econometric models considered in the previous sections.

The numerical optimization of the three-country framework has shown that if the countries agree about the need to correct the current account imbalances, thus accordingly adjusting their targets while keeping their former output objectives unchanged, a large part of the adjustment can be achieved without explicitly coordinating policy instruments.

The simulation of exogenous exchange rate movements suggests that, if policy makers' reactions are taken into account, a moderate dollar depreciation can constitute an alternative to fiscal coordination, as it improves (worsens) output and the current account balance in the U.S. (abroad) thereby forcing foreign authorities to react. This result, which requires an explicit modelling of policy makers' strategic behaviour, constitutes an improvement towards a greater degree of realism in policy analysis, as compared with simple scenarios of dollar depreciation.

Appendix A

For the purposes of the present analysis we consider an n-country interdependent world. Country i has two targets, output (Q_i) and the balance on current account (B_i), and one policy instrument, fiscal policy (G_i).

The relations between instruments and targets of all the countries involved in the model are expressed by:

(1) $\quad T = C\,\Gamma + r\,\varrho + T^B$

where:

$T = (Q_1, B_1, \ldots, Q_n, B_n)$

is the vector of targets,

$T^B = (Q_1, B_1, \ldots, Q_n, B_n)$

is the value of T at the baseline,

$C = (G_1, \ldots, G_n)$

is the vector of deviations of the i-th country budget deficit, in percentage of GNP, from its baseline value.

Γ is the matrix of fiscal policy multipliers. Since we have assumed an interdependent world, all elements of Γ are different from zero; r, a scalar, is the percentage deviation of the effective exchange rate of the dollar from its baseline value, and ϱ is the vector of exchange rate multipliers, i.e. the effects of a dollar change on target

variables. It should be noted that, in absence of changes in policies and exchange rates from the baseline, the values of the target variables coincide with those of the baseline.

A value of r different from zero means that the exchange rate of the dollar deviates from the (constant) baseline value, thereby affecting the target variables. r can be interpreted as the "exogenous" component of the total change in the exchange rate, basically reflecting the need of a US current account adjustment.

We now assume that each country aims at correcting its current imbalance, i.e. at reducing deficits or surpluses, while keeping the output target unchanged. Since we have assumed that each country has one available instrument and two targets, there will be a policy conflict between countries, giving origin to a Nash (or non cooperative) equilibrium. Following the standard literature such an equilibrium is sub-optimal. Cooperation can improve the situation, leading to a Pareto-optimum.

In order to derive the Nash equilibrium we assume that authorities in country i aim at maximizing a quadratic objective function:

$$(2) \qquad U_i = -\frac{1}{2} T_i R_i T'_i$$

where:

$$R_i = \begin{bmatrix} 1 & 0 \\ 0 & \Psi_i \end{bmatrix}$$

is the matrix of utility weights, i.e. the weights

policy-makers are attaching to the different targets in the objective function. The Nash solution is obtained by maximizing U_i subject to the home country policy instrument:

$$(3) \qquad \max_{C_i} \; U_i$$

The first-order condition for country i is:

$$(4) \qquad \frac{\partial U_i}{\partial C_i} = - T_i \; R_i \; \Gamma'_{ii} = 0$$

The amounts of fiscal policy changes corresponding to the Nash equilibrium are:

$$(5) \qquad C^N = - T^B \; R \; \Gamma'_{ii} \; (\Gamma \; R \; \Gamma'_{ii})^{-1}$$

where:

$$R = \begin{bmatrix} R1 & & \\ & \ddots & \\ & & R_n \end{bmatrix}$$

and the target variables values are at Nash:

$$(6) \qquad T^N = C^N \; \Gamma + T^B$$

The cooperative equilibrium can be derived by the joint maximization of a weighted average of each country's objective functions:

$$(7) \qquad \max_{C} \; U^C \, w$$

where:

$$U^C = (U_1, \ldots, U_n)$$

are the single-country objective functions, and

$$w = (w_1, \ldots, w_n)$$

are the bargaining weights, i.e. the weights attached to each country in the cooperative process.

For each given set of R and w we have a cooperative solution:

$$(8) \qquad C^C = - T^B \, w \, R \, \Gamma' (\Gamma \, w \, R \, \Gamma')^{-1}$$

and the corresponding target values:

$$(9) \qquad T^C = C^C \Gamma + T^B$$

The determination of w follows an original model of optimal bargaining behaviour which assumes that countries aim at achieving a Pareto-efficient solution by the minimum policy effort (See Appendix B). Therefore w is the solution of the following problem of minimization:

$$(10) \quad \min_{w} \quad D = (C^C - C^n)(C^C - C^n)'$$

It is finally assumed that the dollar depreciates, and the resulting change in the Nash equilibrium is analyzed. In the case of a dollar depreciation ($r < 0$) the baseline scenario becomes:

$$(11) \quad T^{B\$} = r\Omega + T^B$$

If the authorities want to keep their targets unchanged at the levels prevailing before the exchange rate shock they must necessarily change their fiscal policies. Indeed the change in the baseline will result in a shift in their reaction functions and in a new Nash equilibrium[20]. Accordingly, the fiscal policy changes corresponding to the new Nash equilibrium are:

$$(12) \quad C^{N\$} = T^{B\$} R \, \Gamma'_{ii} \, (\Gamma \, R \, \Gamma'_{ii})^{-1}$$

and the new values for the target variables are:

$$(13) \quad T^{N\$} = C^{N\$} \Gamma + T^{B\$}$$

---

20. See note 14 in the main text.

Appendix B

Economic theory has produced a large set of models of optimal bargaining behaviour with different theoretical properties[21]. Nonetheless in the present work we have decided to follow an original model which assumes that countries aim at reaching a Pareto-efficient solution by the smallest possible degree of fiscal activism.

This proposition, which constitutes a realistic picture of current policy-makers' behaviour, can be expressed in terms of the following problem of minimization:

$$(i) \qquad \min_{w} \quad D = (C^c - C^n)(C^c - C^n)',$$

where D is the sum of squares of deviations between Nash and cooperative fiscal policies. Superscripts c and n denote the values of fiscal policies in the two different policy settings. It can be shown that D is the Euclidean distance between Nash and cooperative equilibria in the n-dimensional space of fiscal policies.

For example, if we consider the simple two- dimensional case, with a home and a foreign country, we have:

$$(ii) \qquad D^2 = (G^c - G^n)^2 + (G^{*c} - G^{*n})^2$$

where an asterisk denotes foreign variables.

Expression (ii) can be represented in the (G^*, G)

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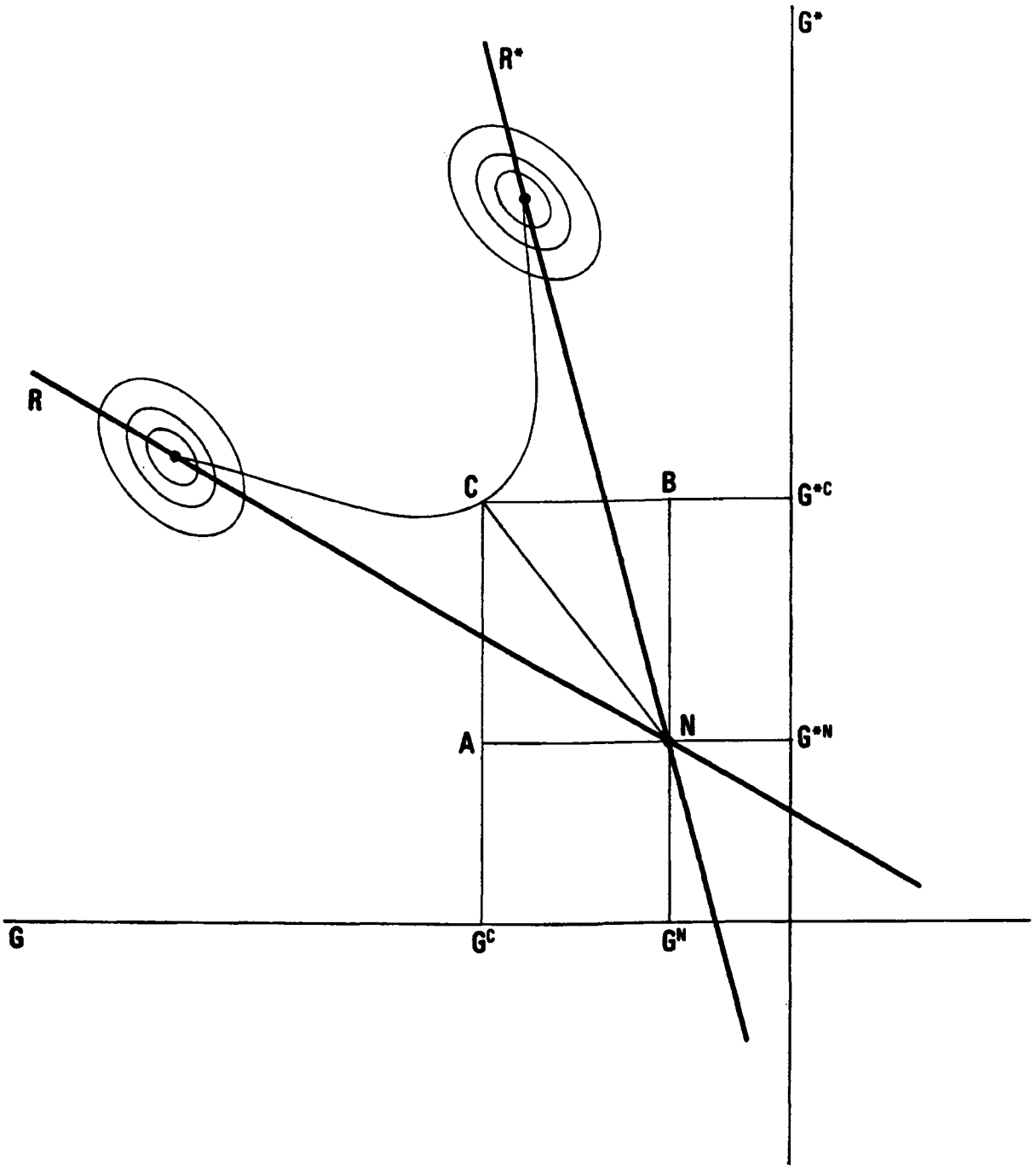
21. For a review of such models see for example Holtham and Hughes Hallett (1987).

space in Figure 3. It corresponds to the square of segment CN. Minimizing expression (ii), i.e. the squared sum of deviations between Nash and cooperative fiscal policies, is equivalent to choosing the minimum distance between C and N.

Figure 3



Appendix C

The main features of the econometric models we are considering can be analyzed in the three-country case starting from the following reduced forms:

$$(1)\quad \bar{Q}_1 = \frac{\partial Q_1}{\partial G_1} G_1 + \frac{\partial Q_1}{\partial G_2} G_2 + \frac{\partial Q_1}{\partial G_3} G_3 + \frac{\partial Q_1}{\partial r} r$$

$$(2)\quad \bar{Q}_2 = \frac{\partial Q_2}{\partial G_1} G_1 + \frac{\partial Q_2}{\partial G_2} G_2 + \frac{\partial Q_2}{\partial G_3} G_3 + \frac{\partial Q_2}{\partial r} r$$

$$(3)\quad \bar{Q}_3 = \frac{\partial Q_3}{\partial G_1} G_1 + \frac{\partial Q_3}{\partial G_2} G_2 + \frac{\partial Q_3}{\partial G_3} G_3 + \frac{\partial Q_3}{\partial r} r$$

$$(4)\quad \bar{B}_1 = \frac{\partial B_1}{\partial G_1} G_1 + \frac{\partial B_1}{\partial G_2} G_2 + \frac{\partial B_1}{\partial G_3} G_3 + \frac{\partial B_1}{\partial r} r$$

$$(5)\quad \bar{B}_2 = \frac{\partial B_2}{\partial G_1} G_1 + \frac{\partial B_2}{\partial G_2} G_2 + \frac{\partial B_2}{\partial G_3} G_3 + \frac{\partial B_2}{\partial r} r$$

$$(6)\quad \bar{B}_3 = \frac{\partial B_3}{\partial G_1} G_1 + \frac{\partial B_3}{\partial G_2} G_2 + \frac{\partial B_3}{\partial G_3} G_3 + \frac{\partial B_3}{\partial r} r$$

Q and B are the deviations of output and the current account balance from their baseline values Q^B and B^B, respectively; G_i denotes the deviation of the i-th country budget deficit, in percentage of GNP, from its baseline value, and r indicates the effective exchange rate of the dollar vis-à-vis the German mark and the Japanese yen.

If we consider for illustration the sole case of country 1 we get, by rearranging (1) and (4):

$$(7)\quad G1 = \left(Q_1 - \frac{\partial Q_1}{\partial G_2} G_2 - \frac{\partial Q_1}{\partial G_3} G_3 - \frac{\partial Q_1}{\partial r} r\right) / \frac{\partial Q_1}{\partial G_1}$$

$$(8)\quad G1 = \left(B_1 - \frac{\partial B_1}{\partial G_2} G_2 - \frac{\partial B_1}{\partial G_3} G_3 - \frac{\partial B_1}{\partial r} r\right) / \frac{\partial B_1}{\partial G_1}$$

Solving the two equations simultaneously and rearranging the terms we get:

$$(9)\quad Q_1 = C_1 B_1 + C_2 G_2 + C_3 G_3 + C_4 r$$

where:

$$C_1 = \frac{\partial Q_1}{\partial G_1} / \frac{\partial B_1}{\partial G_1}$$

$$C_2 = \left(\frac{\partial Q_1}{\partial G_2} - C_1 \frac{\partial B_1}{\partial G_2}\right)$$

$$C_3 = \left(\frac{\partial Q_1}{\partial G_3} - C_1 \frac{\partial B_1}{\partial G_3}\right)$$

$$C_4 = \left(\frac{\partial Q_1}{\partial r} - C_1 \frac{\partial B_1}{\partial r}\right)$$

C_1 is the trade-off for country 1 between a deviation of output from the baseline and a deviation of the current account balance from the baseline, expressed in terms of the same amount of domestic fiscal policy. C_2, C_3, and C_4 measure the improvement (worsening) in the trade-off due to a fiscal

expansion (contraction) in countries 2 and 3 and an exchange rate depreciation (appreciation) in effective terms, respectively. This analysis can be extended to the other countries.

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