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EBS/88/30
Supplement 1

CONFIDENTIAL

February 26, 1988

To: Members of the Executive Board

From: The Secretary

Subject: External Contingency Mechanisms in Fund Arrangements - Preliminary Consideration - Supplementary Information

Attached for the consideration of the Executive Directors is a background paper on contingency mechanisms, which is tentatively scheduled for preliminary consideration on Friday, March 11, 1988.

Ms. Puckahtikom (ext. 8780) is available to answer technical or factual questions relating to Part A, and questions on Part B may be directed to Mr. Hernández-Catá (ext. 4531).

Att: (1)

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External Contingency Mechanisms in Fund Arrangements--Preliminary Considerations--Supplementary Information

Prepared by the Exchange and Trade Relations and Research Departments

(In consultation with other Departments)

Approved by L.A. Whittome and Jacob A. Frenkel

February 25, 1988

This paper provides background information on a number of issues discussed in EBS/88/30 (2/12/88). It consists of two parts covering the following topics:

Part A. Recent Experience with Unforeseen External Developments in Fund Arrangements

Part B. Selected Technical Aspects in the Design of External Contingency Mechanisms

Contents

Part A
Recent Experience with Unforeseen External Developments in Fund Arrangements

I. Experience with Unforeseen External Developments in Fund Arrangements, 1982-87 1/

This section provides a brief account of the experience with unforeseen external developments in stand-by and extended arrangements approved since 1982. Comprehensive reviews of many of these arrangements have been discussed by the Executive Board during periodic reviews of experience under Fund-supported adjustment programs as called for under the Guidelines on Conditionality. 2/ These reviews covered a detailed assessment of the extent to which program objectives were achieved and the factors bearing on program results, which included not only unforeseen exogenous developments but also the strength of program design and implementation. The purpose of this section is to focus narrowly on the role of unforeseen exogenous external developments in adjustment programs. It describes the incidence and scale of such developments in recent Fund arrangements (subsection 2), and their broad implications for adjustment programs (subsection 3). As background, subsection 1 sets out the approach taken to quantify the incidence and scale of exogenously-caused deviations in the current account from program assumptions, and the caveats necessary in interpreting these numbers.

1. The approach and caveats

a. Country coverage

The sample for this exercise covers 125 stand-by and extended arrangements (SBAs and EAs) that were approved in 1982-87 with original expiry dates before end-April 1988 3/ (Appendix Table 3). For these sample arrangements, total Fund purchases amounted to 69 percent of the

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1/ In this section, the year indicated in the country citations refers to the year the arrangement was approved, and not to the program year which could be different for those arrangements that covered more than one program year.

2/ See EBM/86/13 (1/27/86), EBM/87/71 (5/6/87), and two of the staff papers available on those occasions--"Aspects of Program Design," EBS/85/277 (12/17/85) and "External Adjustment and Growth in Fund-Supported Programs--Recent Experience," EBS/87/47 (3/2/87).

3/ Including also two arrangements with later expiry dates: the 1985 EA with Chile and the 1986 SBA with Côte d'Ivoire (in place of which another SBA was approved in principle on December 15, 1987), as well as arrangements that had been canceled by end-January 1988.

amounts committed; 1/ almost one half of these arrangements did not run their full course.

The sample arrangements were for 60 countries with diverse economic structures. Forty-one of these countries are primary product exporters (15 are mineral exporters), 5 are fuel exporters, 2 are exporters of manufactures, and 4 are service and remittance countries. 2/ Also, 16 countries have been classified as market borrowers, with 12 of them classified as heavily indebted.

The sample period, 1982-87, saw considerable fluctuations in the rate of growth of output of the industrial countries, sharp shifts in the terms of trade for developing countries (fuel exporters as well as nonfuel exporters), and broadly declining world nominal interest rates (Appendix Table 4). Thus, except for the absence of experience with sustained increases in world interest rates, the experience of the sample countries over this period can be considered broadly representative of the vulnerability of developing countries to the global economic environment.

b. Technique used in quantifying exogenously-caused deviations in the current account

Assumptions about the near-term course of key external variables are always a central element of adjustment programs. Projections of variables such as the terms of trade, the strength of external demand, and world interest rates are subject to margins of errors, like economic forecasts generally, and outturns can deviate substantially from the values assumed in the program.

An attempt was made in this exercise to quantify the incidence and scale of exogenously-caused deviations in the current account from program assumptions for the sample arrangements. These numbers (which are described in subsection 2 below) are indicative only of the direction and the broad order of magnitude of the deviations, and are more in the nature of simulations than estimates. Such limitations in the use of these numbers arise from the ambiguities of the underlying data, the large approximations, and the judgmental elements involved in the exercise.

The basic technique for quantifying exogenously-caused deviations in the current account outturns from their programmed levels involved the following steps: (i) selecting, as the baseline, the key external

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1/ This calculation excludes four arrangements where the members refrained from making further Fund purchases under the arrangements because of a substantial strengthening in their external position, and arrangements that had not expired by December 1987 or had not been canceled by end-January 1988.

2/ This country classification is based on World Economic Outlook, October 1987, pp. 33-35.

variables and assumptions underlying the program; (ii) estimating the impact on the corresponding current account item of deviations in the outturns of these variables from the assumptions; and (iii) summing the various impacts, netting out shortfalls/excesses for individual items. 1/

The time frame for measuring the deviations was generally the program year, which tended to coincide with the annual cycle of budgetary and other economic policy planning periods for the country in question. In many arrangements where more than one set of program assumptions for a particular program year were available, 2/ the relevant program assumptions chosen as the baseline were those program assumptions that were developed when the policy package for the program period was formulated; these were usually revised program projections. Data for outturns were typically the first estimates available after completion of the program period; frequently, these preliminary estimates were subsequently revised, and sometimes quite substantially.

Thus, the reliability of the numbers derived for individual programs depends on the completeness and quality of data that were presented in staff papers. 3/ Where records were incomplete, the exercise involved particularly rough approximations. Some of the practical complications could be avoided if presentation of the relevant data were systematically tailored to the operation of contingency mechanisms.

1/ Thus, this technique did not rely on simply comparing the overall current account outturn against the programmed target. In terms of the two possible approaches to measuring the deviations from program assumptions discussed in the main paper (EBS/88/30, 2/12/88, pp. 17-18), this technique is essentially akin to the approach described as focusing on the net effect of unanticipated changes in exogenous components of selected current account variables.

2/ For example, in the case of an extended arrangement, assumptions relating to individual annual programs were developed at the adoption of the arrangement but these were usually revised when adjustment policy for a particular annual program was framed; a similar situation applied to arrangements that covered more than one program year.

3/ Under standard presentational requirements, staff papers on use of Fund resources provide data on key external assumptions underlying the program, such as selected commodity prices or average interest costs of foreign debt. At times, however, some assumptions that turned out to be substantially inaccurate or with a major impact had not been explicitly presented or, alternatively, outturns relating to the various assumptions had not been fully presented, making ex post quantification of program deviations, if at all feasible, highly tentative. Usually, the links from the external assumptions to the current account are not quantitatively presented.

c. Coverage of external assumptions

The coverage of the external assumptions underlying the current account was selected on a case-by-case basis, but always included the assumptions highlighted in staff papers as critical. The selection made in this exercise was intended only for illustrative purposes, and without any implication that it would serve as an appropriate coverage for a possible contingency mechanism. Practical considerations for the choice in individual cases included the following criteria: (i) the coverage should involve the minimum possible number of variables that, taken together, provide an adequate coverage of the current account; and (ii) the variables should be confined to those where both assumed and actual values were available or could be reasonably inferred.

In the majority of cases, the baseline assumptions included aggregate export and import prices, and the exogenous component of export volume, where feasible. Disaggregated price and volume data were sometimes used when they were judged to give a more accurate picture (e.g., for countries exporting a few primary commodities). Estimates of import unit values were frequently subject to very large revisions, and quantifying the impact of their deviations was therefore particularly problematic as it involved large measurement errors. Where practical, however, an attempt was made to estimate instead only the impact of deviations in oil prices (where revisions to data tended to be relatively small).

Export volume was considered partly endogenous, being influenced by competitiveness, and partly dependent on the strength of foreign markets. Isolating the effects of deviations in external demand was often not feasible, but in a number of cases (e.g., where the records were more complete, or when very few export items or manufacture exports were involved), it was practical to approximate the impact of unforeseen changes in external demand on exports (generally at the assumed elasticity of export volume to market growth). Approximating the effects of unforeseen changes in marketing arrangements was made only in a very few cases where these effects were clearly dominant.

Assumptions concerning the services account were examined closely in two situations. First, for countries classified as bank borrowers, an attempt was made to estimate the impact on interest payments of unforeseen fluctuations in LIBOR; for practical reasons, further

simplifying procedures were also needed. 1/ A similar effort was not made in other cases where bank debt was relatively small or where interest payments on official debt were rescheduled in any case. Second, for countries where tourism receipts or workers' remittances were important, an attempt was made to approximate the impact of exogenously-caused deviations in these flows from program assumptions. 2/

d. Factors excluded from the quantification

Mainly for practical reasons, this exercise excluded two types of exogenous factors that affected current account developments. First, factors of a domestic character, such as weather conditions or natural disasters, were excluded. In a number of cases, the effects of such factors (e.g., prolonged droughts) on trade flows were considerable but quantification was not possible without detailed information on the lags involved and the nature of the effects. In some cases, the weather-related effects on trade flows had been foreseen in the context of the programs because of the relatively long lag involved (e.g., for export crops with a growing season longer than six months). Second, the side effects of unforeseen external developments were also excluded. For example, in summing the net effect of the various components, this exercise disregarded the offsetting reduction in imports that resulted directly from exogenous shortfalls in export receipts, as in the case of processed exports with a heavy import content or re-exports. The exercise also did not take account of the indirect effects on imports of exogenous shortfalls in exports through constraints on demand.

2. Incidence and scale of unforeseen external developments

The record of the last six years indicates that in 44 percent of the sample arrangements, exogenous external developments deviated substantially from those assumed at the outset of the program (Table 1). In this exercise, for simplicity, "substantial" deviations were defined as exogenous deviations in the current account that

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1/ These included in particular: (1) making a rough estimation of the variable rate component of the total external debt (at the beginning of the program period) of the country in question, and applying the unforeseen change in LIBOR from programmed assumption to this portion of debt; (2) making the calculation only on a gross interest payment basis, without taking account of interest incomes, because of the frequent lack of the relevant data; and (3) taking no account of variations in interest payments due to exchange rate fluctuations among the major currencies. These estimates were often tentative, especially when the base data were weak.

2/ Given the frequent absence of data on assumptions/outturns on key components such as the number of tourist arrivals or workers abroad, these estimates were particularly conjectural, especially since fluctuations of these receipts appeared to have often been partly policy induced.

Table 1. Incidence of Substantial Exogenous External Deviations from Program Assumptions in the Sample Arrangements, 1982-87 1/

	Number of SBAs and EAs in the Sample	Number of Arrangements with Substantial Exogenous External Deviations from Program Assumptions 2/		
		Total	Adverse	Favorable
1982	22	8	5	3
1983	35	20	8	12
1984	21	5	4	1
1985	26	15	6	9 3/
1986	20	7	5	2
1987	1	1	--	1
Total	125	56	28	28
(In percent of total)	(100)	(44)	(22)	(22)

Sources: Staff compilation; and Appendix Tables 7 and 8.

1/ The sample comprised arrangements approved during 1982-87 with original expiry dates before end-April 1988, and the following arrangements with later expiry dates: arrangements that had been canceled by end-January 1988, the 1985 EA with Chile, and the 1986 SBA with Côte d'Ivoire.

2/ In this exercise, "substantial" deviations were defined as exogenously-caused deviations in the current account from program assumptions that exceeded both 0.5 percent of GDP and 25 percent of quota.

3/ Excludes Thailand (1985), a two-year SBA that experienced an adverse exogenous deviation in the first program year (and was included as an arrangement with adverse shocks), and a positive one in the second year.

exceeded both 0.5 percent of GDP and 25 percent of quota. 1/ In the other 56 percent of arrangements, developments in the individual external factors were at times quite large but offsetting so that the overall effect on the programs was relatively limited.

Deviations from program assumptions occurred about evenly in adverse and favorable directions (Chart 1, and see Table 1). As a broad order of magnitude, the average deviation in the adverse direction was 3 percent of GDP and 100 percent of quota (Table 2). The average deviation in the favorable direction was of the same order of magnitude.

Among those cases with adverse shocks, 40 percent faced deviations ranging from 0.5 percent of GDP to 2 percent; for one half, the deviations ranged from 2 percent to 5 percent of GDP; the remaining 10 percent faced shortfalls in excess of 5 percent of GDP (Appendix Table 5). When measured in terms of the Fund quotas, 64 percent of these cases involved deviations equivalent to 25-100 percent of quota, 29 percent involved larger deviations up to 200 percent of quota, and in the remaining 7 percent the deviations were over 200 percent of quota. Broadly similar patterns are evident for cases with unforeseen favorable developments.

The predominant factors in the adverse shocks were weaker-than-expected export price and market developments. The primary product exporting countries (especially those in Africa) were particularly vulnerable; this country group, in fact, accounted for virtually all of the cases where export developments were the decisive factor when shortfalls were recorded. Export excesses tended to be relatively less frequent and benefited mainly the diversified exporters or exporters of manufactures. Other main factors in favorable external developments were unforeseen savings in imports (particularly from the sharp drop in oil prices in 1986) and in interest payments. These results may not be surprising, considering that the period under review was one of weak commodity prices but generally declining world interest rates.

For those arrangements with adverse shocks, total purchases were 65 percent of the amounts committed (see Appendix Table 5). In half of these arrangements, the programs went off track, in part also because of weaknesses in program design and policy implementation. By comparison, only 14 percent of those arrangements with favorable developments did not run their full course, and the average utilization rate for this

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1/ This cut-off point was chosen solely for expositional convenience, without any implication that it was the appropriate one for the individual cases, or that it was the appropriate threshold for the purpose of triggering contingency provisions.

Table 2. Scale of Exogenously-Caused Deviations in the Current Account for the Sample Arrangements, 1982-87 1/

	Order of Magnitude of Exogenously-Caused Deviations in the Current Account from Program Assumptions		Amount of Arrangement Drawn
	In percent of GDP	In percent of quota	In percent of amount of arrangement
Arrangements with adverse shocks			
Average program			
Mean	3.2	100.0	65.0
Median	3.0	75.0	65.0
Arrangements with unforeseen favorable developments			
Average program			
Mean	2.6	128.0	92.0 2/
Median	2.4	80.0	100.0 2/

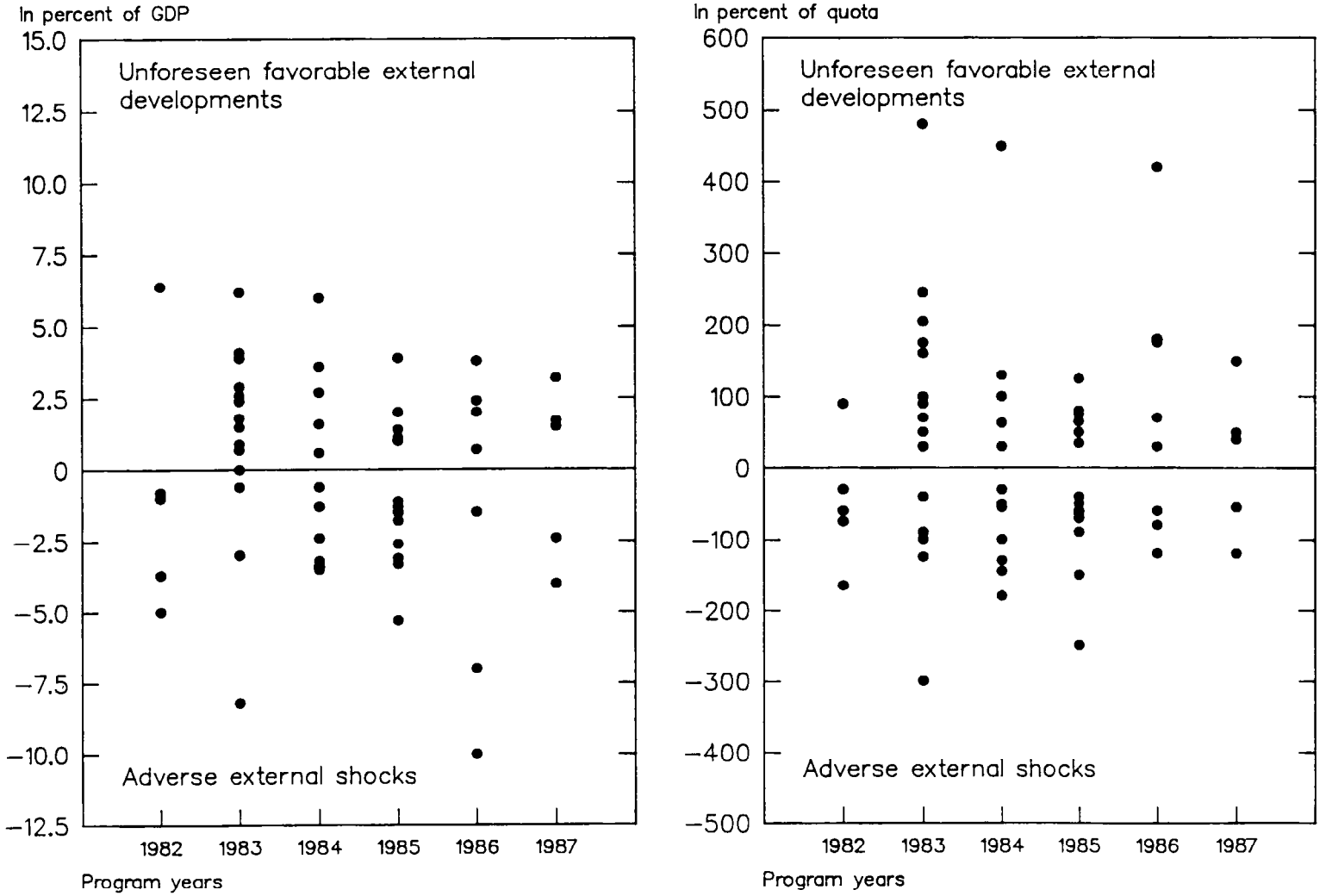
Sources: Staff compilation based on Appendix Tables 7 and 8; and information contained in staff papers on use of Fund resources.

1/ For the coverage of sample arrangements, see footnote 1, Table 1. Confined to cases where exogenously-caused deviations in the current account from program assumptions exceeded both 0.5 percent of GDP and 25 percent of quota. For details of the estimation technique, see subsection I.1.

2/ Excluding arrangements where members refrained from some drawings under the arrangement after a substantial strengthening in their external position.

CHART 1

INCIDENCE AND SCALE OF EXOGENOUSLY-CAUSED DEVIATIONS IN THE CURRENT ACCOUNT FROM PROGRAM ASSUMPTIONS, 1982-87



Source: Staff compilation based on information contained in staff papers on use of Fund resources.

group of arrangements was higher, at 92 percent of the amount committed. 1/

3. Implications for Fund-supported adjustment programs

This section outlines in broad terms the implications for Fund-supported adjustment programs of unforeseen exogenous external developments. More precise analysis of the implications for programs of such developments would require a more detailed country-by-country analysis than is feasible for the current purpose. Such analysis would have to isolate the influence of two other factors having a bearing on the program, namely, the soundness of program design and the effectiveness of policy implementation. 2/ Broad inferences made in this section are thus suggestive rather than definitive, citations are illustrative and not exhaustive, and instances that were counter to the typical situation are often but not always noted.

The experience since 1982 suggests that unforeseen exogenous external developments have been an important factor in determining the extent to which program objectives were achieved. Difficulties were clearly encountered in sustaining the adjustment effort in the majority of cases with adverse shocks. The experience also suggests that unforeseen external developments have not always been a decisive factor in program results. In some instances of adverse shocks, program objectives were broadly attained following policy adaptations. At the same time, in a number of cases with favorable external developments, difficulties in policy implementation outweighed the positive impact of external factors. More generally, in the majority of the arrangements that did not run their full course, external developments turned out broadly as projected (Appendix Table 6).

a. Major adverse shocks

Adverse external shocks have had disruptive effects on adjustment programs, and typically have given rise to additional financing needs for the balance of payments and the budget. Generally, the implications for programs were more serious in those cases where program implementation had already encountered difficulties.

While the nature of the difficulties encountered varied from case to case, a common pattern could be discerned. Usually, net shortfalls in the external current account were translated into a significant deterioration in the fiscal position in a short time, since the scope

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1/ Excluding the four arrangements where members refrained from making further purchases under the arrangement after a substantial strengthening in their external position, and one arrangement where drawings were not envisaged (Nigeria 1987).

2/ Such an analysis would also require a counterfactual comparison between the actual policy outcome against those that would have been otherwise in place.

for quick and full offsetting measures was perceived to be limited. Compensating fiscal measures took time to develop and implement, given that the process of obtaining legislative approval was often lengthy. Some pricing measures (designed to reduce subsidies, for example) could have been implemented speedily, but they would have led to a one-time increase in the price level which may not have been acceptable, if it were to come on top of an ongoing high rate of inflation. Thus, adverse external shocks typically led to larger-than-expected financing requirements of the public sector. Where possible, additional external financing was sought, but in recent years access to such financing was severely constrained.

Thus, with adverse shocks and absent prompt policy adaptations, typically it proved difficult to achieve the original program objectives or to comply with the performance criteria established under Fund arrangements. In the great majority of these programs, both the targets on the external current account and the fiscal position were missed, and performance criteria were also breached (Appendix Table 7). 1/ In a number of these cases, overall program developments also reflected underlying policy weaknesses. Given difficulties in adapting both the policies and targets, in the face of severely limited external financing, there was consequently a large number of program interruptions.

In one half of the cases with adverse shocks, program interruption, if any, proved to be only temporary and the arrangements ran their full course. In some of these, program objectives were achieved and performance criteria met in spite of adverse external shocks (e.g., Malawi 1982). In others, program objectives were adapted and/or performance criteria were waived or modified as appropriate, in light of the new circumstances (e.g., Chile 1984, Morocco 1983, Niger 1985). Margins for maneuver, including policy flexibility, use of reserves, and additional (mostly short-term) external borrowing, were important factors in such outcomes. Nonetheless, these interruptions involved delays in important policy decisions, and led to complications when disbursements of other funds (such as from banks or donors) were closely tied to Fund purchases.

In the other half of the cases with adverse shocks, however, corrective policies took time to develop, and the arrangements expired

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1/ The performance criteria themselves may have been overtaken by the changed circumstances, since provision for automatic adjustments in performance criteria has rarely been made for developments in the current account. Since 1979, only three arrangements have included this type of automatic adjustments and they were for fluctuations in commodity prices. These were South Africa (1982), Chile (1985), and Mexico (1986). In arrangements with automatic adjustments in performance criteria, many adjustments are of a technical or definitional nature or are related to uncertainties regarding the timing of external financing, or serve to specify the policy response if the availability of such financing exceeds the amounts assumed in the program.

(or were canceled) with undrawn balances, typically after a long interruption. In some instances, adaptations in the adjustment package were particularly difficult, given both policy slippages and the fact that, apart from adverse shocks in the current account, there were also shortfalls in the capital account, reflecting delays in disbursements of funds from other sources such as banks and donors (e.g., Malawi 1983, Liberia 1984, Costa Rica 1985, Zaire 1986, and Zambia 1986). In some cases, when the needed policy adaptations became feasible, the underlying circumstances were altered to such an extent that it was more appropriate to replace the existing arrangement with a new arrangement (e.g., Uruguay 1984, Morocco 1985, Côte d'Ivoire 1986, and Togo 1986). In a few cases, much time had been lost and major policy relapses had occurred.

In 40 percent of the cases with adverse developments, with appropriate adjustment in policies and when the adverse shocks gave rise to shortfalls in export receipts (or excesses in cereal imports) under the terms of the compensatory financing facility, purchases were subsequently made in accordance with the compensatory financing policy (see Table 1). In this way, the Fund has provided additional financing--albeit with a lag--to facilitate policy adjustment in response to external shocks related to export receipts/cereal imports.

b. Unanticipated favorable external developments

With unexpectedly favorable external developments, the program objectives were met in the majority of cases (Appendix Table 8). In a number of instances, the program objectives were in fact exceeded and, in particular, the build-up in reserves was larger than envisaged under the program. Also, reliance on foreign borrowing was reduced where the level of external indebtedness was considered very high. Usually, the structure of debt was improved, (nontrade-related) short-term lines of credit were freed up, and certain reserve-related liabilities were reduced. In a few instances, the improvement and strength of the external position was such that the members refrained from making further purchases under the arrangements (e.g., South Africa 1982, Portugal 1983, Thailand 1985, and Korea 1985); there have also been instances of subsequent early repurchases (Portugal 1983 and Korea 1985).

As in those cases with adverse shocks, the nature of policy responses to unforeseen favorable external developments has varied from case to case. In those instances where the program objectives were exceeded, these results typically reflected the authorities' judgment that continued financial restraint was essential, for example, to counter the liquidity impact of the external surplus and to dampen inflationary pressures in order to lay a sound basis for growth. In other cases, larger than expected external financing permitted speedier implementation of structural measures such as exchange and trade liberalization.

A cautious policy approach was also taken by the authorities in cases where the favorable developments were not expected to be permanent, and financial policies were consistent with a build-up of substantial margins relative to the ceilings in Fund arrangements. For example, in the third program year of the 1985 extended arrangement with Chile, the authorities were committed to policies that would maintain the margins in the credit and reserve targets that had been obtained through unanticipated favorable developments in the previous program period; also, it was provided that should copper prices turn out significantly better than assumed, most of the incremental earnings were to be deposited in the Copper Stabilization Fund agreed with the World Bank. Also, in the 1986 stand-by arrangement with Mexico, the oil contingency mechanism envisaged that if the actual oil price rose above the upper threshold level, the ceilings would be lowered for the public sector borrowing requirement and for the related domestic financial limits, whereas the targets for the primary surplus and net international reserves would be raised; these adjustments have been made as envisaged.

In some cases, however, unforeseen favorable developments led to relaxation in adjustment policies which proved difficult to reverse when the favorable developments turned out to be temporary. In these cases, financial policies were more expansionary than expected. Certain planned adjustment actions (such as pricing or tax measures) were postponed; unbudgeted expenditures increased sharply; and price and wage pressures were allowed to develop and competitiveness weakened. In these cases, favorable external developments were not always associated with achievement of program objectives: higher-than-programmed import demand was often a factor in the underperformance in the external current account, and larger-than-programmed budgetary expenditures were reflected in a weaker fiscal position, in spite of better revenue performance. In fact, some of the program targets were missed and/or performance criteria were breached in one fourth of the cases with favorable external developments (e.g., Guatemala 1984, Zaire 1984, Jamaica 1985, and Nigeria 1987). In these instances, complications in other areas of program design and policy implementation offset the positive impact of external developments, causing the programs to go off track.

Table 3. Stand-By and Extended Arrangements in the Sample, 1982-1987 1/, and Related CFF Purchases

Stand-By and Extended Arrangements									CFF Transactions			
					(As % of Quota)						Amount of Purchases	
Country	Effective Date	Type of Arrangement	Original Expiry Date	Original Duration (Months)	Total	Annual Access	Amount (SDR M.)	Amount Drawn 2/ (SDR M.)	Date of Drawing	End of Shtfall Yr	(in mil. SDR's)	(in % of quota)
Nepal	12 23 85	SBA	1 22 87	13	50.0	46.2	18.65	18.65				
Niger	10 5 83	SBA	12 4 84	14	75.0	64.3	18.00	18.00	7 7 83	Dec-82	12.00	50.00
Niger	12 5 84	SBA	12 4 85	12	47.5	47.5	16.00	16.00				
Niger	12 5 85	SBA	12 4 86	12	40.0	40.0	13.48	10.78				
Niger	12 5 86	SBA	12 4 87	12	30.0	30.0	10.11	4.72				
Nigeria	1 30 87	SBA	1 31 88	12	76.5	76.5	650.00	-- 2/				
Panama	4 28 82	SBA	4 27 83	12	44.0	44.0	29.70	--				
Panama	6 24 83	SBA	12 31 84	18	222.2	148.1	150.00	150.00	6 29 83	Dec-82	58.90	87.30
Panama	7 15 85	SBA	3 31 87	21	88.1	50.3	90.00	90.00				
Peru	6 7 82	EFF	6 6 85	36	264.2	88.1	650.00	265.00	6 11 82	Dec-81	199.90	81.25
Peru	4 26 84	SBA	7 31 85	15	75.6	60.4	250.00	30.00	5 1 84	Dec-83	74.70	22.60
Philippines	2 25 83	SBA	2 28 84	12	100.0	100.0	315.00	100.00	3 2 83	Sep-82	188.55	59.90
Philippines	12 14 84	SBA	6 13 86	18	139.6	93.1	615.00	403.00				
Philippines	10 24 86	SBA	4 23 88	18	45.0	30.0	198.00	128.00 2/	10 29 86	Jun-86	224.10	50.90
Portugal	10 7 83	SBA	2 28 85	17	172.5	121.8	445.00	259.30	10 13 83	Mar-83	258.00	100.00
Senegal	11 24 82	SBA	11 23 83	12	75.0	75.0	47.25	5.91				
Senegal	9 19 83	SBA	9 18 84	12	100.0	100.0	63.00	63.00				
Senegal	1 16 85	SBA	7 15 86	18	90.0	60.0	76.60	76.60				
Senegal	11 10 86	SBA	11 9 87	12	40.0	40.0	34.00	34.00				
Sierra Leone	2 3 84	SBA	2 2 85	12	86.7	86.7	50.20	19.00				
Sierra Leone	11 14 86	SBA	11 13 87	12	40.0	40.0	23.16	8.00				
Solomon Islands	6 22 83	SBA	6 21 84	12	75.0	75.0	2.40	0.96				
Somalia	7 15 82	SBA	1 14 84	18	173.9	115.9	60.00	60.00				
Somalia	2 22 85	SBA	2 21 86	12	45.5	45.5	20.10	11.70	3 1 85	Jun-84	32.60	73.80
South Africa	11 3 82	SBA	12 31 83	14	57.2	49.1	364.00	159.00	11 8 82	Jun-82	636.00	100.00
Sri Lanka	9 14 83	SBA	7 31 84	11	55.9	60.9	100.00	50.00				
Sudan	2 22 82	SBA	2 21 83	12	150.0	150.0	198.00	70.00				
Sudan	2 23 83	SBA	2 22 84	12	128.8	128.8	170.00	170.00	3 16 83	Jun-82	39.10	29.60
Sudan	6 25 84	SBA	6 24 85	12	53.0	53.0	90.00	20.00				
Tanzania	8 28 86	SBA	2 27 88	18	60.0	40.0	64.20	57.96 2/				
Thailand	11 17 82	SBA	12 31 83	13	100.0	92.3	271.50	271.50				
Thailand	6 14 85	SBA	3 31 87	22	103.5	56.4	400.00	260.00	6 19 85	Dec-84	185.00	47.90
Togo	3 4 83	SBA	4 3 84	13	75.1	69.3	21.40	21.40				
Togo	5 7 84	SBA	5 6 85	12	49.5	49.5	19.00	19.00				
Togo	5 17 85	SBA	5 16 86	12	40.0	40.0	15.36	15.36				
Togo	6 9 86	SBA	4 8 88	22	60.0	32.7	23.04	8.64 2/				

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Stand-By and Extended Arrangements									CFF Transactions			
					(As % of Quota)						Amount of Purchases	
Country	Effective Date	Type of Arrangement	Original Expiry Date	Original Duration (Months)	Total	Annual Access	Amount (SDR M.)	Amount Drawn 2/ (SDR M.)	Date of Drawing	End of Shtfall Yr	(in mil. SDR's)	(in % of quota)
Turkey	6 24 83	SBA	6 23 84	12	75.0	75.0	225.00	56.25				
Turkey	4 4 84	SBA	4 3 85	12	52.4	52.4	225.00	168.75				
Uganda	8 11 82	SBA	8 10 83	12	150.0	150.0	112.50	112.50				
Uganda	9 16 83	SBA	9 15 84	12	126.7	126.7	95.00	65.00				
Uruguay	4 22 83	SBA	4 21 85	24	300.0	150.0	378.00	151.20				
Uruguay	9 27 85	SBA	3 26 87	18	75.1	50.1	123.00	123.00	10 2 85	Mar-85	66.10	40.40
Western Samoa	6 27 83	SBA	6 26 84	12	75.1	75.1	3.38	3.38	6 29 83	Dec-82	1.15	26.00
Western Samoa	7 9 84	SBA	7 8 85	12	56.3	56.3	3.38	3.38				
Yugoslavia	4 18 84	SBA	4 17 85	12	60.4	60.4	370.00	370.00				
Yugoslavia	5 16 85	SBA	5 15 86	12	48.9	48.9	300.00	300.00				
Zaire	12 27 83	SBA	3 26 85	15	100.0	80.0	228.00	198.00	12 30 83	Mar-83	114.50	50.20
Zaire	4 24 85	SBA	4 23 86	12	55.7	55.7	162.00	162.00				
Zaire	5 28 86	SBA	3 27 88	22	73.6	40.1	214.20	47.60				
Zambia	4 18 83	SBA	4 17 84	12	100.0	100.0	211.50	144.00	5 25 83	Dec-82	97.20	46.00
Zambia	7 26 84	SBA	4 30 86	21	83.2	47.6	225.00	80.00				
Zambia	2 21 86	SBA	2 28 88	24	85.0	42.5	229.80	35.00	2 26 86	Nov-85	68.80	25.40
Zimbabwe	3 23 83	SBA	9 22 84	18	200.0	133.3	300.00	175.00	3 28 83	Dec-82	56.10	37.40

1/ Includes arrangements approved during 1982-87 with orginal expiry dates before end-April 1988 and those that had been cancelled by end-January 1988 (except Cote d'Ivoire 1985 in place of which a new arrangement was approved in principle on 12/15/87, and Togo 1986 for which a new arrangement has also been scheduled for Board consideration shortly).

2/ Amount drawn as of December 1987

3/ Combined export and cereal purchase

Table 4. Global Economic Indicators, 1969-1987

(Annual changes, in percent)

	Average 1969-78 1/	1979	1980	1981	1982	1983	1984	1985	1986	1987
Output 2/										
Industrial countries	3.4	3.4	1.3	1.5	-0.3	2.7	5.0	3.1	2.7	2.4
Developing countries	6.0	4.3	3.4	1.6	1.6	1.6	4.1	3.3	4.0	3.3
Unit value of trade (in SDR terms)										
Exports										
Developing countries	12.1	25.0	36.5	15.4	1.9	-4.5	3.9	-3.9	-25.9	0.5
Fuel exporters	19.6	39.9	62.0	23.1	3.1	-8.7	2.7	-3.3	-49.3	9.3
Nonfuel exporters	7.3	13.1	12.4	7.2	0.7	-1.0	4.8	-4.3	-12.7	-2.5
Imports										
Developing countries	8.0	14.2	17.3	11.4	2.8	-1.1	2.6	-2.5	-11.1	-0.1
Fuel exporters	7.6	10.9	12.4	10.7	3.1	-0.3	2.0	-0.6	-3.6	-0.5
Nonfuel exporters	8.0	15.8	19.3	11.8	2.7	-1.6	2.9	-3.3	-13.7	0.1
Terms of trade (in SDR terms)										
Developing countries	3.8	9.5	16.4	3.6	-0.9	-3.5	1.3	-1.4	-16.7	0.6
Fuel exporters	11.2	26.2	44.0	11.2	0.1	-8.5	0.7	-2.7	-47.4	9.9
Nonfuel exporters	-0.7	-2.3	-5.8	-4.1	-2.0	0.6	1.8	-1.1	1.1	-2.5
World trade prices (in U.S. dollar terms) for major commodity groups 3/										
Manufactures	9.6	13.6	10.4	-3.9	-2.1	-2.8	-3.0	1.2	17.9	12.8
Oil	22.8	46.0	63.6	9.8	-4.1	-11.7	-2.4	-4.8	-49.8	27.6
Non-oil primary commodities	10.3	17.9	5.5	-13.5	-9.9	6.9	4.2	-12.9	-1.1	-1.8
Six-month Eurodollars 4/	7.9 5/	12.2	14.0	16.7	13.6	9.9	11.3	8.6	6.8	7.3

Source: World Economic Outlook, October 1987.

1/ Compound annual rates of change.

2/ Real GDP (or GNP). Composites for the country groups are averages of percentage changes for individual countries weighted by the average U.S. dollar value of their respective GDPs (or GNPs) over the preceding three years.

3/ As represented, respectively, by the export unit value index for the manufactures of the industrial countries; the oil export unit value of the oil exporting countries (according to the former analytical categories); and the index of market quotations for non-oil primary commodities exported by the developing countries.

4/ London interbank offered rate on six-month U.S. dollar deposits.

5/ *Average for 1972-78.*

Table 5. Summary of Performance Under Sample Arrangements with Substantial Exogenous External Developments, 1982-87

Cases with Unforeseen Adverse Exogenous External Developments

	Total	Order of Magnitude of Adverse Exogenously-Caused Deviations in the Current Account from Program Assumptions		
		0.5-2.0 percent of GDP	2.1-5.0 percent of GDP	Over 5 percent of GDP
Number of programs	29	11	15	3
(In percent of total)	(100)	(38)	(52)	(10)
Current account target missed	20	9	9	2
Fiscal target missed	23	8	12	3
Performance criteria missed	19	8	9	2
		(In percent of amount of arrangement) 1/		
Average amount drawn	65	60	73	46

Cases with Unforeseen Favorable Exogenous External Developments

	Total	Order of Magnitude of Favorable Exogenously-Caused Deviations in the Current Account from Program Assumptions		
		0.5-2.0 percent of GDP	2.1-5.0 percent of GDP	Over 5 percent of GDP
Number of programs	31	14	14	3
(In percent of total)	(100)	(45)	(45)	(10)
Current account target missed	6	4	2	—
Fiscal target missed	8	4	3	1
Performance criteria missed	10	4	3	3
		(In percent of amount of arrangement) 1/		
Average amount drawn	92	87	94	96

Source: Appendix Tables 7 and 8.

1/ Excluding arrangements where members refrained from further purchases under the arrangements after substantial strengthening in their external position, precautionary arrangements, and arrangements that had not expired (or been canceled) by end-December 1987 (except the 1985 EA for Chile and the 1986 SBA with Côte d'Ivoire).

Table 6. Purchases Under Sample Arrangements with Substantial Exogenous External Developments, 1982-87 1/

	Total Number of SBAs and EAs in the Sample 1/	Arrangements with Undrawn Balances by Expiry Dates 2/			Arrangements Fully Drawn 2/		
		Total number 3/	Of which: involving substantial exogenous external deviations from program assumptions		Total number 3/	Of which: involving substantial exogenous external deviations from program assumptions	
			Adverse	Favorable 4/		Adverse	Favorable 4/
1982	22	9	2	--	13	3	3
1983	35	20	4	3	15	4	9
1984	21	10	2	--	11	2	1
1985	26	8	3	1	18	3	9
1986	20	7	2	--	4	--	1
1987	1	--	--	--	1	--	1
Total	125	54	13	4	62	12	24

Source: Staff estimates, based on information contained in use of Fund resources documents.

1/ See footnote 1 of Table 1 for the coverage of the sample. In this exercise, "substantial" deviations were defined as exogenously-caused deviations in the current account from program assumptions that exceeded both 0.5 percent of GDP and 25 percent of quota.

2/ Includes only those arrangements that had expired or been canceled by end-December 1987.

3/ Total numbers of arrangements in these two columns do not add up to the total number of sample arrangements of 125 owing to exclusion of 9 arrangements with expiry dates between January and April 1988, for which the relevant data are not yet available.

4/ Excludes arrangements where members refrained from further purchases under arrangements after a substantial strengthening in their external position, and one arrangement where drawings were not envisaged. (These arrangements were classified as fully drawn for the purpose of this table.)

Table 7. Unforeseen Adverse Exogenous External Developments and Performance Under Fund-Supported Adjustment Programs, 1982-87 1/

Approval of Arrangement	Program Period	Order of Magnitude of Adverse Exogenously-Caused Deviations in the Current Account from Program Assumptions		Achievement of Program Targets 2/		Compliance with Performance Criteria 2/	Amount of Arrangement Drawn 3/
		Range in percent of GDP	Range in percent of quota	Fiscal	Current account		
1982							
El Salvador	1982	0.5-2	25-100	m	m	x	100
Liberia	1982	2-5	25-100	x	x	x	64
Malawi	1982/83	2-5	100-200	m	m	m	100
Somalia	1983	... 4/	25-100	x	x 4/	m	100
Sudan	1982	0.5-2	25-100	x	x 5/	... 6/	35
1983							
Chile	1984	2-5	100-200	x	x	x	100
Dominican Rep. (EFF)	1983	0.5-2	25-100	x	x	x	33
Liberia	1983/84	Over 5	100-200	x	m 7/	m 8/	100
Malawi (EFF)	1983	2-5	25-100	x	x	m)	57
	1985	0.5-2	25-100	x	x	x)	
Morocco	1984	2-5	100-200	x	x	m	100
Niger	1984	2-5	25-100	x	m	m	100
Turkey	1983	2-5	Over 200	x	x	x	25
Uruguay	1984	0.5-2	25-100	x	x	x	40
1984							
Belize	1985	2-5	25-100	m	x	x	100
Liberia	1984/85	2-5	25-100	x	m	x	20
Niger	1985	2-5	100-200	x	x	m	100
Peru	1984	2-5	100-200	x	m	x	12
1985							
Costa Rica	1985	0.5-2	25-100	x	x	x	63
Dominican Rep.	1985	0.5-2	25-100	m	x	m	100
Madagascar	1985	0.5-2	25-100	m	x	m	100
Morocco	1985	0.5-2	25-100	x	x	x	5
Thailand	1985	2-5	Over 200	x	m	x	65
Togo	1985	2-5	25-100	m	m	x	100
1986							
Burundi	1987	2-5	100-200	x	x	x	-- 9/10/
Cote d'Ivoire	1986	0.5-2	25-100	x	m	x	24 9/
Madagascar	1987	2-5	25-100	x	x	m	83 9/
Zaire	1986	Over 5	100-200	x	x	x	22
Zambia	1986	Over 5	25-100	x	x	x	15

Source: Staff estimates, based on information contained in staff papers on use of Fund resources.

1/ For stand-by and extended arrangements with original expiry dates before end-April 1988 and those that had been canceled by end-January 1988. Confined to cases where exogenously-caused deviations in the current account from program assumptions exceeded both 0.5 percent of GDP and 25 percent of quota. For details of the estimation technique, see sub-section I.1.

2/ m = met; x = not met.

3/ In percent of amount of arrangement.

4/ No GDP estimates available; deviation from program targets amounted to 7.7 percent of broad money (fiscal) and 11 percent of exports of goods and services.

5/ Excluding transfers; target including transfers met.

6/ No performance criteria set for September and December due to noncompletion of mid-term review.

7/ Most recent estimates (SM/87/170). Large shortfall (by 3.2 percent of GDP) had been estimated in EBS/84/234.

8/ Indicative end-program targets missed.

9/ As of December 31, 1987.

10/ Precautionary arrangement.

Table 8. Unforeseen Favorable External Developments and Performance Under Fund-Supported Adjustment Programs, 1982-87 1/

Year of Approval of Arrangement	Program Period	Order of Magnitude of Favorable Exogenously-Caused Deviations in the Current Account from Program Assumptions		Achievement of Program Targets 2/		Compliance with Performance Criteria 2/	Amount of Arrangement Drawn 3/
		Range in percent of GDP	Range in percent of quota	Fiscal	Current account		
1982							
Costa Rica	1983	2-5	25-100	m	x	m	100
Gambia, The	1981/82	over 5	25-100	m	m	x	100
South Africa	1982	0.5-2	100-200	m	m	m	44 4/
1983							
Bangladesh	1983	0.5-2	25-100	m	m	m	100
Ecuador	1983	2-5	25-100	m	m	x	100
Guatemala	1984	0.5-2	100-200	x	x	x	50
Korea	1983	2-5	over 200	m	m	m	) 100
	1984	2-5	over 200	m	m	m	)
Mexico (EFF)	1983	0.5-2	100-200	m	m	m	100
Niger	1983	2-5	100-200	x	m	m	100
Panama	1983	over 5	over 200	m	m	x	100
Philippines	1983	0.5-2	25-100	m	x	x	32
Portugal	1984	0.5-2	25-100	x	m	x	58 4/
Togo	1983	2-5	25-100	m	m	m	100
Western Samoa	1983	0.5-2	25-100	m	x	m	100
Zaire	1984	over 5	25-100	x	m	x	87
1984							
Togo	1984	2-5	25-100	m	m	m	100
1985							
Chile	1987	0.5-2	25-100	m	m	m	100
Ecuador	1985	2-5	25-100	x	m	m	100
Jamaica	1985/86	2-5	25-100	x	x	x	36
Kenya	1985	0.5-2	25-100	m	m	m	100
Korea	1985	0.5-2	25-100	m	m	m	) 57 4/
	1986	2-5	over 200	m	m	m	)
Mauritania	1985	2-5	25-100	m	m	m	100
Panama	1986	2-5	100-200	m	m	x	100
Senegal	1985/86	0.5-2	25-100	m	m	m	100
Thailand	1986	0.5-2	100-200	m	m	m	65 4/
Uruguay	1986	2-5	25-100	m	m	m	100
1986							
Mexico	1987	2-5	100-200	x	m	m	...
Senegal	1986/87	0.5-2	25-100	x	m	m	100
1987							
Nigeria	1987	0.5-2	25-100	x	x	x	-- 5/

Source: Staff estimates, based on information contained in Staff papers on use of Fund resources.

1/ For stand-by and extended arrangements with original expiry dates before end-April 1988 and those that had been canceled by end-January 1988. Confined to cases where unforeseen exogenously-caused deviations in the current account from program assumptions exceeded both 0.5 percent of GDP and 25 percent of quota. For details of the estimation technique, see sub-section I.1.

2/ m = met; x = not met.

3/ In percent of amount of arrangement; and in percent of the amount available during the program period in question where the arrangements had not yet expired by end-December 1987.

4/ Members refrained from further drawings under the arrangement after a substantial strengthening in their external position.

5/ Arrangement in which drawings were not envisaged.

Part B
Selected Technical Aspects in the Design of External Contingency Mechanisms

II. Estimating the Exogenous Component of Contingent Deviations

The assessment of the impact of unforeseen external developments on a country's balance of payments is an important aspect of the review of Fund programs. The specific character of this assessment, and particularly the extent of aggregation and the degree of complexity involved, naturally depends upon the particular structure of each country's international transactions. In many cases, the estimation of contingent deviations is limited to the detailed examination of a few commodities. For some countries with a diversified pattern of current account transactions, however, a more aggregative approach may need to be adopted. In a similar vein, the importance of unforeseen changes in interest costs varies substantially from country to country.

This section presents a formal approach to the problem of estimating the exogenous component of unforeseen changes in current account variables. To some extent, the approach may be seen as a generalization of a variety of procedures used by Fund missions in the context of program reviews; it also takes into consideration certain aspects of the methodology used in the context of the CFF to deal with exogenous changes in export performance. Because of its generality, the approach would need to be substantially modified (and in many cases greatly simplified) in designing contingency mechanisms for specific countries.

The general approach is developed in subsection 1 and illustrated with reference to merchandise exports. The approach is then extended to the analysis of unexpected changes in merchandise imports (subsection 2) and in certain other current account transactions (subsection 3). Subsection 4 points out the limitations of the approach used in the previous sections and discusses the role of judgment in gauging the exogenous component of unforeseen disturbances in cases where a formal approach cannot be followed. Subsection 5 examines the issues related to the calculation of unexpected changes in interest costs.

1. Merchandise exports

The basic problem can be illustrated by focusing on a simple model of export determination in which, as a first approximation, all parameters are assumed to be known without error. The implications of errors in the estimated parameters for the calculation of contingent deviations are discussed under item b. It must be stressed at the outset that the approach outlined in this subsection is not intended to provide recipes for calculating contingent deviations in specific circumstances. Rather, it attempts to provide a conceptual framework in which the

problem of isolating the exogenous component of unforeseen deviations can be analyzed, under the assumption that the required information (including the relevant parameters and projections for key exogenous variables) is available.

a. Calculation with known parameters

The analysis focuses first on the general case of a diversified exporter facing a less than perfectly elastic world demand for its products. The case of a country that faces a given world market price for its exports is then examined as a special case.

In general, the demand for a country's exports from the rest of the world can be represented by the log-linear function:

$$x = a\,y + b\,(p_f - p_x - e) + u \qquad (1)$$

where x = volume of exports

y = aggregate demand in partner countries, in real terms

p_f = foreign price, expressed in foreign currency

p_x = export price, in local currency

e = exchange rate, in foreign currency per unit of local currency

u = a term which captures the effect of a variety of random disturturbances, some of which may be beyond the country's control

a,b = parameters assumed to be known with certainty.

All variables are expressed in logarithms; y and p_f are assumed to be fully exogenous (beyond the exporting country's control), while p_x and e are assumed to be endogenous (subject to the influence of the country's policies).

The supply of exports is assumed to be a log-linear function of the difference between the export price and the producer price of goods sold in the domestic market (p_d), both expressed in local currency, and domestic output (q_d).

$$x = 1/c\,(p_x - p_d) + h\,q_d + v \qquad (2)$$

where 1/c and h are positive supply elasticities and v is a random disturbance affecting the supply of exports. 1/

Combining equations (1) and (2) yields the reduced form:

$$x = a'y + b'(p_f - p_d - e) + h'q_d + w \qquad (3)$$

where $a' = a/(1 + bc)$, $b' = b/(1 + bc)$ and $h = bch/(1+bc)$.

If p_d, q_d and e are assumed to be subject to the influence of the country's policies, the exogenous component of the unexpected deviation in export volume will be given by:

$$(x - \hat{x})^* = a'(y - \hat{y}) + b'(p_f - \hat{p}_f) + w^* \qquad (4)$$

where hats indicate the projected value of a variable and w* is a judgmental estimate of the effect of random disturbances that are beyond the country's control but for which no baseline projection is available. 2/ Thus, the exogenous deviation in export volume is a weighted sum of the errors in forecasting foreign GNP and world prices plus the net estimated effect of exogenous random disturbances.

Two special cases are worth mentioning in connection with equation (4). First, if the price elasticity of export supply 1/c is infinite, the reduced-form coefficients of equation (4) are simply equal to the structural elasticities of equation (1), i.e., a'=a and b'=b. Second, if the country is a price taker in the world market for the commodities it produces, (i.e., if it faces an infinitely price-elastic foreign

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1/ Equation (2) indicates that the supply of exports rises with the relative profitability of exports. It can be derived by assuming that producers maximize profits from selling goods in both the world and domestic markets and that the output of goods sold in each market involves a specific Cobb-Douglas production function. This supply function allows for different price elasticities of demand for the two types of goods. Also, as noted by Goldstein and Khan (1985), this type of function allows for (imperfect) supply substitution between the home and export markets for a given tradable good (in the manner of a price-discriminating oligopolist) as well as for substitution between production of all tradable goods and nontradable goods.

2/ In principle, the residual errors of forecast u and v could be used to estimate the size of w*, provided that the major disturbances occurring during the period are known to be clearly exogenous (for example, trade restrictions imposed by partner countries or weather-related supply disturbances).

demand for its exports), then $p_x = p_f - e$ and the exogenous component of the deviation in export volume is simply:

$$(x - \hat{x})^* = 1/c\ (p_f - \hat{p}_f) + w^* \qquad (5)$$

Returning to the general case, the exogenous component of the deviation in export value is:

$$(xv - \hat{xv})^* = a'(1 + c)(y - \hat{y}) + b'(1 + c)(p_f - \hat{p}_f) \qquad (6)$$

where $xv = x + p_x - e$ is the value of exports expressed in foreign currency. As before, all variables are expressed in logarithms. If the country is a price taker and the price elasticity of foreign demand (b) is infinite, the exogenous deviation in export value is simply equal to the error in forecasting the world price multiplied by $(1 + c)/c$.

An important special case arises when there is a wedge between the price received by domestic producers of exportable goods and the price at which these goods are sold in world markets, because of export taxes or policy-determined limits on producer prices. If exports are subject to an ad valorem tax at a rate t, the relevant price in the export supply function (2) would be $p_x(1-t)$. If the country is a price taker in world markets, the effect on the volume of exports of an unforeseen decline in foreign prices (equation 5) will be reduced by a factor of t/c and there would be a corresponding reduction in the effect on export value. The case where the price received by domestic producers is artificially held below the world price is equivalent to the case of a 100 percent export tax. In that case, an unforeseen decline in world prices would have no effect on the volume of exports and the effect on the value of exports would simply be equal to the unexpected decline in world prices.

b. The effect of errors in the estimated parameters

In the previous section, it was assumed that all the parameters of the model (the elasticities a, b and c) were known with certainty. In practice, however, these parameters--if they are available--would be estimates based on historical relationships. These estimates might be biased if the underlying estimation technique is inappropriate; or they might be unstable if the corresponding functional relationship is itself unstable. This would result in systematic errors in the calculation of export shortfalls even if the baseline projections for the exogenous variables are unbiased.

Even if the estimated coefficients of the model are stable and unbiased, they will be subject to an estimation error. The question

that might be raised in this regard is whether the error resulting from imprecisely estimated coefficients is large relative to the error in forecasting the relevant exogenous variable. The problem can be illustrated with reference to equation (1), the foreign demand function for the country's exports in real terms. In the general case, when all the coefficients are subject to estimation error, the error of forecasting the dependent variable will involve all the elements of the variance-covariance matrix of estimated coefficients as well as the variance of the disturbance term. 1/ This procedure is complicated and requires information on estimated covariances that is not, in general, readily available. However, the question of assessing the error in estimating the shortfall can be tackled on the basis of certain simplifying assumptions.

Consider the simplest case in which the predicted value of exports $\hat{x}$ is equal to the estimated income elasticity a multiplied by the forecast value of foreign GNP, y. 2/ The error in forecasting exports is then:

$$x-\hat{x} = y\,(a-\hat{a}) + \hat{a}\,(y-\hat{y}) \qquad (7)$$

If $\hat{a}$ and $\hat{y}$ are unbiased estimators of a and y, respectively, and are mutually independent, then:

$$E(x-\hat{x})^2 = E(y^2)\,Var(\hat{a}) + \hat{a}^2\,E(y-\hat{y})^2 \qquad (8)$$

where E is the expected value operator and $Var(\hat{a})$ is the variance of $\hat{a}$.

Equation (8) indicates that the expected squared error of forecasting x is equal to the sum of two terms. The first term reflects the error arising from imprecise knowledge of the estimated elasticity a. The second term is the product of the expected squared error of forecasting foreign GNP multiplied by the square of the estimated elasticity. The right-hand side of equation (8) can be calculated by relying on: (i) data on actual and year-ahead WEO forecasts of GNP for a variety of partner countries; and (ii) estimated elasticities of foreign demand for the exports of developing countries (and the standard errors of these estimates) obtained from various sources.

In one of the most careful econometric studies of LDC exports, Marquez and McNeilly (1987) found that the average income elasticity of

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1/ See Klein (1983), Chapter III.

2/ As before, lower case letters denote logarithms of the corresponding variables.

non-oil imports of industrial countries from developing countries ranged from 1.4 to 1.9, depending on the specific technique used to estimate distributed lags. 1/ This is a remarkable narrow range given that previous estimates of such elasticities ranged from as low as 0.9 (Riedel, 1984) to as high as 4.7 (Dornbush, 1985). The estimates presented by Marquez and McNeilly are free from certain biases--arising from the ommission of relevant variables, aggregation across countries and commodities, and simultaneity--which affected many of the previous estimates. At the same time, the authors found that the income elasticities of LDC non-oil exports differed considerably depending on the importing country--from a low of -0.17 for Japan to a high of 2.2 for the United States--raising questions about the usefulness of elasticities estimated for LDC exports to industrial countries as a group.

The first column in Table 9 shows the income elasticities of the demand for non-oil imports from LDC's by five industrial countries, as estimated by Marquez and McNeilly, and their estimated standard errors. The second column shows the root mean squared (RMS) error of the one-year-ahead forecast of real GNP growth in the corresponding country, taken from Artis' (1988) evaluation of WEO forecasts, and calculated as:

$$\left[\frac{1}{n} \sum_{t=0}^{n} (y_t - \hat{y}_t)^2 \right]^{\frac{1}{2}}$$

where y_t is the rate of growth of real GNP for the relevant country and n is the number of observations. 2/ Column (4) gives the RMS error in estimating the exogeneous deviation, calculated as:

$$\left[\frac{1}{n} \Sigma \, y_t^2 \quad Var(\hat{a}) \right]^{\frac{1}{2}}$$

Finally, column (5) provides the ratio of the RMS error of forecasting the deviation to the RMS of the estimated deviation. This ratio provides an indication of the error stemming from inaccurate knowledge of the elasticity relative to the magnitude of the deviation.

As indicated in column (3), the estimated deviations are relatively large for the developing country's exports to the United States, the Federal Republic of Germany and Canada, reflecting to a considerable extent the large values of the estimated income elasticities. The estimated deviation is substantially smaller for exports to the United

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1/ The estimates presented by these authors are tested for the properties of the error term--normality, homoscedasticity and serial correlation--for the stability of parameter estimates, and for the choice of dynamic specification.

2/ The sample covers annual observations for the period 1971 to 1986.

Kingdom because of a considerably lower estimated elasticity and a comparatively small error in forecasting the growth of real GNP. In the case of Japan the shortfall is very small, in spite of an above-average error in predicting real GNP growth, owing to a negligible income elasticity. Column (5) suggests that the errors stemming from imprecision in estimating income elasticities are small relative to the estimated shortfalls in the cases of the United States, Germany and Canada. The estimated error is a little smaller than the corresponding shortfall for the United Kingdom, but it is substantially larger in the case of Japan.

Income elasticities of the demand for the exports of developing countries also have been estimated by broad categories of importing countries. For example, Bond (1985) estimated demand functions for the exports of four categories of developing countries to industrial countries and to other non-oil developing countries. The relevant estimates are presented in column (1) of Table 10.

Focusing first on the exports to industrial countries, the estimated deviations (column 3) are particularly large for the major exporters of manufactures, reflecting the magnitude of the corresponding income elasticity. The error in estimating the deviation is quite small in relation to the size of the deviation for the exporters of manufactures and relatively small for the low-income developing countries. However, the errors are quite large for middle-income developing countries and for the net oil exporters. Turning to the results for exports to other non-oil developing countries (bottom panel of Table 10), the estimated deviations are comparatively large for exports of middle-income LDCs and net oil exporters and low for major exporters of manufactures. Column (5) shows that the RMS errors are fairly large and exceed the estimated deviation in two cases.

The relatively large magnitude of the RMS errors shown in column (5) of Table 10 for certain categories of exports raises some questions about the appropriateness of using the corresponding elasticities in estimating shortfalls stemming from errors in forecasting the growth of foreign demand. It should also be kept in mind that the econometric results presented by Marquez and McNeilly suggest that the income-elasticity of foreign demand for the exports of developing countries varies significantly from one importing country to the other. Whenever possible, therefore, the use of bilateral elasticities would seem preferable as it would avoid some of the biases that could result from aggregating exports by broad groups of countries.

2. Merchandise imports

The method illustrated above in subsection 1 can be applied to the calculation of shortfalls for merchandise imports. The demand for imports in real terms can be represented by the equation:

$$m = \alpha y_d - \beta(p_m - p_d - e) + \varepsilon \qquad (9)$$

where y_d is a measure of domestic demand (an endogenous variable that is clearly subject to the influence of domestic policy variables). p_m is the price of imports expressed in foreign currency, and ε is a random vector. To be sure, domestic demand is influenced by exogenous variable such economic activity, prices and interest rates in the rest of the world. But the task of isolating the exogenous component of changes in domestic demand would be exceedingly complex and would require information on a large number of parameters--such as the marginal propensity to spend and the interest-sensitivity of investment--for which estimates, if they are available, are often unreliable and controversial.

In principle, the price of imports in foreign currency would simply be equal to an appropriately weighted average of foreign export prices. In practice, however, this relation may not hold exactly because of problems in the measurement of the relevant price indexes. 1/

$$p_m = \gamma p_f \qquad (10)$$

where γ is a parameter that may differ somewhat from 1.

Using equations (9) and (10), the exogenous component of the shortfall for the value of imports can be computed as:

$$(mv - \hat{mv})^* = (1-\beta)\ \gamma(p_f - \hat{p}_f) + \omega^* \qquad (11)$$

where ω^* is a vector of random disturbances deemed to be beyond the country's control.

3. Other current account transactions

Formulas similar to those discussed in the previous sections for trade flows could be used to isolate the exogenous component of unforseen changes in certain other current account transactions. For example, expenditures on international travel appear to be statistically related to disposable income in the originating country as well as to relative prices adjusted for transportation costs. Tourist expenditures also have been found to be significantly affected by a variety of

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1/ *Also, as in the case of other historical relations discussed in* this section, the link between foreign prices and the domestic import price may involve lags.

factors such as duty-free allowances for returning travelers, foreign exchange restrictions, international fairs, and the opening up of new transportation routes (see, for example, Artus, 1972).

Estimates of income elasticities for total expenditures abroad by tourists in selected industrial countries have been estimated by Artus (1972) and Bond (1979). These estimated elasticities are fairly large and have relatively small standard errors. In principle, these elasticities could be used to compute the deviation in tourist receipts in any host country resulting from unforeseen changes in disposable income in the relevant industrial country. However, this would be based on the questionable assumption that the income elasticity of demand for tourism in industrial countries is the same regardless of the country of destination. There are very few econometric studies on tourism in developing countries; estimated income elasticities of the demand for tourism are given in Table 11 for Barbados, (for which a very complete study is available), The Bahamas and Mexico.

The value of workers remittances also has been found to be sensitive to changes in aggregate demand in labor importing countries. For example, Swamy (1981) found that inflows of workers remittances into a variety of developing countries were statistically related to the trend value of GDP in the host country, which was used as a proxy for the demand for labor. 1/ The relevant estimates are summarized in Table 12. Although the results appear to be statistically significant, the information required to assess the error in estimated shortfalls stemming from imprecise knowledge of the estimated elasticities is not available.

4. Practical limitations of the formal approach

While the framework developed in the previous sections could play a useful role in calculating exogenous shortfalls in many instances, it should be recognized that implementation of the approach would raise a number of practical difficulties. First, the proposed formulas involve the use of baseline projections for the exogenous variables and there are questions about the adequacy of certain WEO projections for the purpose of establishing a baseline projection (See Section III of this Supplement). Second, the formulas require estimates of certain parameters (such as income and price elasticities) which may not always be available. Since derivation of the required estimates for all the

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1/ Swamy also found that, for certain countries, the value of workers' remittances was significantly related to the deviation between actual and trend GDP. It may be noted that workers' remittances have been found to be significantly influenced by several factors that are within the control of the labor exporting country, such as interest rate and exchange rate policies. See Kopits (1987), p. 22.

countries that would be potential beneficiaries of an ECM could take time, such estimates initially might be taken from existing studies on similar countries, complemented by judgmental adjustments. Finally, data on actual values of the relevant exogenous variables might be of poor quality and might not be available on a timely basis.

Reliance on econometric estimates for the values of the required parameters also would pose problems if these estimates were to be biased or if they were to be derived from unstable historical relationships. Moreover, even unbiased and stable estimates would be subject to estimation error. Accordingly, the calculation of contingent deviations also would be subject to error--not because of errors in forecasting exogenous variables, since these would be a part of the deviation itself, but rather because of imprecision in estimating the required coefficients. The illustrative calculations presented above in subsection 1.b suggest that, in some cases, errors of this type are fairly large in relation to the estimated deviations.

It seems clear from the points made above that the calculation of contingent deviations would need to rely to a considerable extent on judgmental estimates. In particular, judgment will be required if the deviation cannot be modeled (because it results from a random disturbance or for any other reason); and if estimates of the required coefficients or baseline projections for the relevant exogenous variables are not available. Even if the shortfalls result from unpredictable disturbances, however, it may be relatively easy to determine that the shortfall was beyond the member's control, such as in the case of natural disasters. Also, it would be logical to regard shortfalls resulting from certain external disturbances--such as the effect on exports of strikes in partner countries or the impact on workers' remittances of sudden administrative actions in host countries--as being beyond the member's control. In those cases, the size of the shortfall would need to be estimated judgmentally; an examination of the forecast error for the relevant period also might be helpful, provided that an estimated equation is available for the variable in question.

Formulas also might be exceedingly difficult to establish in the case of most foreign trade policy measures affecting the country's exports (except in the case of import duties where the resulting effects could be calculated provided that information on the price elasticity of partner country imports is available.) Export shortfalls stemming from quotas or other quantitative restrictions imposed by partner countries would need to be based on judgment. Even the question of whether foreign trade actions are entirely beyond the affected country's control might be difficult to answer, for example in the cases of measures allegedly taken in response to "unfair trade" practices by the member--countervailing or antidumping duties--or in the case of so-called "voluntary export restraints."

5. Interest payments

This subsection deals with the calculation of the exogenous component of unforeseen changes in the cost of external borrowing. The analysis focuses first on the effect of unforeseen changes in the benchmark rate (i.e., the actual interest rate charged on borrowings minus the risk premium), expressed in nominal terms. This is followed by a discussion of the effects of unexpected changes in inflation and in the risk premium. The section concludes with a brief review of the scope for hedging unforeseen changes in interest rates in world financial markets.

a. Changes in the world interest rate

The cost of borrowing (B) can be defined as the product of the nominal interest rate (r) times the stock of external debt measured in current prices (D). The unforeseen component of the cost of borrowing will then be:

$$B - \hat{B} = r(D - \hat{D}) + \hat{D}(r - \hat{r}) \qquad (12)$$

where hats indicate the value of the corresponding variable specified in the baseline projection. The first term on the right-hand side of equation (12) represents the unexpected component of the cost of borrowing resulting from an unforeseen change in the nominal value of the debt. The second term reflects the effect of unforeseen changes in the interest rate given the projected stock of debt.

Changes in the stock of debt can result from changes in its real value or from erosion due to inflation. Accordingly,

$$D - \hat{D} = p(d - \hat{d}) + \hat{D}\pi^{u} \qquad (13)$$

where $d = D/p$ is the real value of the debt, p is the relevant price deflator, and $\pi^{u} = (p-p)/p$ is the unexpected component of the rate of inflation.

Combining equations (12) and (13) gives the formula:

$$B - \hat{B} = rp(d - \hat{d}) + r\hat{D}\pi^{u} + \hat{D}(r - \hat{r}) \qquad (14)$$

The first term on the right-hand side of (14) represents the effect on the cost of borrowing of an unforeseen change in the real value of the debt. For the purpose of a contingency mechanism this term could be

disregarded on the grounds that a deviation in d from the level specified in the baseline could be viewed as being within the control of the debtor country. It might be argued that, if a part of the external financing anticipated in the baseline were not forthcoming, this would constitute a deviation beyond the control of the debtor country. It should be noted, however, that such a deviation would imply an unforeseen reduction in the cost of borrowing and therefore would not call for contingent financing under an ECM, but rather for repayment of debt or reserve augmentation. The term $\pi^{u}r\ D$ represents the extent to which the cost of borrowing is affected by an unexpected change in prices. This term generally can be ignored as being of second order of magnitude. 1/

In view of the points made above, the exogenous component of the unexpected change in interest costs could be obtained simply by multiplying the stock of debt at the beginning of the period by the difference between actual and predicted values of the international interest rate. 2/

$$(B - \hat{B})^{*} = \hat{D}(r - \hat{r}) \qquad (15a)$$

If it is determined that contingency mechanisms should be based on unexpected real (rather than nominal) interest rates, the formula would be:

$$(B - \hat{B})^{*} = \hat{D}(r - \hat{r}) - \hat{D}(\pi - \hat{\pi}) \qquad (15b)$$

Equation 15b implicitly assumes that the effects of unexpected inflation on the cost of borrowing are not to be covered by contingency mechanisms because they are offset by a reduction in the real value of the debt. It might be argued, however, that contingencies should cover the cost of restoring the real value of the debt at higher interest rates. In that case, the term $D\pi^{u}(r-r)$ would need to be added to the right-hand side of equation (15b). In view of the typical magnitude of errors in projecting inflation and interest rates (discussed in Section 4 of this Supplement), this term is likely to be very small in most cases.

1/ Suppose the interest rate is projected to be 20 percent and the error in forecasting inflation is one percentage point (which is just above the mean absolute error in projecting U.S. inflation over the period 1978-87 on the basis of a naive forecast. The term $r\pi^{u}D$ would then be 0.002D and would be less than 1/4 percent of GDP even if the debt to GDP ratio were 100 percent.

2/ Illustrative calculations of exogenous shortfalls in the cost of borrowing under various assumptions are provided in Section IV of this Supplement.

b. Changes in the risk premium

The preceding discussion has focused on deviations in the reference, or benchmark international interest rate on the assumption that changes in the risk premium result from the country's actions. It might be argued, however, that such changes might reflect to some extent changes in factors beyond the country's control--such as movements in commodity prices or in levels of world economic activity. In principle, equations 15a or 15b could be modified to incorporate these effects, but this would require a quantitative evaluation of the impact of exogenous variables on the risk premium.

In one of the few econometric studies on the issue, Edwards (1984) analyzed the behavior of spreads between the interest rates charged on loans to 20 capital importing countries and the LIBOR. 1/ He found that the spreads were statistically related to a few variables--the debt/GNP ratio, the debt service/exports ratio, and the ratio of official reserves to GNP. All these variables are affected by the country's policies although, of course, the debt service ratio could be influenced by exogenous factors affecting export performance. The estimated coefficient on the ratio of the current account deficit to GNP--an endogenous variable which may include an exogenous component--was statistically insignificant in half of the regressions and, contrary to expectations, suggested that an improvement in the current account would lead to a rise in the spread. Further tests by Edwards (1986) broadly confirmed these results. Again, all of the variables that contributed to the explanation of the spread were clearly within the control of the debtor countries. 2/

c. Hedging interest costs in financial markets

The world financial markets provide a variety of instruments through which borrowers can hedge against unforeseen rises in market interest rates. These instruments can be described under three broad categories: futures contracts, options, and over-the-counter interest rate agreements.

In 1982, the London International Financial Futures Exchange (LIFFE) introduced interest futures contracts on a number of financial instruments including three-month Eurodollar deposits. Since then, the Singapore International Monetary Exchange, and the Chicago Mercantile Exchange have introduced futures trading in Eurodollar deposits and other key short-term instruments, such as U.S. Treasury bills and large certificates of deposit. Futures markets provide a framework in which

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1/ The results were obtained from pooled cross-section and time-series data for the period 1976-80, and were based on data for interest rates on public and publicly guaranteed Eurodollar loans.

2/ The only exception refers to an equation for the spread on Mexican bonds, which includes the price of oil as an explanatory variable.

institutions can hedge against large swings in interest rates by buying or selling futures contracts--i.e., contracts for the future delivery of financial assets at an agreed upon interest rate. Market participants are typically large private corporations and financial institutions. The markets are efficient and can be accessed by making only a small initial margin payment. However, the use of financial futures contracts for hedging purposes requires substantial planning and a detailed knowledge of trading mechanisms and procedures. Futures contracts have a time horizon usually limited to 12 months.

Interest rate options were introduced in the major option exchanges in the early 1980s. 1/ Since 1985, the Philadelphia Stock Exchange and the LIFFE have traded option contracts on three-month Eurodollar deposits with a trading unit of US$1 million. A borrower planning to raise Eurodollar funds at some time during the next several months can hedge against increases in the Eurodollar rate by buying a suitable number of put option contracts. These options will give the holder the right to sell Eurodollars at the strike price at or before a predetermined date. If the Eurodollar rate increases, the price of the put option will rise, resulting in a gain which will compensate for the increased interest cost on the loan to be serviced. As in the case of financial futures, option trading requires in-depth knowledge of the option exchanges involved and careful monitoring of trading activities. Option contracts are of limited duration and involve transaction costs (brokerage fees and margin requirements) that can be very substantial.

Investment bankers now provide an alternative to dealing in exchange-traded contracts by offering a variety of over-the-counter financial services delivered directly to the client and tailored to his specific needs. Some financial institutions offer "ceiling rate agreements" which guarantee a maximum interest rate to borrowers. These agreements extend the interest rate guarantee for periods exceeding the normal maturities available on the exchanges and involve payment of an up-front fee quoted as a percent of the contract amount.

1/ An option is the right, but not the obligation, to purchase or sell a stated number of securities within a predetermined period at a specified price (the strike price). The option to purchase a security is known as the call option, while the right to sell a security is referred to as the put option. The option expires if it is not exercised by the expiration date.

Table 9. Error in Forecasting the Growth of LDC Exports to Selected Industrial Countries: Relative Contribution of Error in Forecasting Foreign GNP and Error in Estimating the Income Elasticity.

LDC Non-Oil Exports to:	(1) Estimated Elasticity (Standard Error)	(2) Root mean square of: Error in Forecasting Foreign GNP Growth	(3) Root mean square of: Estimated Deviation	(4) Root mean square of: Error in the Estimated Deviation	(5) Ratio (4)/(3)
Canada	1.87 (0.7)	2.18	4.08	2.72	0.67
Germany	1.99 (0.6)	2.07	4.11	1.48	0.36
Japan	-0.17 (1.1)	3.26	0.55	5.65	10.27
United Kingdom	0.81 (0.5)	1.75	1.42	1.34	0.94
United States	2.15 (0.4)	1.92	4.13	1.52	0.36

Notes: The estimated elasticities and their standard errors are from Marquez and McNeilly (1987). Root mean square (RMS) errors are in percentage points.

Column (1) is the RMS error in forecasting the growth of real GNP in the relevant country.

Column (3) is obtained by multiplying column (2) by the estimated income elasticity given in column (1).

Column (4) is the RMS error in estimating the shortfall, obtained by multiplying the variance of the elasticity by the mean square of foreign GNP growth, and taking the square root of the product.

Table 10. Error in Forecasting the Growth of Non-Oil LDC Exports to Selected Areas: Relative Contribution of Error in Forecasting Foreign GNP/GDP and Error in Estimating the Income Elasticity

Non-Oil LDC Exports	(1) Estimated Income Elasticity (Standard Error)	(2) Root mean square of Error in Forecasting GNP Growth	(3) Root mean square of Estimated Deviation	(4) Root mean square of Error in Estimated Deviation	(5) Ratio (4)/(3)
Exports to Industrial Countries					
By low-income LDCs	1.28 (0.33)	1.58	2.02 [0.09]	1.11	0.55
By middle-income LDCs	1.42 (0.95)	1.58	2.23 [0.68]	3.25	1.46
By major exporters of manufactures	2.91 (0.20)	1.58	4.59 [4.71]	0.68	0.15
By net oil exporters	1.97 (2.74)	1.58	3.11 [0.90]	9.28	2.98
Exports to other non-oil LDCs					
By low-income LDCs	1.36 (0.65)	1.72	2.34 [0.03]	2.69	1.15
By middle-income LDCs	2.84 (0.84)	1.72	4.89 [0.31]	3.49	0.71
By major exporters of manufactures	0.85 (0.25)	1.72	1.47 [0.32]	1.04	0.71
By net oil exporters	1.94 (0.86)	1.72	3.34 [0.24]	3.58	1.07

Note: The estimated elasticities and their standard errors are from Bond (1985), Table 9. Root mean square errors (RMS) are in percentage points. Numbers in square brackets in column (3) are calculated by multiplying the RMS error of the estimated deviation by the 1986 value of exports for the corresponding category and are expressed in billions of U.S. dollars. See notes to Table 9 for the definition of other concepts.

Table 11. Estimated Income Elasticities of Foreign Demand for Tourism in Selected Developing Countries 1/

Country of Destination	Country of Origin of Tourists	Estimated Income Elasticity	Sample Period
The Bahamas	United States	1.77 (3.6)	1974:1-1979:4
Barbados	United States	6.58 (3.0)	1956-1983
	Canada	5.54 (3.0)	
	United Kingdom	1.55 (2.2)	
Mexico 2/	United States	3.6	1960-1975

Sources: The Bahamas: Recent Economic Developments, SM/82/71, Appendix I; Barbados: Clarke, Wood and Worrell (1986); Mexico: Clavijo and Gomez (1977).

1/ The income elasticities are estimated with respect to the following variables: The Bahamas, number of U.S. stopover visitors; Barbados, bednights in luxury hotels, winter season; Mexico, gross earnings from tourism (including border transactions) in constant prices. Figures in parenthesis are t statistics.

2/ The coefficient reported is the long-run income elasticity with respect to real personal disposable income in the United States. The short-run elasticities are 1.7 for income in the current year and 1.9 for income in the preceding year. Elasticities are evaluated at the point of means on the basis of the estimated coefficients of a linear regression. The t-statistics for these coefficients are 2.4 and 3.9 respectively.

Table 12. Income Elasticities and Estimated Deviations in Forecasting Workers Remittances for Selected Developing Countries

Labor Exporting Country	Labor Importing Country	Estimated Income Elasticity 1/	RMS Estimated Deviation 2/
Yugoslavia	Germany	1.82	3.76
Greece	Germany	1.17	2.42
Turkey	Germany	1.67	3.45
Portugal	France	1.86	2.88
Morocco	France	1.44	2.23
Tunisia	France	1.58	2.45
Algeria	France	0.94	1.46
Mexico	United States	2.27	4.36
Jamaica	United States, United Kingdom	3.19	5.55

1/ Elasticity of the value of workers remittances with respect to trend nominal GNP in the labor importing country. From Swamy (1981).

2/ Root mean square error in forecasting the growth of real GNP in the relevant labor-importing country, from Artis (1988), multiplied by the corresponding income elasticity. In percent.

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III. The Forecasting Record of the World Economic Outlook

The design of contingency mechanisms would require the adoption of a baseline scenario as a point of reference against which unanticipated movements in key exogenous variables could be assessed. In this regard, the projections developed in the context of the World Economic Outlook (WEO) could provide a useful framework. Although other world projections exist, few are as comprehensive and detailed in terms of both coverage of the economies of industrial and developing countries and the range of variables that are of potential interest to an external contingency mechanism (ECM). Moreover, the WEO forecasting procedures are familiar to the Fund's member countries as well as to the staff.

A thorough evaluation of the accuracy of WEO forecasts, and of the methodology underlying such forecasts, has recently been provided by Artis. 1/ The remainder of this section reviews the major findings of Artis's analysis and of a study by the World Bank staff 2/ on the relative accuracy of alternative forecasts for primary commodity prices, emphasizing their implications for the possible use of WEO forecasts in the context of ECMs. The section concludes that WEO projections for key exogenous variables could play a useful role in constructing baseline projections for contingency mechanisms. At the same time, certain possible limitations are noted with respect to the scope and frequency of update of WEO projections, and questions are raised about the efficiency of forecasts for individual developing countries and about the role of technical assumptions regarding certain key WEO variables.

1. Evaluating forecast accuracy

WEO forecasts are prepared semiannually for a large number of variables, although more frequent updates are provided on some occasions. WEO forecasts are conditional upon assumptions made in each forecasting round about the expected path of exchange rates and oil prices, as well as the stance of monetary and fiscal policies over the forecast period. The range of variation of interest rates in major industrial countries and in world financial markets is also circumscribed by the assumptions made concerning national economic policies. This approach is dictated by considerations related to the technical difficulty of predicting these variables and to the sensitivity of projections about key financial variables such as the exchange rate.

The assumptions made about these factors may have a considerable impact on WEO projections. For instance, alternative assumptions about

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1/ See Artis, M.J., "How Accurate Is the World Economic Outlook? A Post Mortem on Short-Term Forecasting at the International Monetary Fund," SM/87/297, December 23, 1987.

2/ Duncan, R., "EPDCS' Primary Commodity Price Forecasting: Procedures and Performance" (World Bank, internal draft, May 28, 1986).

oil prices or the stance of macroeconomic policies in major countries may strongly influence price and output forecasts worldwide and thus contribute to the WEO's forecasting error for many countries.

WEO forecasts are usually produced at least twice a year, once in the Spring and once in the Fall. The forecasting horizon extends over a two-year period, although Artis' evaluation focuses only on the accuracy of current year and year-ahead forecasts. The former relates to the Spring WEO forecast for the current year, and the latter to the Fall WEO forecast for the year ahead. Artis's analysis covers WEO forecasts for the major industrial countries over the period 1971-86 and for the less developed countries over the period 1977-86.

Forecasting accuracy may be assessed by different criteria and with reference to alternative diagnostic statistics. In the first instance, it may be evaluated by considering the extent to which forecast values differ from the realized values of certain variables. This involves an examination of several statistics such as the average absolute error and the root mean squared error (RMSE) of the forecast. These diagnostic measures provide an indication of the extent to which forecasts differ from outturn values over a given period, irrespective of the sign of the deviation. The RMSE has the advantage of penalizing large deviations more highly than smaller ones. An alternative measure of accuracy, which facilitates comparisons of forecasting errors for different variables, is the so-called Theil statistic. It is defined as the ratio of the RMSE of the forecast to the RMSE of an alternative forecast for the same variable. Following common practice, Artis takes the alternative forecast to be a "naive" forecast in which the predicted value of a variable in year t is equal to the value of that variable in year t-1.

Another important aspect of forecasting accuracy relates to efficiency, which refers to the extent to which forecast errors could be used to improve the accuracy of predictions. Where forecast errors vary systematically with the forecasts themselves, efficiency is said to be low. Forecast efficiency is closely related to bias, which occurs when prediction errors for a variable are on average significantly different from zero, implying that forecast values tend to either over- or under-predict realized values.

To assess whether WEO forecasts suffer from inefficiency or bias, Artis examines the results of so-called realization-forecast regressions. These regressions are of the form: $R(t) = a + b\,F(t) + u(t)$, where $R(t)$ and $F(t)$ denote actual and forecast values, respectively, at time t; a and b are the intercept and slope coefficients, respectively; and $u(t)$ is the forecast error at time t. A perfect forecast would yield an intercept as zero, a slope of unity, and a coefficient of determination (R^2) equal to 1.00. Where forecasting efficiency is low, or if a systematic bias is present, significant deviations of the regression estimates from their expected values would occur, implying that forecast errors could be

systematically explained by the forecasts themselves. A somewhat more narrow test of bias would involve an examination of whether the average forecast errors are significantly different from zero.

2. WEO forecasting accuracy: what the record shows

The accompanying tables summarize the results of Artis' inquiry into the accuracy of WEO forecasts. The tables provide an overview of the diagnostic statistics computed by Artis for current year and year-ahead WEO forecasts for key macroeconomic variables in the Group of Seven (G-7) industrial countries and the non-oil developing countries, for commodity prices, and for the developing country's export earnings. They also summarize Artis' findings regarding the accuracy of WEO forecasts for the G-7 industrial countries in comparison with the forecasts prepared by the OECD and by national forecasting agencies in several G-7 countries.

a. Macroeconomic variables

The accuracy of WEO forecasts for some of the macroeconomic variables of greatest relevance to external contingency mechanisms is summarized in Table 13. The variables considered are the growth of output, inflation, and the growth of export and import volumes for the G-7 industrial countries and the non-oil developing countries.

(i) G-7 countries

For the industrial countries, the current year output and inflation forecasts are particularly accurate. They show low average absolute errors compared to the mean absolute value of the series, and the Theil coefficients indicate that the RMSEs of the WEO forecasts are considerably smaller than those of the alternative naive forecasts. The results of the realization-forecast regressions provide little or no indication of inefficiency. As might have been expected, the year-ahead forecasts are less accurate than the current year forecasts. Nevertheless, the year-ahead forecasts are fairly satisfactory, with all the Theil statistics well below unity and the average absolute errors considerably below the mean absolute values of the relevant series.

The accuracy of the forecasts for the growth of trade volumes appears to be broadly similar to that of the output and inflation forecasts although the realization-forecast regressions suggest that efficiency may be marginally lower. The export and import volume forecasts demonstrate similar accuracy for both current year and year-ahead forecasts; specifically, the Theil statistics corresponding to both forecast horizons are of approximately the same low magnitude, less than 0.4.

Artis's examination of the forecast errors for the growth of output in industrial countries suggests a degree of "output optimism" in the WEO projections. The test results for individual G-7 countries generally do

not indicate significant bias, but the tests for forecast errors pooled across countries point to a small but significant "optimistic" bias for both current year and year-ahead forecasts. This result appeared to reflect the pattern of errors during the second half of the 1970s, perhaps reflecting the fact that slower growth in many countries was only gradually perceived as a break in trend rather than as a cyclical downturn. Inspection of the forecast errors for output growth in the 1980s did not provide evidence of continued bias. There is no indication of bias with regard to WEO forecasts for inflation in G-7 countries.

(ii) Non-oil LDCs

The WEO forecasting record for the developing countries is considerably poorer than for the industrial countries. With regard to the non-oil developing countries as a group, the average absolute errors are reasonably low in relation to the mean absolute value of the outturn series for both domestic and external trade variables. (See right panel of Table 13.) However, the computed values of the Theil statistic for the year-ahead forecasts are near unity (and much higher in the case of inflation), indicating that naive forecasts often might yield equally good predictions. While the realization-forecast regressions for the non-oil developing countries as a group provide no evidence of inefficiency, they tend to exhibit low explanatory power. Moreover, it should be noted that in several cases the results of realization-forecast regressions for specific groups of developing countries (not shown in Table 13) raise questions about the efficiency of the underlying forecasts.

As in the case of the industrial countries, current year forecasts for less developed countries are somewhat more reliable than the corresponding year-ahead predictions. Finally, Artis's tests for bias again suggest a tendency toward "output optimism" for the developing countries, especially with regard to the year-ahead forecasts. As in the case of industrial countries, this tendency was concentrated in the late 1970s.

b. Commodity prices and LDC export earnings

Commodity prices tend to exhibit considerable variability owing to a variety of supply disturbances related, among other factors, to weather and work stoppages. Commodity prices also can be significantly affected by changes in agricultural policies, especially in the major producing countries. As a result, projections of these prices are subject to unusually large margins of uncertainty. To the extent that export earnings of developing countries are derived from primary commodity exports, forecasts of such earnings also will be subject to considerable uncertainty. Artis's examination of the accuracy of WEO current year projections of commodity prices is restricted to the period 1981-86 because discontinuities in the data for commodity prices and related WEO forecasts precluded examination of projections over a longer period.

Artis's findings with respect to WEO forecasts for four major groups of commodities and for the export earnings of non-oil developing countries are reported in Table 14. The mean absolute change in prices for these four groups is about 12 percent per annum for both the beverages and food groups, and about 8 percent for metals and agricultural raw materials. In view of this relatively high variability, the rather large average absolute forecast errors (about 6 percent for agricultural raw materials and about 8 percent for food, beverages, and metals) are not surprising. 1/ Except in the case of metals, the WEO commodity price forecasts compare favorably with the corresponding naive ("no change") forecasts, as indicated by the values of the Theil statistics. However, except for food and beverages, the forecasts appear to infringe upon the efficiency criteria, as judged by the t ratios of the intercepts in the realization-forecast regressions.

3. Comparison with alternative forecasts

a. G-7 macroeconomic variables

The World Economic Outlook's year-ahead forecasts of economic growth and inflation in the major industrial countries can be compared to alternative forecasts released by the OECD and national forecasting agencies. Artis focuses on differences in forecast errors between WEO and alternative projections for these variables over the period 1973-85.

Artis's findings, summarized in Table 15, indicate that there are few large differences in forecast errors between alternative predictions for the variables of interest. Overall, the correlations between WEO forecasts and alternative forecasts are quite high, particularly between WEO and OECD forecasts for output growth, and between WEO and national forecasts for inflation. The practice of sharing information extensively among forecasters in national agencies and international organizations appears to have narrowed the differences between these projections.

b. Commodity prices

A recent analysis by R. Duncan of the World Bank provides a comparison of forecast errors by the Fund, the Bank, and commercial forecasting services for two groups of commodities over the period 1983-85. On the basis of this analysis, WEO commodity price forecasts appear to compare well with those prepared by the World Bank and other forecasting groups. Of the 62 forecasts compiled for the metals and minerals group, WEO forecast errors were lower in 65 percent of the cases. WEO forecasts of price developments for the agricultural commodities group were less

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1/ To some extent, the magnitude of the errors reflect the failure to predict the length and depth of the 1981-82 recession, with the result that commodity price prospects for that period were overstated.

accurate; nevertheless, of the 146 forecasts examined for this group, WEO forecast errors were lower in 48 percent of the cases. 1/ The forecast errors of the Fund and the World Bank were similar in most cases, perhaps because discussions are held each year between staff of the two organizations just prior to finalization of forecasts.

Both WEO and World Bank forecasts failed to predict the weak commodity price performance observed during the early 1980s--largely because of the unexpected duration and depth of the 1981-82 recession. The underlying assumptions regarding key variables, especially the index of dollar unit values of manufactured exports and exchange rates, may also have been a source of error. The index of unit values of manufactures, compiled separately by the two organizations, has been subject to particularly wide margins of error in recent years.

4. Summary and Conclusions

Recent studies conclude that the WEO's forecasting performance has been reasonably accurate, particularly for output growth and inflation in industrial countries, where forecasting errors are quite low relative to the mean absolute value of the relevant time series and compared to the errors that would have resulted from a naive forecast. Similar conclusions apply to the forecasts of export and import volume growth for both industrial and developing countries. The record is less satisfactory as regards output growth and inflation in developing countries where, in many cases, a naive prediction of no change in the growth of output would have been more accurate than the corresponding WEO forecast. Even in this case, however, forecasting errors were found to be reasonably low in relation to the mean absolute value of the relevant series. Not surprisingly, the errors in forecasting commodity prices are found to be comparatively large, although the projections tend to compare favorably with the corresponding "naive" forecasts and with projections prepared by the World Bank.

In general, the WEO projections were found to be free of systematic bias, although some tendency toward optimism was detected in the forecasts for output growth in both industrial and developing countries. This tendency was concentrated in the late 1970s; since 1980, forecast errors for output growth have been more evenly distributed. Except in the case of some commodity prices, there is little evidence of inefficiency in WEO projections in the sense that forecast errors for most variables are not highly correlated with the corresponding forecast values. Another important conclusion is that the WEO forecasts generally cannot be improved by using information from available forecasts prepared by the OECD or by private or official national forecasters.

1/ Comparison of forecasting accuracy for commodities other than those included in metals/minerals and agriculture is not readily available.

These considerations suggest that WEO projections for key exogenous variables could play a useful role in the construction of baseline scenarios to be used in the context of contingency mechanisms. At the same time, a number of limitations should be noted. First, WEO projections clearly are not available for all the variables that might be relevant under an ECM. Second, there is a question as to whether the frequency of update of WEO projections, usually twice a year, would be sufficient for the purpose of establishing the baseline for contingency arrangements. Third, it should be recognized that while the WEO projections for non-oil developing countries as a group appear to be reasonably accurate, this result might reflect offsetting errors as a result of aggregation, so that the forecast errors for individual countries might be significantly larger. Indeed, the relatively large prediction errors for sub-groups of developing countries suggest that this might be the case.

Finally, it should be stressed that WEO projections are conditional upon assumptions regarding monetary and fiscal policies in member countries. Furthermore, the WEO projections for world oil prices and exchange rates among the major currencies (and to some extent world interest rates) are technical assumptions rather than true forecasts, and it must be recognized that errors in projecting these key variables can have a significant impact on the accuracy of WEO projections. Of course, it cannot be taken for granted that such errors would be reduced by relying on staff forecasts rather than on technical assumptions.

Table 13. WEO Forecast Accuracy: Summary Statistics--Industrial and Developing Countries

(In percent)

		Group of Seven Industrial Countries				Non-Oil Developing Countries			
		Output growth	Inflation	Export growth	Import growth	Output growth	Inflation	Export growth	Import growth
					(Current year) 1/				
Mean absolute actual value		3.163	5.650	...	...	3.370	36.860	5.845	5.520
Average absolute error		0.619	0.556	1.887	3.141	0.960	6.310	2.140	3.200
RMSE		0.761	0.698	2.493	3.365	1.218	7.059	2.673	4.134
Theil's inequality statistic		0.244	0.360	0.366	0.263	1.055	0.898	0.528	0.627
Regression:	Intercept	-0.027	0.185	-0.668	-1.321	0.155	-2.851	0.795	0.540
		(0.83)	(0.34)	(0.60)	(0.96)	(0.09)	(0.58)	(0.40)	(0.31)
	Slope	*1.002*	*0.973*	*1.182*	*1.265*	*0.827*	*1.300*	*0.853*	*0.832*
		(0.002)	(0.35)	(0.99)	(1.34)	(0.45)	(1.89)	(0.47)	(0.52)
$\bar{R}^2$		0.899	0.913	0.744	0.74	0.289	0.880	0.320	0.282
					(Year Ahead) 2/				
Mean absolute actual value		3.031	7.346	...	...	3.629	38.114	6.189	5.050
Average absolute error		1.130	1.215	2.011	3.049	1.660	12.629	3.078	3.744
RMSE		1.713	1.757	2.588	3.281	1.947	14.767	3.804	5.448
Theil's inequality statistic		0.544	0.794	0.367	0.352	1.206	3.042	0.845	1.037
Regression:	Intercept	-0.811	0.917	-0.688	-1.684	3.404	-24.322	2.621	2.621
		(0.76)	(0.47)	(0.57)	(1.25)	(0.84)	(0.55)	(0.25)	(0.25)
	Slope	1.066	0.922	1.81	1.273	0.047	2.450	0.146	0.146
		(0.23)	(0.29)	(0.94)	(1.43)	(1.14)	(0.83)	(0.44)	(0.44)
$\bar{R}^2$		0.512	0.476	0.740	0.769	-0.200	0.140	-0.142	-0.142

Source: Artis, M.J., "How Accurate is the World Economic Outlook? A Post Mortem on Short-Term Forecasting at the International Monetary Fund."

Notes: The definitions of current-year and year-ahead forecasts are discussed in the text. The mean absolute actual is defined as $\Sigma|R_i|/n$ where R_i is the realization (or actual value of the variable) in year i; and n is the number of years in the sample. The mean absolute error is $\Sigma|F_i-R_i|/n$ where F is the forecast value. RMSE is $\sqrt{\Sigma(F_i-R_i)^2/n}$ and the Theil's inequality coefficient is RMSE(F)/RMSE(F,n), where F is a naive "no change" forecast. The intercept (a) and slope (b) coefficients are based on the realization-forecast regression $R_i = a+bF_i+u_i$, where u_i is the forecast error in year i. Figures in parentheses are t statistics; they test whether the relevant coefficient is different from zero (in the case of the intercept), or different from one (in the case of the slope).

1/ Current year forecasts for industrial countries generally refer to the period 1971-86; those for developing countries refer to 1977-86.

2/ Year ahead forecasts for industrial countries generally refer to the period 1973-85; those for developing countries refer to 1979-85.

Table 14. WEO Forecast Accuracy: Primary Product Prices and LDC Export Earnings

(In percent)

	Agricultural Raw Materials	Beverages	Food	Metals	Non-Oil LDC Export Earnings
			Current Year (1981-86)		
Mean absolute actual value	7.46	12.29	11.67	8.07	8.06
Average absolute error	5.652	8.095	7.562	8.533	5.887
RMSE	8.954	10.080	9.259	8.954	7.497
Theil's inequality statistic	0.800	0.534	0.556	1.209	0.668
Regression: intercept	-5.050	-1.103	-5.112	-8.248	-5.487
	(1.967)	(0.287)	(1.279)	(6.778)	(2.313)
Slope	1.013	0.649	0.942	0.794	0.833
	(0.025)	(1.669)	(0.029)	(1.098)	(0.567)
$\overline{R}^2$	0.376	0.631	0.382	0.771	0.585

Source: Artis, M.J., "How Accurate is the World Economic Outlook? A Post Mortem on Short-Term Forecasting at the International Monetary Fund."

Notes: See Table 13.

Table 15. WEO, OECD, and National Forecast Errors: Ouput Growth and Inflation--Group of Seven Industrial Countries 1/

(In percent)

	Output Growth			Inflation		
	WEO	OECD	National forecasts	WEO	OECD	National forecasts
1973	0.1	-0.3	0.6	-2.5	-2.5	-3.4
1974	5.0	4.0	2.4	-4.9	-4.9	-4.2
1975	2.0	1.2	2.2	0.8	1.0	-0.1
1976	-0.8	-1.6	-0.1	0.4	0.4	-0.3
1977	0.6	-0.4	0.6	0.0	0.0	-0.1
1978	-0.1	-0.6	0.3	-0.9	-0.5	-0.8
1979	0.2	-0.7	-0.2	-1.0	-0.8	-0.7
1980	0.5	-0.5	-0.0	-0.0	0.1	-0.5
1981	-0.6	-0.5	0.3	-0.7	1.0	0.0
1982	2.2	1.9	2.0	1.1	1.4	1.2
1983	-0.4	-0.2	-0.6	1.9	1.7	1.1
1984	-1.7	-1.7	-0.9	1.1	1.6	0.5
1985	0.6	-0.3	0.4	0.5	0.5	0.5
Average absolute error	1.1	1.1	0.8	1.2	1.3	1.0
Correlation coefficient 2/	--	0.97	0.89	--	0.90	0.95

Source: Artis, M.J., "How Accurate is the World Economic Outlook? A Post Mortem on Short-Term Forecasting at the International Monetary Fund."

1/ Statistics are based on year-ahead forecasts. National forecast errors refer to combined forecast errors of national forecasting agencies in the G-7 countries.

2/ Correlation coefficient between WEO forecast errors and the errors of the corresponding alternative projection.

IV. Estimating Unforeseen Changes in Interest Costs: Some Illustrative Simulations

This section reports the results of a variety of simulations that attempt to gauge the magnitude of interest costs arising from unanticipated changes in world interest rates. The simulations cover the period 1978-87. They focus on the cost of servicing that portion of the external debt of developing countries that is subject to variable interest rates.

1. Data and methods

Two basic sets of simulations were performed: one for the capital-importing developing countries (Table 16) and another for the group of 15 heavily indebted developing countries (Table 17). 1/ For each of the two groups of countries, the effects of unforeseen changes in interest rates were calculated with respect to both the gross external debt and the net external debt, the latter being defined as net of official holdings of foreign exchange. For each concept of debt, simulation results are provided for nominal interest rates and for two alternative measures of real interest rates.

The basic data used in the simulations are presented in Tables 18 and 19. Actual data and projections for the nominal interest rate refer to the six-month London interbank offer rate on U.S. dollar deposits. 2/ The unanticipated changes in the nominal interest rate were based on two alternative year-ahead forecasts: (i) WEO projections made in October of any given year for the following year; and (ii) "naive" projections based on the assumption that the level of the interest rate prevailing in the fourth quarter of any given year would prevail during the full course of the following year. WEO projections for the Eurodollar rate are available only for the period 1985-87. In view of this limitation, simulations based on naive forecasts were performed in order to cover a longer time period (1978-87) and particularly the period of rapidly rising interest rates from 1978 to 1981.

1/ The World Economic Outlook defines the capital-importing LDCs to include all developing countries except a small number of capital-exporting countries (the Islamic Republic of Iran, Iraq, Kuwait, the Socialist People's Libyan Arab Jamahiriya, Oman, Qatar, Saudi Arabia, and the United Arab Emirates). The heavily indebted LDCs include the following group of 15 countries: Argentina, Bolivia, Brazil, Chile, Colombia, Cote d'Ivoire, Ecuador, Mexico, Morocco, Nigeria, Peru, the Philippines, Uruguay, Venezuela, and Yugoslavia.

2/ The simulations are based on the highly simplified assumption that all debt is denominated in U.S. dollars and is contracted in the Eurodollar market.

In estimating the unexpected change in interest costs, it was assumed that a baseline is established at the beginning of each year. Thus, the error in forecasting the interest rate in any given quarter was calculated by taking the difference between the actual value of the interest rate in that particular quarter and the value predicted in the baseline (on the basis of either the WEO projection or the naive forecast). The unforeseen change in interest costs in each quarter was then calculated by multiplying the error in forecasting the interest rate in that quarter by the appropriate stock of external debt outstanding at the beginning of the year. Since it is common practice in most agreements involving Eurocurrency loans to fix the interest rate for the first six months, the forecasting errors were assumed to be zero in the first half of each year. 1/ Finally, the quarterly estimates were converted to an annual basis. To summarize, the unforeseen change in borrowing costs in year j (B_j) is given by the formula:

$$B_j = \sum_{i=1}^{4} h(r_{ij} - \hat{r}_j) \, D_j \qquad (1)$$

where r_{ij} is the actual value of the nominal interest rate in the ith quarter of year j; $\hat{r}_j$ is the level of r predicted at the beginning of the year; D_j is the stock of external debt outstanding at the beginning of the year; and h is a dummy variable equal to zero in the first two quarters and to one in the final two quarters of each year. It should be noted that this method of calculating unforeseen changes in interest costs excludes the effects stemming from unexpected changes in the risk premium and in the level of debt, on the assumption that such changes are subject to the influence of the debtor country's policies. 2/

Two measures of price expectations were used in simulating the effects of deviations in real interest rates for the period 1985-87: (i) WEO projections for the U.S. implicit price deflator for GNP; and (ii) forecasts derived from the University of Michigan survey of consumer price expectations in the United States. 3/ The simulations for the entire period 1978-87 were based on naive forecasts for the U.S. GNP deflator and for the U.S. consumer price index. The errors in forecasting real interest rates were calculated in a way similar to that discussed above in the case of nominal rates, except that deviations associated

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1/ It must be noted that this procedure is not equivalent to assuming that only one half of the annual forecasting error would be relevant, because deviations from baseline tend to be significantly larger in the second half of any given year than in the first half.

2/ These issues are examined in Section II of this Supplement.

3/ Data on actual and predicted values of interest rate and inflation variables are shown in Table 18.

with unanticipated changes in inflation were taken into consideration in every quarter of the year, and not only in the final two quarters. In other words, the error in forecasting the real interest rate was calculated as the difference between the errors in predicting the nominal interest rate and the inflation rate for the second half of the year. For the first half of the year, however, the error was simply equal to the unanticipated component of the rate of inflation (with negative sign), since the nominal interest rate in that period was assumed to be known with certainty. 1/ More formally, the unforeseen change in real interest costs in year j was calculated as:

$$B_j - \sum_{i=1}^{4} (\Pi_{ij} - \hat{\Pi}_j) D_j \qquad (2)$$

where Π denotes the rate of inflation and B_j is the unforeseen deviation in the nominal cost of borrowing defined in equation (1).

As regards the debt variables used in the simulations, the gross external debt was calculated for each group of countries by adding the total short-term debt to an estimate of the proportion of long-term debt subject to variable interest rates 2/ (Table 19). The net debt was calculated by subtracting official holdings of foreign exchange from the gross external debt.

2. Simulation results

Forecast errors for nominal and real interest rates over the past decade on the basis of both WEO and naive forecasts are presented in Table 20. They indicate that nominal interest rates most frequently have been underestimated in the period 1978-84. Since 1985, however, forecast errors for nominal interest rates have been predominantly negative, implying that debt service costs would have been lower than anticipated on the basis of either WEO or naive forecasts. A similar pattern of forecast errors is evident for real interest rates in the period 1978-84. Since 1985, the forecast errors are quite sensitive to the choice of alternative baseline projections for inflation.

1/ It should be noted that unanticipated changes in inflation would also affect the real cost of borrowing associated with long-term, fixed-interest debt. These effects are not taken into consideration in the simulations described below, which cover only the variable-rate component of the external debt.

2/ At the end of 1986, almost 60 percent of the total foreign debt of capital-importing developing countries was estimated to consist of liabilities contracted at variable interest rates.

The simulation results for debt service costs stemming from unforeseen interest rate movements for the capital-importing and the heavily indebted developing countries are presented in Tables 16 and 17, respectively. The results are given separately for deviations in gross and net interest costs. The tables also provide summary statistics covering the full sample period. These statistics are presented on an annual basis although they were initially calculated on the basis of semiannual deviations. They indicate: the average positive deviations (i.e., the average of unancitipated increases in interest costs); the average deviation (a measure of bias); the average absolute deviation; and the root mean squared deviation. 1/

Starting with the naive forecasts for the nominal interest costs in capital-importing countries (first column of Table 16), the largest positive deviations--implying unforeseen increases in debt service costs--occur in 1984 and 1987 (about $3 billion and $4 billion, respectively). The largest negative deviations--implying unforeseen declines in interest costs--are appreciably larger (almost $7 billion in 1982 and nearly $6 billion in both 1985 and 1986). The summary statistics for the entire period 1978-87 indicate a mean absolute deviation of about $3 1/2 billion a year and a negative average deviation of about $1/2 billion. This latter result indicates that, on average, unforeseen declines in nominal interest costs would have exceeded unforeseen rises during the period under consideration. For the period 1985-87, the mean absolute deviation is somewhat smaller on the basis of WEO projections than for the naive forecasts. Both projections show significantly negative average deviations (i.e., unforeseen declines in interest costs), perhaps reflecting the declining trend of nominal interest rates during that period.

Turning to the simulations for real interest costs (Columns 2 and 3 in Table 16), the results are, again, significantly affected by the choice of a price deflator. With regard to the naive forecasts, unforeseen increases in costs predominate in the period 1981-84 while unanticipated declines tend to predominate in 1978-80 and in 1985-87. The annual average deviations for the entire sample period are positive, indicating that, on balance, unforeseen rises in real interest costs tend to outweigh unforeseen declines. The mean absolute and root-mean-squared deviations are larger than for nominal interest rates, particularly in the case of the simulation based on consumer price expectations. To some extent, this reflects errors in predicting inflation (and thus real interest rates) in the first half of each year. No conclusive results emerge from comparing the simulations for absolute deviations in real interest costs based on WEO and naive forecasts, respectively, for the period 1985-87

1/ Both the average absolute deviation and the root mean squared deviation illustrate the typical magnitude of deviations in a given year irrespective of sign. The latter measure is sometimes preferred because it weighs more heavily larger deviations.

(Columns 1 and 2 of Table 16). Average deviations for that period are negative in the case of the naive forecast but positive in the case of the WEO projections.

Simulated deviations in net interest costs are presented in the right-hand panel of Table 16. The effect of adjusting the external debt numbers by netting out official holdings of foreign exchange is to reduce the size of the mean absolute deviations for the full sample period by approximately 20 percent for nominal interest costs and by 22-24 percent for real interest costs. 1/ There is also a small reduction in the average deviations. Table 17 presents the full set of simulation results for the 15 "heavily indebted" developing countries. In qualitative terms, the results are similar to those discussed in reference to Table 16. The mean absolute deviations are just under 60 percent of those reported for all capital-importing countries in the case of gross interest costs, and about 65 percent in the case of net interest costs.

It should be emphasized that the results presented in Tables 16 and 17 are based on the assumption that nominal interest rate terms are fixed over the first half of each year. Relaxing this assumption, i.e., taking into consideration errors in forecasting nominal interest rates in the first two quarters of each year, does not alter the results substantially. The reason for this result is that the underlying forecast errors tend to be larger in the second half than in the first half of each year, given that baseline projections are established at the beginning of each year and are assumed not to be revised during the course of the year. More generally, it should be stressed that the assumptions made regarding the starting dates of baseline scenarios and the countries covered by contingencies are adopted solely for the purpose of convenience. Alternative assumptions might involve possible revisions to the baseline projections over the course of each year, which would almost certainly reduce the absolute magnitude of unforeseen deviations in interest costs. Also, it would be more realistic to assume baseline projections for separate groups of countries starting at different dates during each year, although this would require quarterly or monthly data on external debt positions which is not readily available. In any event, the adoption of this kind of assumption is unlikely to have a large effect on simulations covering a long time period. In particular, unexpected borrowing costs for each group of countries would be lowered given the widespread practice of prespecifyng the interest rate on Eurocurrency loans for the first six months.

1/ Total official holdings of foreign exchange for the capital-importing countries amounted to $113 billion at the end of 1985 (Table 19). By way of comparison, it was estimated that the stock of foreign assets held by the private sector of these countries at the end of 1985 was in the neighborhood of $325 billion. See Deppler, Michael and Martin Williamson, "Capital Flight: Concepts Measurement and Issues," Staff Studies for the World Economic Outlook (August 1987), Chapter II, p. 42.

Table 16. Costs of Unanticipated Interest Rate Changes Based on Alternative Year-Ahead Forecasts: Capital-Importing LDCs

(In billions of U.S. dollars)

	Gross Interest Costs			Net Interest Costs		
	Nominal	Real 1/	Real 2/	Nominal	Real 1/	Real 2/
			(Based on WEO forecasts)			
1985	-4.6	-0.5	4.1	-3.7	-0.4	3.3
1986	-5.2	2.9	11.3	-4.2	2.4	9.0
1987	3.0	6.3	4.5	2.5	5.2	3.7
Annual deviations: 1985-87						
Average positive	1.0	3.9	6.6	0.8	3.2	5.4
Average	-2.3	2.9	6.6	-1.8	2.4	5.4
Average absolute	4.3	4.9	6.6	3.5	4.0	5.4
Root mean squared	4.4	4.0	5.6	3.5	3.3	4.5
			(Based on naive forecasts)			
1978	2.5	1.5	0.8	1.4	0.9	0.5
1979	1.7	0.1	-3.0	1.0	0.0	-1.7
1980	-1.4	-2.3	-3.5	-0.9	-1.4	-2.2
1981	1.3	2.5	8.9	0.9	1.8	6.2
1982	-6.9	2.5	7.4	-5.4	2.0	5.8
1983	1.3	7.4	7.6	1.0	6.1	6.3
1984	3.2	0.8	-1.7	2.6	0.7	-1.4
1985	-5.9	-1.2	-3.0	-4.7	-1.0	-2.4
1986	-5.8	-1.7	3.4	-4.6	-1.4	2.8
1987	4.2	-2.0	-9.5	3.5	-1.6	-7.8
Annual deviations: 1978-87						
Average positive	1.4	2.3	3.1	1.0	1.7	2.3
Average	-0.6	0.8	0.7	-0.5	0.6	0.6
Average absolute	3.4	3.7	5.4	2.6	2.9	4.1
Root mean squared	4.0	3.2	4.5	3.1	2.5	3.5
Annual deviations: 1985-87						
Average positive	1.4	1.7	1.5	1.2	1.3	1.2
Average	-2.5	-1.6	-3.0	-2.0	-1.3	-2.5
Average absolute	5.3	5.0	6.1	4.3	4.0	4.9
Root mean squared	5.3	3.7	5.0	4.3	3.0	4.1

Sources: International Monetary Fund, International Financial Statistics, and World Economic Outlook; and Economic Research Institute, University of Virginia.

Notes: Errors in forecasting nominal interest rates were assumed to be zero in the first half of each year. Positive (negative) deviations denote increases (decreases) of unanticipated debt service costs. Net costs refer to gross debt service costs adjusted for unanticipated changes in interest earnings on official foreign exchange holdings.

1/ Based on forecast errors for the U.S. GNP deflator.
2/ Based on forecast errors for U.S. consumer prices.

Table 17. Costs of Unanticipated Interest Rate Changes Based on Alternative Year-Ahead Forecasts: Heavily Indebted LDCs

(In billions of U.S. dollars)

	Gross Debt Service Costs			Net Debt Service Costs		
	Nominal	Real 1/	Real 2/	Nominal	Real 1/	Real 2/
			(Based on WEO forecasts)			
1985	-2.7	-0.3	2.4	-2.4	-0.3	2.1
1986	-2.9	1.7	6.3	-2.6	1.5	5.6
1987	1.6	3.4	2.4	1.5	3.1	2.2
Annual deviations: 1985-87						
Average positive	0.5	2.2	3.7	0.5	1.9	3.3
Average	-1.3	1.6	3.7	-1.2	1.4	3.3
Average absolute	2.4	2.7	3.7	2.1	2.4	3.3
Root mean squared	2.5	2.2	3.2	2.2	2.0	2.8
			(Based on naive forecasts)			
1978	1.3	0.8	0.4	0.9	0.5	0.3
1979	0.9	0.0	-1.7	0.7	0.0	-1.2
1980	-0.8	-1.3	-2.0	-0.6	-0.9	-1.5
1981	0.8	1.5	5.3	0.6	1.2	4.1
1982	-4.2	1.5	4.5	-3.6	1.3	3.9
1983	0.8	4.6	4.7	0.7	4.2	4.3
1984	1.9	0.5	-1.0	1.8	0.5	-0.9
1985	-3.4	-0.7	-1.8	-3.0	-0.6	-1.6
1986	-3.2	-1.0	1.9	-2.9	-0.9	1.7
1987	2.3	-1.1	-5.1	2.1	-1.0	-4.6
Annual deviations: 1978-87						
Average positive	0.8	1.3	1.8	0.7	1.2	1.6
Average	-0.4	0.5	0.5	-0.3	0.4	0.5
Average absolute	2.0	2.2	3.1	1.7	1.9	2.7
Root mean squared	2.3	1.9	2.6	2.0	1.7	2.2
Annual deviations: 1985-87						
Average positive	0.8	0.9	0.9	0.7	0.8	0.8
Average	-1.5	-0.9	-1.6	-1.3	-0.8	-1.5
Average absolute	3.0	2.8	3.4	2.6	2.5	3.0
Root mean squared	3.0	2.1	2.8	2.7	1.9	2.5

Sources: International Monetary Fund, International Financial Statistics, and World Economic Outlook; and Economic Research Institute, University of Michigan.

Notes: Errors in forecasting nominal interest rates were assumed to be zero in the first half of each year. Positive (negative) deviations denote increases (decreases) in unanticipated debt service costs. Net costs refer to gross debt service costs adjusted for unanticipated changes in interest earnings on official foreign exchange holdings.

1/ Based on forecast errors for the U.S. GNP deflator.
2/ Based on forecast errors for U.S. consumer prices.

Table 18. Forecast and Actual Values for the Eurodollar Interest Rate and Inflation, 1978-87

(In percent)

Year	Year-Ahead Forecast Values						Actual Values		
	WEO projections 1/			Naive forecast 2/					
	Six-month Eurodollar interest rate	U.S. Inflation		Six-month Eurodollar interest rate	U.S. Inflation		Six-month Eurodollar interest rate	U.S. Inflation	
		GNP deflator	Consumer Prices		GNP deflator	Consumer Prices		GNP deflator	Consumer Prices
1978	...	6.0	6.9	7.4	6.7	6.6	9.2	7.3	7.6
1979	...	7.8	8.9	11.5	8.0	9.0	12.2	8.8	11.2
1980	...	9.1	11.2	14.6	8.8	12.7	14.0	9.1	13.5
1981	...	8.1	9.3	15.9	10.0	12.6	16.7	9.6	10.4
1982	...	7.2	6.9	14.9	8.7	9.6	13.6	6.4	6.2
1983	...	5.6	5.6	9.8	5.1	4.5	9.9	3.8	3.2
1984	...	4.2	5.1	10.1	3.6	3.3	11.3	4.1	4.3
1985	9.9	3.9	5.1	10.3	4.0	4.1	8.6	3.2	3.6
1986	8.0	3.7	4.8	8.2	3.0	3.5	6.8	2.3	1.9
1987	6.5	3.4	3.8	6.1	1.8	1.3	7.2 3/	2.9 3/	3.6 3/

Source: International Monetary Fund, International Financial Statistics and World Economic Outlook; and the Economic Research Institute of the University of Michigan.

1/ WEO forecasts prepared in October of the previous year. Consumer price inflation forecasts are based on the University of Michigan survey of expectations.

2/ Fourth quarter values from the previous year.

3/ Estimate based on the assumption of unchanged actual values unchanged between the third and fourth quarters of 1987.

Table 19. International Liabilities and Foreign Exchange Holdings of Developing Countries, End of Year, 1977-86

(In billions of U.S. dollars)

Year	Capital Importing Countries 1/		Heavily Indebted Countries 2/	
	Variable-rate debt 3/	Foreign exchange 4/	Variable-rate debt 3/	Foreign exchange 4/
1977	166.1	69.4	90.2	29.4
1978	203.3	83.5	114.2	33.9
1979	263.8	99.5	152.1	42.6
1980	342.4	105.1	202.4	44.6
1981	425.6	95.9	259.1	36.1
1982	492.2	85.9	301.3	22.8
1983	508.5	92.4	306.2	24.2
1984	563.1	108.5	327.7	37.2
1985	573.9	112.9	322.7	38.1
1986	608.1	107.1	327.1	31.3

Sources: International Monetary Fund, International Financial Statistics and World Economic Outlook.

1/ All developing countries except the Islamic Republic of Iran, Iraq, Kuwait, the Socialist People's Libyan Arab Jamahiriya, Oman, Qatar, Saudi Arabia and the United Arab Emirates.

2/ Argentina, Bolivia, Brazil, Chile, Colombia, Cote d'Ivoire, Ecuador, Mexico, Morocco, Nigeria, Peru, the Philippines, Uruguay, Venezuela, and Yugoslavia.

3/ Short-term debt plus the estimated proportion of long-term debt subject to variable interest rates.

4/ Official holdings.

Table 20. Forecast Errors: Nominal and Real Interest Rates, 1978-87

(Percentage points)

Year	Nominal Interest Rates		Real Interest Rates			
			Based on U.S. GDP deflator		Based on U.S. consumer prices	
	WEO	Naive	WEO	Naive	WEO	Naive
1978	...	1.5	...	0.9	...	0.5
1979	...	0.8	...	0.0	...	-1.5
1980	...	-0.5	...	-0.9	...	-1.3
1981	...	0.4	...	0.7	...	2.6
1982	...	-1.6	...	0.6	...	1.7
1983	...	0.3	...	1.5	...	1.5
1984	...	0.6	...	0.2	...	-0.3
1985	-0.8	-1.0	-0.1	-0.2	0.7	-0.5
1986	-0.9	-1.0	0.5	-0.3	2.0	0.6
1987	0.5	-0.7	1.0	-0.3	0.7	-1.6

Source: Table 18.

Notes: A positive (negative) number indicates that the predicted value of the interest rate was higher (lower) than the realized value. The errors are averages of quarterly outturn less forecast values corresponding to WEO and naive year ahead forecasts for six-month London interbank offer rates on U.S. dollar deposits, adjusted in the case of real interest rates for alternative forecasts of inflation. Forecast errors for nominal interest rates and for the nominal interest rate component of real interest rates are assumed to be zero in the first half of each year.