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**Working Paper — Digitized Version**

## Efficient real exchange rate adjustment in developing countries: alternative devaluation strategies, economic structure, and sequencing of reforms

Kiel Working Paper, No. 473

**Provided in Cooperation with:**

Kiel Institute for the World Economy – Leibniz Center for Research on Global Economic Challenges

*Suggested Citation:* Schweickert, Rainer (1991) : Efficient real exchange rate adjustment in developing countries: alternative devaluation strategies, economic structure, and sequencing of reforms, Kiel Working Paper, No. 473, Kiel Institute of World Economics (IfW), Kiel

This Version is available at:

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**Efficient Real Exchange Rate Adjustment  
in Developing Countries: Alternative  
Devaluation Strategies, Economic Structure,  
and Sequencing of Reforms**

by  
Rainer Schweickert

April 1991

Institut für Weltwirtschaft an der Universität Kiel  
The Kiel Institute of World Economics

ISSN 0342-0787

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Düsternbrooker Weg 120, D-2300 Kiel  
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Wirtschaftswissenschaften  
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\* This paper is part of a research project on real exchange rate devaluation in developing countries; financial support of the Fritz Thyssen Stiftung is gratefully acknowledged.

Efficient Real Exchange Rate Adjustment in Developing Countries:  
Alternative Devaluation Strategies, Economic Structure, and Se-  
quencing of Reforms

I. Introduction

It has become generally accepted in economic literature that at least a large part of the persistent problems which developing countries have with high inflation, fiscal imbalance, and external debt have been caused by inconsistent monetary and exchange rate policies. The nominal parities of their currencies were mostly fixed or devaluation rates too low to account for the external shocks experienced before and after the debt crisis emerged (e.g. unfavourable changes in the terms-of-trade, rising world market interest rates and increased rationing of external credit). Fiscal deficits were often financed by monetary expansion. As a result, the real exchange rates have become overvalued [Edwards, 1989b], and most developing countries face the problem of devaluing their real exchange rate to a level which is consistent with internal and external equilibrium and, thus, sustainable in the long run.<sup>1</sup>

There are two basic concepts of real exchange rate devaluation given that the overvaluation of a currency results from the inconsistency of monetary and exchange rate policies: monetary contraction and nominal devaluation. The monetary expansion may be slowed down to be consistent with a given parity or, alternatively, the parity must be adjusted to a given monetary expansion. The present discussion about macroeconomic reform programs can be seen as a discussion about the appropriate real devaluation strategy. "Stabilization programs" stress the need for monetary contraction [see e.g. Sachs, 1987], whereas "adjustment programs" rely on nominal devaluation in the first place [see IMF, 1987]. Consequently, the relevant problem is not the sequencing of price stabilization and real exchange rate adjustment, but deciding on the appropriate real devaluation strategy. This paper thus contributes to the debate about macroeconomic

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<sup>1</sup> This is the definition of the equilibrium real exchange rate [Dornbusch, 1980, pp. 100ff.].

reforms by analysing theoretically and empirically the efficiency of the alternative strategies. Three questions are addressed:

- Can we discriminate between monetary contraction and nominal devaluation with respect to their efficiency as real devaluation strategies?
- Do the effects of the alternative strategies depend on structural characteristics of developing economies?
- Do structural policies such as trade, capital account, and capital market liberalization affect the efficiency of real devaluation strategies?

The basic hypothesis of this paper is that the efficiency of a strategy depends on its effectiveness, its sustainability, and its potential costs. The effectiveness is given by the speed and extent to which real devaluation is achieved. Effectiveness is an important issue because overvaluation is not without cost. The distortion of price signals due to exchange rate misalignment hampers the efficiency of production and leads to a misallocation of investment, thereby reducing overall economic growth prospects. The sustainability of a policy is determined by its feasibility and credibility. The scope for monetary and exchange rate policy may be seriously limited in the short run for developing countries with high external indebtedness, high inflation rates and fiscal problems. The extent to which macroeconomic constraints are strengthened or relaxed by a monetary contraction or a nominal devaluation must be taken into consideration in order to assess the feasibility and credibility of the alternative strategies. The most relevant constraints are the fiscal deficit, the foreign exchange position, and inflationary expectations. All three restrictions can actually limit the scope for policy action and, equally important, the whole reform program is likely to be abandoned, if these variables cross certain thresholds. Finally, the efficiency of a real devaluation strategy depends also on the possible costs incurred in terms of changes in short-run economic growth and investment activity. Again the credibility of the reform program may be affected when the actual performance falls short of a minimal target.

The relative advantage of real devaluation strategies may be affected once different economic structures of developing economies are considered. Structural characteristics matter, because monetary contraction and nominal devaluation rely on different adjustment mechanisms which, in turn, affect economic sectors to a different extent. Consequently, the distribution of benefits and costs is likely to vary between sectors depending on the strategy applied and the net benefit for the whole economy is influenced by the relative size of the sectors. Moreover, as advocates of the structuralist approach to macroeconomics have pointed out, even adjustment mechanisms are likely to depend on economic structures [see Taylor, 1983, pp. 37-56]. In this context the most important characteristics seem to be trade and production structures. Country specific policy recommendations are required if the relative advantage of real devaluation strategies is influenced by structural characteristics.

Frequently, real exchange rate adjustment is part of reform packages which contain, to different extents, liberalization policies as well [see e.g. Sachs, 1989b]. Among these trade, exchange control, and capital market liberalization policies figure prominently. Provoked by the failure of most reform programs the debate on the sequencing of reform steps has been extended to the relation between macroeconomic and structural reforms. Policy recommendations range from "liberalize first" to "stabilize first" [for an overview, see Edwards, 1989a, p. 8f.]. In this paper, it is argued that a real exchange rate devaluation is of crucial importance in order to restore macroeconomic equilibrium. The relevant question then is, whether liberalization attempts do have an influence on the effectiveness, the sustainability, and economic performance effects of a real devaluation. If so, the relative advantage of the alternative strategies is likely to be affected. This impact has to be taken into account when discussing the optimal sequencing of macroeconomic and structural reforms.

The "structural characteristics" and the "sequencing" of the paper are as follows. Section II outlines theoretical arguments and formulates hypotheses on the efficiency of real devaluation strategies, country specific qualifications, and appropriate sequencing of reforms. The regression equations used to test the hypotheses of Section II are given in Section III. Section IV presents the estimation results and Section V summarizes and gives policy conclusions.

## II. Efficiency of Alternative Real Devaluation Strategies

### 1. Effectiveness, Constraints, and Economic Performance

The way in which the two strategies - monetary contraction and nominal devaluation - affect the real exchange rate can be analysed using the definition of real exchange rate changes given in equation (1) [Saidi/Swoboda, 1983, p. 3]:

$$(1) \quad R = N + (INF - INF^*).$$

Assuming a constant foreign inflation rate ( $INF^*$ ), a devaluation of the real exchange rate ( $R$ ), i.e.  $R < 0$ , can be achieved by a nominal devaluation ( $N$  defined as the relative price of foreign currency to home currency) if domestic inflation does not increase. This strategy of nominal devaluation is typically part of IMF adjustment programs. On the other hand, it is possible to devalue the currency in real terms when a monetary contraction leads to a decline in domestic inflation and the nominal parity of the currency is fixed. This is the strategy of a monetary contraction implicitly included in macroeconomic stabilization programs.<sup>1,2</sup>

<sup>1</sup> It is important to distinguish between macroeconomic stabilization and adjustment on the one hand and exchange rate stabilization and adjustment on the other. The problem of stabilizing the real exchange rate, i.e. the question of an optimal currency regime [see Schneeberger, 1989, p. 84ff.] is not analysed here. It is assumed that the adjustment of the real exchange rate is of first priority for developing countries, at least in the short run.

<sup>2</sup> The real exchange rate can be alternatively defined as the ratio of tradable to non-tradable goods [Edwards, 1988a, p. 3].  
contin. on page 5



Possible disadvantages of the monetary contraction strategy are (1) the lag between monetary supply changes and the adjustment of goods prices and (2) the uncertainty arising from changes of the demand for money which can even offset the disinflation effect of a supply reduction. On the contrary, a nominal devaluation directly affects the real exchange rate. The initial real devaluation may be even larger than the long-run real devaluation if an inflationary impact is delayed. It is therefore to be expected, that nominal devaluation has an advantage over monetary contraction as far as the effectiveness of real exchange rate devaluation is concerned.

Arguably, the two strategies differ as well with respect to their impact on macroeconomic constraints, namely the fiscal deficits, foreign exchange reserves and inflation rates. The less a policy raises fiscal deficits and inflation and the more it contributes to the recovery of reserves, the more favourable it is, especially if these macroeconomic constraints are strictly binding. The fiscal deficit which can be financed during an adjustment period and the loss of foreign reserves a country can afford are limited for economies rationed in external and/or domestic credit markets in the first place. An additional inflationary impulse could easily lead to hyperinflation in countries with extremely high inflation rates. Binding constraints restricting the feasibility of real devaluation strategies are therefore to be expected for countries with high inflation rates and high external indebtedness. A reform strategy also needs to be credible in order to be successful. Credibility, however, is eroded when macroeconomic constraints are strengthened, making a reversal of the reform program more likely. On the other hand, the real exchange rate can be devalued to a larger extent or a given rate of devaluation

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The two definitions are identical, if the relative weights of tradable and non-tradable goods in the price index of the home and the foreign country are identical and if the law-of-one-price holds for tradable goods. In the latter case, a nominal devaluation directly affects tradable goods prices whereas a monetary contraction only affects the prices of non-tradable goods. The arguments with respect to equation (1) can then be applied analogously.

is easier to achieve, if such negative impacts are avoided by a real devaluation strategy.

Fiscal deficit: It is favourable to apply the real devaluation strategy which puts relatively less pressure on the government either to raise additional domestic credits or to cut expenditure. First, public credit demand crowds out private credit demand and private investment. Second, political economy arguments suggest that public investment expenditure will be cut in the first place. This is because the reduction of subsidies and payroll expenditures provokes the opposition of powerful interest groups.

Monetary and exchange rate policies affect specific components of the fiscal budget. A nominal devaluation increases the stock of external public debt in terms of domestic currency. Government revenue from import taxes will decline if a devaluation results in lower import values (no J-curve effect). A monetary contraction presumably raises interest paid for domestic credits and cuts revenues from inflation tax. Given the possibility of cutting (other) expenditures or of raising (other) taxes, the effect of the alternative real devaluation strategies on the fiscal deficit basically depends on the relative importance of the budget components just mentioned.<sup>1</sup> Fiscal deficits can be expected to rise particularly in countries with high external indebtedness and high trade tax revenues when a nominal devaluation is applied. High interest obligations for domestic credits and high inflation tax revenues make rising fiscal deficits due to a monetary contraction more likely.

The effects on the fiscal deficit determine the demand for additional financing. To the extent that external credits are rationed, the supply of financial funds is limited to the domestic capital market. A monetary contraction possibly squeezes credit

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<sup>1</sup> How real exchange rate effects on fiscal deficit were influenced by structural characteristics of the fiscal budget was analysed by Reisen [1989, p. 9ff.]. But he did not distinguish between alternative real devaluation strategies.

supply. Consequently, a monetary contraction would require more fiscal discipline than a nominal devaluation if domestic credit supply is a binding constraint. The more a government depends on domestic credit the less pronounced will then be a rise in fiscal deficits in the case of a monetary contraction.

Foreign exchange: Especially when external credits are rationed foreign exchange holdings determine the period in which a current account deficit has to be removed or turned into a surplus. Foreign exchange could be saved if the real devaluation is achieved instantaneously and improves the current account immediately. A disadvantage of the monetary contraction is that disinflation may be delayed while the nominal parity is fixed thus resulting in a real appreciation.<sup>1</sup> Monetary contraction can, hence, hypothesized to put additional strain on the foreign exchange position. On the contrary, a nominal devaluation can be assumed to lead to an instantaneous real devaluation. However, the current account may deteriorate in the short run due to J-curve-effects.

Inflation: In many developing countries inflation is driven by indexation rules which reflect inflationary expectations of private agents. A real devaluation is not possible at all as long as these expectations are determined by changes in tradable goods prices exclusively. A similar result is likely in the case of a nominal devaluation and markup pricing when a country depends heavily on imported intermediate and capital goods [Taylor, 1983, pp. 48ff.]. Such an inflationary impact could be avoided by a monetary contraction. However, both monetary contraction and nominal devaluation do not affect inflation rates in the short-run if adaptive expectations dominate indexation rules. Under such conditions a monetary contraction leads to a real appreciation while a nominal devaluation reduces the real exchange rate. In the long run, inflationary expectations will correspond to the expectations about the consistency of monetary, exchange rate,

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1 But the speed at which inflationary expectations can be reduced crucially depends on the development of the fiscal deficit [Sachs, 1987, p. 31; van Wijnbergen, 1987, p. 36].

and fiscal policies. Assuming rational expectations, the inflation rate and, consequently, the real exchange rate will immediately adjust to their long-run levels. The short-run real devaluation achieved is then identical for both strategies.

The efficiency of a real devaluation strategy further depends on its possible costs in terms of foregone real economic growth and investment. The traditionally dominant view, i.e. that the substitution effects engendered by a real devaluation are sufficiently strong to assure an expansionary net effect on output, has been increasingly challenged since the publication of the influential paper by Krugman and Taylor [1978].<sup>1</sup> However, the discussion about contractionary versus expansionary effects of a real devaluation is not very telling once the need for macroeconomic reform is generally accepted. The relevant problem then is to minimize contractionary effects and to maximize expansionary effects of a real exchange rate depreciation by applying the appropriate strategy. Three arguments point to differences between a monetary contraction and a nominal devaluation concerning economic performance effects:

- Arguably, a nominal devaluation increases government expenditure through its effect on external debt while a monetary contraction may reduce the revenues from the inflation tax. In the first case the government balance-sheet increases whereas it decreases in the latter case. This holds irrespective of whether the gap in the balance sheet is closed by higher deficit financing or a cut in (other) expenditures. Therefore, disposable private income is presumably higher after a monetary contraction compared with a nominal devaluation. The distribution of national income would even shift in favour of the pri-

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<sup>1</sup> Cline [1983] provides a compendium of strange assumptions and the evidence against them. Many models leading to "'queer cases' from the view point of traditional theory" are characterized by "odd assumptions about 'substitutability' in production or consumption" [Lal, 1989, p. 291]. For a detailed discussion and empirical evidence, see Nunnenkamp/Schweickert [1990b].

vate sector if public expenditure is actually cut after a decline of revenues from inflation tax. According to this reasoning, more favourable economic performance effects can be expected from a relatively higher private expenditure in the case of a monetary contraction.<sup>1</sup>

- As argued above, the monetary contraction strategy may result in a lower credit supply. Negative investment effects are to be expected, if domestic enterprises depend on domestic financial sources in the first place [Rojas-Suarez, 1987, pp. 439f.]. This disadvantages may be offset, however, if a monetary contraction results in higher real interest rates through reducing domestic inflation. These are favourable conditions for mobilizing domestic savings, lowering costs of financial intermediation, and stimulating private investment [Corsepius, 1989]. Therefore, it is an empirical question whether or not a monetary contraction results in a credit contraction or a slowdown in investment activity.
- Lower investment and economic growth effects can be expected from a nominal devaluation, compared with a monetary contraction, due to rising prices for imported inputs. Particularly in countries with strong import dependence. Higher prices for imported inputs may significantly weaken incentives to shift economic activities among sectors and to raise production especially in sectors producing tradable goods.

Up to this point, the analysis of the relative merits and flaws of the alternative real devaluation strategies shows that an a-priori superiority can neither be established for a nominal devaluation nor for a monetary contraction. The next question is whether the picture is less ambiguous for specific country groups, i.e. once structural characteristics are taken into account.

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<sup>1</sup> Generally, a higher efficiency of private resource allocation is assumed. Moreover, a positive overall investment response is to be expected, if the private investment ratio is higher than the public investment ratio.

## 2. Impact of Trade and Production Structures

Contrary to structural policies, the basic characteristics of an economy cannot be adjusted easily in order to optimize a real devaluation strategy. The most important features of an economy which are expected to impact on the relative advantage of the alternative devaluation strategies are the production and export structure as well as the degree of openness. Most notably, agricultural and more industrialized economies have to be distinguished.

According to advocates of the structuralist approach to macroeconomics, specific characteristics of developing countries where production is dominated by manufacturing industries, are markup pricing, dependence on imported intermediate and capital goods and quantitative rather than price adjustment [Taylor, 1983, pp. 13-21]. High dependence on imports and, consequently, low price elasticity of imports is disadvantageous especially when the country chooses the nominal devaluation strategy. Higher losses in foreign exchange as well as less investment and growth than in a basically agricultural economy could be the result. The comparison is less clear-cut on the export side. In the case of a nominal devaluation the expansion of capacity utilization and new investment in manufacturing is hampered by higher input costs. On the other hand, a monetary contraction possibly aggravates the rationing of domestic credit needed to finance higher working capital and investment.

In addition to the foreign exchange and the performance effects the inflationary impact of alternative real devaluation strategies may be influenced by the production structure as well. Wage-indexation becomes more likely in more industrialized developing countries with a higher degree of organization of the labour force. An upward jump in prices causing the real wage to fall, will then lead to wage increases which are passed along into further price increases through markup pricing. This is the classic case of a structural inflation. Such wage-indexation rules make the overall rate of price increase highly sensitive to

upward shocks [Taylor, 1988, p. 41f.]. The initial price shock can be caused by a large nominal devaluation. With respect to inflationary effects, a nominal devaluation may be better suited for agricultural economies, whereas countries with a large manufacturing sector would be better advised to choose the monetary contraction strategy.

The degree of openness is another relevant characteristic of an economy. Openness towards world markets improves the likelihood that changes in relative prices will be transmitted into supply responses. Moreover, an open economy can achieve major trade improvements with a relatively small real depreciation [Dornbusch, 1990, p. 9]. Consequently the nominal devaluation or the monetary contraction required can be weaker and adjustment costs lower. Additionally, the nominal devaluation strategy could be more effective in open economies, since large parts of the economy are directly affected. On the other hand, its effectiveness is reduced by the larger increase in the overall price level due to a higher share of tradable goods in the price index. X

### 3. Sequencing of Macroeconomic and Structural Reforms

IMF adjustment programs usually encompass structural policies such as trade, exchange control, and capital market liberalization. These policies can be expected to influence the determinants and effects of real exchange rate changes, thereby giving rise to questions of an optimal sequencing of macroeconomic and structural reforms.

With respect to trade liberalization, i.e. lower import tariffs and the abolition of non-tariff trade barriers, the short-run growth impact of trade liberalizations is still debated, because the opening-up towards the world market intensifies the need for domestic real adjustment [Edwards, 1989c]. It is argued that liberalizing trade and devaluing the real exchange rate simultaneously may exceed the internal capabilities for adjustment resulting in a negative feedback on the macroeconomic reform process.

But at the same time a trade liberalization dampens inflation because of intensified competition and lower import prices. Both effects can stimulate economic growth through a greater efficiency of domestic production [Ize, 1990]. Moreover, exports are encouraged by lower prices for imported inputs. Exports may even grow faster than imports thereby relaxing the foreign exchange constraint [ibid]. Furthermore the pressure on the fiscal budget can decrease because of higher revenues from trade taxes when the expansion of the tax base due to the substitution of quantitative restrictions by tariffs and due to rising imports, offset the decline in the tariff rate. These are clearly favourable conditions for a macroeconomic reform and lead to the conclusion that trade liberalization should not be postponed.<sup>1</sup>

In case of a successful real devaluation policy, the reduced expectations of future exchange rate depreciation can result in capital inflows or the repatriation of flight capital. On the one hand such capital inflows relax financial constraints. But they may also lead to a real appreciation, due to a nominal appreciation or rising domestic prices [McKinnon, 1984]. Moreover, speculation against the domestic currency will continue if the real devaluation strategy is expected to fail.<sup>2</sup> Given that extreme

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<sup>1</sup> This is consistent with the view that tariffs should be reduced without a preceding or accompanying real depreciation, the exchange rate providing an anchor for domestic prices [Krueger, 1981]. On the other hand, serious doubts has been raised in the literature about the possibility of a successful trade liberalization without a preceding or simultaneous reduction of real overvaluation [Corden, 1987; Michaely et al., 1989], fiscal deficits [McKinnon/Mathiesen, 1981; McKinnon, 1984], and inflation rates [Fischer, 1986 and 1987]. Moreover, historical evidence from successful Asian exporters suggest that stabilization should be consolidated before attempting trade reforms [Sachs, 1987].

<sup>2</sup> The effects of speculation can be expected to differ according to the exchange rate regime adopted. Arguably, floating rates do not constitute a one-way bet for speculators that pegged rates do [Reisen, 1991, p. 53]. Consequently, floating rates would be better suited for avoiding excessive capital flows. But this argument applies to our analysis only to a limited extent since the assumed real devaluation removes inconsistencies in domestic policies which constitute the possibility of one-way bets.



capital movements in either direction could endanger the real devaluation process, foreign exchange controls are advocated in order to prevent a real appreciation [Dornbusch, 1983].<sup>1</sup> It is of course possible to circumvent capital controls by overinvoicing of imports and underinvoicing of exports [Agenór, 1990]. But the controls raise the costs and limit the extent of currency speculation. The real devaluation policy may become more effective and sustainable if private agents favour this as a safeguard against destabilization in the case of a failure or massive capital inflows in the case of a successful reform. Moreover, a higher stability of real exchange rate adjustment<sup>2</sup> leads to more favourable investment conditions and growth prospects [Rodrik, 1989, p. 19; Faini/de Melo, 1990, pp. 29f.].

The success of real devaluation strategies can be additionally influenced by capital market policies. Financial repression in the form of low real interest rates typically has been the consequence of institutionally fixed nominal interest rates combined with high and accelerating inflation rates [Fry, 1988, p. 16]. The nominal devaluation strategy can thus be less favourable for countries with repressed financial markets because its effectiveness depends on the stability of inflation rates. On the other hand, the disinflationary impact of a monetary contraction is assumably less pronounced in countries which experienced low and stable inflation rates in the past and where monetary authorities build up some confidence in the stability of inflation.

Financial market developments are also important for the stability of the adjustment process. A necessary condition for a reduc-

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<sup>1</sup> It is worth noting that overvaluation could generally not be avoided or reduced by strict capital controls because it is due to inconsistent domestic policies and distortions in capital and goods markets in the first place [Fischer et al., 1985, pp. 71f.]. However, the relevant question here is whether or not free capital movements support a policy which tries to remove inconsistencies between domestic policies, namely a real devaluation policy.

<sup>2</sup> This holds only in the case of an adjustment towards the equilibrium level. Otherwise short-run stability is only achieved at the cost of a greater longer-run instability.

tion of inflation is that the supply of goods and services grows faster than demand. The supply response to a real devaluation could be limited on the financial side by the availability and the costs of credit. Capital supply to finance investment and capacity utilization in sectors which experience additional demand can fall short of demand if a monetary contraction leads to a credit contraction. A demand surplus would be created or expanded and inflation would accelerate [McKinnon, 1973, pp. 84ff.]. The possibility of such a disequilibrium adjustment process emphasizes the need for a deregulation of capital markets. A credit contraction resulting in disequilibrium in capital and goods markets is most likely to follow a monetary contraction if real interest rates are not allowed to rise in order to mobilize private savings and to relax credit constraints [see Corsepius, 1989]. Additional incentives for efficient resource utilization may be needed because a positive supply response could be hampered by rising interest rates which increase the costs of working capital market financing [Lizondo/Montiel, 1988, p. 37].

A deregulation of interest rates seems to be an important measure to support a monetary contraction strategy. While reducing inflation, a monetary contraction leads to higher real interest rates. Consequently, a slowdown in monetary expansion and a deregulation of interest rates are complementary. The problem of a competition of instruments, recently at the centre of the discussion about sequencing [see Sachs, 1989a, pp. 282ff. and Edwards, 1989a, p. 17] is avoided. A combination of capital market liberalization and monetary contraction can therefore provide an appropriate starting point of a real devaluation policy for financially repressed economies.<sup>1</sup>

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<sup>1</sup> The sequencing of structural reforms was analysed assuming that real exchange rate devaluation is of crucial importance. The sequencing of current and capital account liberalization has been discussed in the literature without explicitly considering the need for macroeconomic stabilization. However, Sell [1990] argues for an already liberalized current account accompanying a capital account liberalization if the stabilization of domestic prices has a high priority in economic policy. For other  
contin. on page 15

To conclude, the theoretical analysis of alternative real devaluation strategies - nominal devaluation and monetary contraction - does not prove an absolute advantage of a strategy after including structural policies and structural characteristics of developing countries. Neither an unique optimal reform package nor an optimal program for each country group could be established on theoretical considerations. Therefore, the next step is the empirical analysis of the real devaluation strategies based on the hypotheses presented above.

### III. Equation Specification

The procedure in the empirical part will correspond to the presentation in the last section. In order to test the hypotheses pooled cross-section regressions were performed using annual data for 33 developing countries from 1979 to 1986.<sup>1</sup> The time period was chosen to include experiences with reform programs before and after the debt crisis emerged. Biased results due to the structural break in 1982 are avoided by including dummy variables. The 33 countries provide a wide range of structural characteristics and economic policies, especially with respect to real effective exchange rate changes, inflation rates, and external indebtedness.<sup>2</sup> All regressions were estimated using the ordinary-least-squares technique.

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arguments on the sequencing of structural reforms see Edwards/van Wijnbergen [1986] and Edwards [1989d] for the current-account-first position and Lal [1987]; Bhandari [1989] and Sell [1988] for the capital-account-first position. Blejer/Sargari [1988] suggest liberalizing the domestic capital market before relaxing exchange controls.

<sup>1</sup> The countries are Argentina, Bangladesh, Brazil, Chile, Colombia, Costa Rica, Ecuador, Egypt, El Salvador, Ghana, Greece, India, Indonesia, Jamaica, Kenya, Kuwait, Malawi, Malaysia, Mexico, Morocco, Pakistan, Paraguay, Peru, Philippines, South Korea, Sri Lanka, Tanzania, Thailand, Tunisia, Turkey, Uruguay, Venezuela, and Yugoslavia.

<sup>2</sup> The variance of the real effective exchange rate was high (low) in 11 (10) sample countries: 10 (7) countries experienced high (low) inflation rates. 13 countries were heavily indebted [for the classification see Nunnenkamp/Schweickert, 1990b, pp. 35f.].

## 1. Basic Equations

Equation (2) analyses the effectiveness of monetary and exchange rate policies on the real exchange rate:<sup>1</sup>

$$(2) R = a_0 + a_1 M + a_2 N + a_3 \text{TOT} + a_4 \text{NCF} + a_5 \text{D1} \times \text{NCF} + a_6 \text{R1} + a_7 \text{D1},$$

where R = annual growth rate of the real effective exchange rate (negative for devaluation);<sup>2</sup>  
M = annual growth rate of money supply M1 [IMF, d]  
N = annual growth rate of the nominal effective exchange rate (negative for devaluation);<sup>2</sup>  
TOT = terms-of-trade shocks (positive for negative shocks);<sup>3</sup>  
NCF = net inflow of long-term and short-term capital relative to imports (in per cent) [IMF, a];  
R1 = once lagged values of R;  
D1 = Dummy variable (1 for 1979-1981; 0 otherwise).

Positive coefficients of  $a_1$  ( $a_2$ ) indicate, that a monetary contraction (nominal devaluation) results in a real exchange rate depreciation. Contrary to M and N, the variables TOT and NCF represent determinants of the equilibrium real exchange rate. The coefficient  $a_4$  is expected to be positive, whereas the impact of a terms-of-trade shock is theoretically indeterminate [Edwards, 1988b, pp. 319ff.]. Lagged values of the endogenous variable and the dummy variable will be included as explanatory variables in each of the following regression equations as well. The lagged variables are used as a catch all for neglected variables in the reduced-form equations. D1 and D1 x NCF test for a structural break in the development of the endogenous variable and for a change in the impact of net capital inflows after 1981 respectively.

<sup>1</sup> For the determinants of real exchange rates see Edwards [1988b, pp. 333ff.].

<sup>2</sup> The calculation is based on nominal exchange rates and consumer prices. Trade weights refer to the shares in world trade and are calculated from IMF. Data is from IMF [b; d]. For the formula applied and its economic justification see Fischer, Spindanger [1986, pp. 83ff.].

<sup>3</sup> Measured as the hypothetical percentage changes of the current account due to changes in import and export prices. For the calculation, see Nunnenkamp, Schweickert [1990a, p. 480].

Regression equations (3) - (5) analyse the effects of monetary and exchange rate policies on foreign reserves, the fiscal deficit, and inflation rates. The development of these variables was hypothesized to be of crucial importance for determining the feasibility and the credibility of a real devaluation policy.

$$(3) \text{ RES} = b_0 + b_1M + b_2N + b_3\text{TOT} + b_4\text{NCF} + b_5\text{D1} \times \text{NCF} + b_6\text{RES1} + b_7\text{D1},$$

$$(4) \text{ DEF} = c_0 + c_1M + c_2N + c_3\text{GE} + c_4\text{YR} + c_5\text{DEF1} + c_6\text{D1},$$

$$(5) \text{ INF} = d_0 + d_1M + d_2N + d_3\text{INFC} + d_4\text{INFC1} + d_5\text{D1},$$

where RES = foreign exchange reserves relative to imports (in per cent) [World Bank, a];  
DEF = fiscal balance in per cent of GDP (negative values for deficits) [IMF, d];  
INF = annual growth rate of the consumer price index [IMF, d];  
GE = government expenditure relative to GDP (in per cent) [IMF, d];  
YR = annual growth rate of real GDP [UNCTAD, 1988];  
INFC = difference between the actual and the once lagged inflation rate (INF);  
RES1,  
DEF1,  
INFC1 = once lagged values of RES, DEF, INFC.

Positive values of  $b_i$ ,  $c_i$ ,  $d_i$  ( $i = 1, 2$ ) would imply, that a slow down in monetary expansion or a nominal devaluation reduces all three endogenous variables. Such an impact on inflation rates would be positive for the devaluation process. Higher fiscal deficits and a reduction in foreign exchange holdings, however, could jeopardize the sustainability of a real devaluation strategy. Equation (3) additionally includes TOT and NCF to correct for external influences on the reserve position. Correspondingly, GE and YR are included as control variables in the determination of fiscal deficits. The exogenous variables INFC and INFC1 test for structural or inertial inflation.<sup>1</sup>

<sup>1</sup> Because of the high multicollinearity between monetary policy (M) and the once and twice lagged values of the inflation rate, adaptive expectations could not be tested directly. Using first differences reduces multicollinearity substantially.

Possible costs of a real devaluation in terms of weaker economic growth and investment activity would lead to positive coefficients of the real exchange rate variable in equations (6) and (7).

$$(6) Y = e_0 + e_1 R + e_2^{TOT} + e_3 NCF + e_4 D1 \times NCF + e_5 GE + e_6 UMS + e_7 Y1 + e_8 D1,$$

$$(7) INV = f_0 + f_1 R + f_2^{TOT} + f_3 NCF + f_4 D1 \times NCF + f_5 Y1 + f_6 INV1 + f_7 D1,$$

where Y = annual growth rate of real GDP per capita [UNCTAD, 1988];  
INV = gross investment relative to GDP (in per cent) [World Bank, 1989];  
UMS = unexpected money supply;<sup>1</sup>  
Y1,  
INV1 = once lagged values of Y and INV.

Again, TOT and NCF account for the impact of external changes. GE and UMS were included only in the growth equation because they can be expected to have some impact on economic performance in the short run, but do not affect investment considerations. Real economic growth in the previous period was assumed to have a favourable influence on investment decisions.

## 2. Variability of Coefficients

The estimation approach outlined in equations (2) - (7) would not be sufficient to test the hypotheses raised in section II. The arguments suggest, that the multipliers of monetary and exchange rate policies as well as the impact of real exchange rate changes are not constant. More specifically, the hypotheses suggest that

- economic performance effects of real exchange rate changes depend on the policy instrument applied;
- the impact of monetary and exchange rate policies on fiscal deficits varies with the structure of the fiscal budget;
- these coefficients can differ between country subgroups identified by different trade and production structures and varying degrees of openness;

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<sup>1</sup> Unexpected money supply was proxied by the residuals of a regression modelling money supply M2 as a autoregressive process of third order [see Nunnenkamp/Schweickert, 1990a].

- all coefficients of money supply, the nominal exchange rate, and real exchange rate changes shown in equations (2) - (7) are likely to be influenced by structural policies, i.e. by trade, exchange control, and capital market policies.

Additional regressions were performed in order to test explicitly the subsets of hypotheses by using a variable coefficient model [Belsley, 1973]. The assumed relationship between the alternative use of monetary or exchange rate policy and the multiplier of the real exchange rate changes (R) on real growth and investment should exemplify the procedure. Taking the coefficients of R from equations (6) and (7), the hypothesis suggests that

$$(8) e_1 = e_{10} + e_{11}M + e_{12}N \text{ and}$$

$$(9) f_1 = f_{10} + f_{11}M + f_{12}N.$$

Positive coefficients of M and N show that a monetary contraction or a nominal devaluation, i.e. M and N are declining, dampen contractionary effects ( $e_1, f_1 > 0$ ) and strengthen expansionary effects ( $e_1, f_1 < 0$ ) of a real devaluation, because  $e_1$  and  $f_1$  would decline as well. If then the coefficient of either M or N is significantly larger, using this policy to devalue the real exchange rate would be advantageous in terms of economic performance.

The coefficients of equations (8) and (9) can be directly estimated by substituting the expressions for  $e_1$  and  $f_1$  in equations (6) and (7). This provides an estimation approach with variable coefficients.<sup>1</sup>

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<sup>1</sup> A general problem of the approach is the heteroscedasticity of the error term which arises because both the basic equations and the equations for the coefficients are assumed to be stochastic equations. In order to avoid a misinterpretation of significance levels, the variance-covariance matrix was corrected for heteroscedasticity in all regressions using the variable coefficients technique.

$$(6') Y = e_0 + e_{10}R + e_{11}R \times M + e_{12}R \times N + e_2^{TOT} + \dots \text{ and}$$

$$(7') INVR = f_0 + f_{10}R + f_{11}R \times M + f_{12}R \times N + f_2^{TOT} + \dots$$

The same procedure is applied to test the remaining hypotheses about the variability of coefficients. The assumed relationships between the coefficients and their determinants are given in the following paragraphs.

Equations (10) - (11) account for the influence of the structural composition of the fiscal budget on the fiscal balance effects of monetary and exchange rate policies.

$$(10) c_1 = c_{10} + c_{11}DF + c_{12}IT$$

$$(11) c_2 = c_{20} + c_{21}FIP + c_{22}TT$$

where<sup>1</sup>

DF = new domestic credits raised by the government [IMF, c];

IT = inflation tax;<sup>2</sup>

FIP = interest payments on external public debt [World Bank, a];

TT = trade taxes [IMF, c].

Equation (12) tests for the influence of the structural characteristics of an economy on the coefficients of monetary and exchange policy and for the impact of real exchange rate changes on economic performance:

$$(12) y_i = y_{i0} + y_{i1}EXPA + y_{i2}PSA + y_{i3}IIC + y_{i4}OP,$$

where  $i = \begin{cases} (1,2 & \text{if } y = a, b, c, d \\ (1 & \text{if } y = e, f, \end{cases}$

and EXPA = agricultural exports in per cent of total exports [UN, a];

PSA = agricultural production in per cent of total GDP (both measured in terms of factor costs) [World Bank, 1989];

<sup>1</sup> All explanatory variables in equations (10)-(12) are expressed in per cent of government expenditure (GE).

<sup>2</sup> Defined as real money supply M1 multiplied by the rate of inflation (according to the consumer price index; INF); [see Fischer/Trapp, 1986, p. 1118].



- IIC = imported intermediate and capital goods proxied by the sum of imported industry supplies, fuels, machinery, and transport equipment (in per cent of total imports) [UN, a];
- OP = degree of openness (sum of imports and exports in per cent of GDP) [IMF, d].

Equation (13) formalizes the influence of structural policies on the relevant coefficients.

$$(13) \quad x_i = x_{i0} + x_{i1}TP + x_{i2}FEC + x_{i3}KMP1 + x_{i4}KMP2,$$

where  $i = \begin{cases} 1, 2 & \text{if } x = a, b, c, d \\ 1 & \text{if } x = e, f \end{cases}$

- and TP = trade policy proxied by average import tariff rates (in per cent) based on tariffs which have actually been collected [IMF, c];<sup>1</sup>
- FEC = foreign exchange controls proxied by the ratio of black market to official exchange rates [Cowitt, a; IMF, d];<sup>2</sup>
- KMP1 = capital market policy proxied by the ratio of M1 to GDP (in per cent) [IMF, d];
- KMP2 = capital market policy proxied by the ratio of M2 minus M1 to GDP (in per cent) [IMF, d].<sup>3</sup>

#### IV. Empirical Results

##### 1. Monetary Contraction Versus Nominal Devaluation

The empirical analysis strongly supports our basic hypothesis, that the two alternative real devaluation strategies differ in terms of their effectiveness, their impact on macroeconomic re-

<sup>1</sup> This should be seen as a first approximation dictated by data limitations. It assumes especially that quantitative restrictions are positively correlated with trade taxes.

<sup>2</sup> For an economic justification see e.g. Edwards/Khan [1985, p. 396].

<sup>3</sup> Because of data limitations, financial deepening instead of real interest rates is used as a proxy for capital market policy, i.e. financial repression. A positive correlation between financial repression and financial deepening is assumed. Financial deepening is normally measured as the ratio of M2 to GDP [Gupta, 1984, p. 8]. Here, M2 is split up into its components M1 (KMP1) and savings and time deposits (KMP2). Opportunity costs of the two components are different because of the nominal interest paid on the latter. Consequently different effects on the coefficients are to be expected.

restrictions, and their economic growth and investment effects. Effectiveness of the policy instruments is analysed in equation (14) which provides the estimation results for the determinants of real exchange rate changes (equation (2) above):<sup>1</sup>

$$\begin{aligned} (14) \text{ R} = & -4.267^{***} + 0.306^{***}M + 0.515^{***}N \\ & (-2.314) \quad (10.211) \quad (15.450) \\ & + 0.265\text{TOT} + 0.003\text{NCF} + 0.026\text{D1xNCF} \\ & (1.477) \quad (0.064) \quad (0.331) \\ & + 0.097^{**}\text{R1} + 3.238\text{D1} \\ & (2.091) \quad (1.143) \end{aligned} \quad \bar{R}^2 = 0.49.$$

The determinants of the equilibrium real exchange rate - TOT and NCF - had no significant influence on real exchange rate changes actually observed over the whole estimation period from 1979 to 1986. Real exchange rates were explained by the lagged endogenous variable and the two policy variables in the first place. The positive coefficients for both monetary and exchange rate policy reveal that monetary contraction as well as nominal devaluation led to a real devaluation. Although it is not recognized in the literature, the significantly positive coefficient of M clearly demonstrates that monetary contraction is indeed an alternative to nominal devaluation for developing countries aiming at real exchange rate devaluation. An F-test shows, however, that the coefficient of N is significantly larger than the coefficient of M (Table A1). This supports our expectation that a larger real devaluation could be achieved by a nominal devaluation in the short run. In other words, the expansion of money supply has to be reduced to a larger extent in order to yield a desired short-run effect on the real exchange rate, compared with the nominal devaluation required for this purpose.

Pronounced differences between real devaluation strategies are also to be observed with respect to their impact on the macro-economic restrictions (Table 1). The reserve positions of de-

<sup>1</sup> t-values in parentheses; \*\* significant at the 5 per cent level; \*\*\* significant at the 1 per cent level (two-tailed t-test).

Table 1 - Monetary and exchange rate policy effects on reserve positions, fiscal deficits, and inflation rates in developing countries, 1979-1986<sup>a</sup>

Explanatory variables	Dependent variables		
	RES	DEF	INF
Const.	5.956*** (3.112)	0.009 (0.012)	3.298* (1.681)
M	-0.010 (-0.397)	-0.003 (-0.489)	0.803*** (22.950)
N	-0.097*** (-3.413)	-0.003 (-0.478)	-0.088** (-2.486)
TOT	-0.270* (-1.752)		
NCF	-0.118*** (-2.770)		
D1xNCF	0.135** (2.039)		
YR		0.247*** (4.247)	
GE		-0.478** (-1.987)	
RES1	0.889*** (31.838)		
DEF1		0.865*** (23.651)	
INFC			-0.233*** (-3.451)
INFC1			0.372*** (5.651)
D1	-4.124* (-1.691)	-0.409 (-0.724)	1.507 (0.543)
$\bar{R}^2$	0.81	0.70	0.90
D.F.	249	241	254

t-values in parentheses; \* significant at the 10 per cent level; \*\* significant at the 5 per cent level; \*\*\* significant at the 1 per cent level (two-tailed t-test). - <sup>a</sup> For the specification of regression equations and the definition of variables see equation (3) - (5) in the text.

Source: IMF [a; d]; UNCTAD [1988]; World Bank [a]; own calculations.

veloping countries were generally not affected by changes in monetary policy, but improved by devaluation of the nominal exchange rate.<sup>1</sup> The positive effect of the nominal devaluation strategy contradicts the existence of J-curve effects. A nominal devaluation can rather be expected to relax the foreign exchange constraint. At the same time, however, the sustainability of a real devaluation process may suffer from the inflationary impact of the policy adopted. In this respect a disadvantage of the nominal devaluation strategy has to be recognized: Inflation was accelerated by a nominal devaluation, whereas monetary contraction proved to be successful in significantly reducing price increases of consumer goods. This is supported by the estimated coefficients of INFC and INFC1. The coefficient of the once lagged inflation variable calculated from these values (0.605) is significantly smaller than 1. This result clearly contradicts the hypothesis of adaptive expectations driving the inflation rate which would require a coefficient significantly larger than 1. Since an automatic acceleration of inflation is not to be observed, there is a good chance to reduce inflation rates by a properly implemented monetary contraction.

Contrary to the foreign exchange reserves and inflation rates, fiscal deficits seem to be independent of both monetary and exchange rate policy.<sup>2</sup> There are good reasons to assume that monetary and exchange rate effects are determined by the structure of the fiscal budget. Therefore, the fiscal balance equation has

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<sup>1</sup> The reserve position was strongly influenced by external conditions. A worsening of the terms-of-trade led to a decline in foreign exchange holdings. The coefficients of NCF,  $D1 \times NCF$ , and  $D1$  reflect the change in the lending regime in 1982. Obviously, developing countries held significantly higher reserve positions after 1981 in order to guarantee liquidity for external payments in a situation where external credits were no longer easily available (negative coefficient of  $D1$ ). Moreover, countries with declining reserves apparently had priority access to remaining credit lines mainly from official sources (negative coefficient of NCF and positive coefficient of  $D1 \times NCF$ ).

<sup>2</sup> As was to be expected, a decline in real economic growth and rising government expenditures led to rising fiscal deficits.

been reestimated allowing the coefficients of monetary and exchange rate variables to be determined by the structural composition of the fiscal budget:<sup>1</sup>

$$\begin{aligned} (15) \text{ DEF} = & 1.254 + 0.027^{**}M - 0.001^{***}M \times \text{DF} \\ & (2.061) \quad (2.301) \quad (-4.834) \\ & + 0.000M \times \text{IT} - 0.155N + 0.000N \times \text{FIP} \\ & (0.438) \quad (-1.617) \quad (0.073) \\ & + 0.001^{**}N \times \text{TT} + 0.033\text{YR} - 0.151^{***}\text{GE} \\ & (2.026) \quad (0.918) \quad (-5.438) \\ & + 0.549^{***}\text{DEF1} - 0.532\text{D1} \\ & (9.890) \quad (-1.565) \quad \bar{R}^2 = 0.75 \end{aligned}$$

A first important result is that monetary contraction per se can actually cause fiscal deficits to rise. This is shown by the significantly positive coefficient of M, i.e. for the constant component of the money multiplier. However, the negative coefficient of MxDF reveals that the deterioration of the fiscal balance induced by a monetary contraction is less severe if a high share of government expenditure is financed by domestic credits. Interest rates are possibly fixed in most countries so that there are no higher credit costs connected with a monetary contraction. Moreover, available credit funds are likely to decline. If the government's share of total credit available is limited the fiscal deficit is bound to decline. Under such conditions fiscal discipline is enforced by a monetary contraction especially if the share of expenditure financed by domestic credit is high.

The impact of inflationary financing remains insignificant. Reduced receipts from the inflation tax do not limit the feasibility of a monetary contraction. Arguably, the inflation tax is not important in low inflation countries and receipts do not

<sup>1</sup> t-values in parentheses; \* significant at the 10 per cent level; \*\* significant at the 5 per cent level; \*\*\* significant at the 1 per cent level. - For the specification of the regression equation and the definition of variables see equations (4), (10), and (11) in the text.

necessarily decline in high inflation countries because the relationship between money creation and inflation tax revenue has become indeterminate or even negative.

The nominal devaluation effect on the fiscal budget is not changed by actual foreign interest payments. Because of sovereignty problems in international lending a rise in interest payment obligations (in terms of the borrower currency) does not necessarily lead to higher actual interest payments. The fiscal effects then depend on the transfer negotiations. Contrary to the impact of foreign interest payments the rise in fiscal deficits due to a nominal devaluation increases with higher revenues from trade taxes. The effect of higher prices for tradables seems to be more than offset by the lower quantities traded. This is in line with the result that no J-curve effect is to be observed if currencies are devalued in nominal terms (see Table 1). As a consequence a nominal devaluation can diminish government revenue from trade taxes thereby increasing the fiscal deficit. Since the share of trade taxes in total government revenue is normally high in developing countries the feasibility of a nominal devaluation could be seriously affected.

Generally speaking, regressions run on the macroeconomic restrictions determining the sustainability of a real devaluation did not reveal a clear advantage of any particular devaluation strategy. Table A1 shows that significant differences between the policy instruments exist with respect to their impact on the reserve position and inflation rates. The F-tests performed, however, point to conflicting conclusions: a nominal devaluation is superior in relaxing foreign exchange constraints but raises inflation. On the other hand, inflation can be reduced by a monetary contraction. The appropriate policy choice thus depends on the specific situation of a country, i.e. whether it suffers more from a shortage of foreign exchange or from accelerating inflation rates. With respect to fiscal deficits the estimation with variable coefficients has shown that the feasibility of monetary contraction depends on fiscal discipline whereas fiscal budget

effects of nominal devaluations are determined by the importance of revenues from trade taxes in the first place. Again, the optimal policy choice depends on the specific political and economic situation of a country.

The regressions testing for possible costs of real exchange rate changes are presented in Table 2. Most notably, the hypothesis of contractionary effects of real exchange rate changes can not be confirmed for a fairly wide spectrum of developing countries [see also Nunnenkamp/Schweickert, 1990a]. This hypothesis would imply significantly positive coefficients of  $R$ . Moreover, the estimated coefficients reveal that the use of monetary and exchange rate policies actually influences the performance effects of real exchange rate changes to different extents.<sup>1</sup>

The economic performance effects of alternative real devaluation strategies are clearly demonstrated in the regressions run on economic growth. The coefficients of the variables  $RxM$  and  $RxN$  are highly significant in the second version of the growth equation. Their positive values imply that both monetary contraction and nominal devaluation could reduce contractionary effects and enhance expansionary effects of a real exchange rate devaluation.<sup>2</sup> But the coefficient of  $R$  remains insignificant in the first growth equation. This coefficient can be interpreted as the average growth impact of changes in  $R$ . Its insignificance reflects the fact that both the growth of money supply and nominal

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<sup>1</sup> Growth and investment effects of changes of the terms-of-trade, net capital inflows, government expenditure and money supply shocks remain insignificant. This points to the heterogeneity of the country sample with respect to the impact of the variables. The reduction in domestic absorption after the beginning of the debt crisis led generally to a cut in investment in the first place (positive coefficient of  $D1$  in the investment equations). On the contrary, real economic growth is found to be different for the two subperiods only when the influence of the monetary and exchange rate variables is not explicitly taken into consideration. The differences in economic growth seem to be at least partly due to a change in monetary and exchange rate policies.

<sup>2</sup> Section III.2 above exemplifies the interpretation of the coefficients.

Table 2 - Real exchange rate effects on growth and investment in developing countries, 1979-1986<sup>a</sup>

Explanatory variables	Dependent variables			
	Y	Y	INV	INV
Const.	-0.144 (-0.199)	-0.156 (-0.205)	1.872*** (2.721)	1.862*** (2.848)
R	-0.013 (-1.381)	-0.017 (-1.232)	-0.010 (-1.405)	-0.025*** (-2.645)
RxM <sup>b</sup>		0.038*** (3.247)		0.013 (1.365)
RxN <sup>b</sup>		0.006** (2.062)		-0.002 (-1.212)
TOT	-0.037 (-0.976)	-0.031 (-0.724)	0.024 (0.902)	0.025 (1.034)
NCF	-0.010 (-0.983)	-0.015 (-1.018)	0.005 (0.732)	0.007 (1.014)
D1xNCF	0.073*** (4.549)	0.075** (2.114)	0.004 (0.334)	0.003 (0.251)
GE	0.015 (0.616)	0.018 (0.610)		
UMS	0.011 (1.043)	0.006 (0.486)		
Y1	0.400*** (6.711)	0.415*** (5.383)	0.035 (0.793)	0.021 (0.364)
INV1			0.866*** (30.149)	0.866*** (28.834)
D1	-1.269** (-2.096)	-1.394 (-1.562)	1.066** (2.473)	1.143*** (2.587)
$\bar{R}^2$	0.27	0.28	0.81	0.81
D.F.	240	236	253	247

t-values in parentheses; \* significant at the 10 per cent level; \*\* significant at the 5 per cent level; \*\*\* significant at the 1 per cent level (two-tailed t-test). - <sup>a</sup> For the specification of regression equations and the definition of variables see equations (6), (7) and (6'), (7') respectively in the text. - <sup>b</sup> The coefficients of these variables were multiplied by 100.

Source: IMF [a; b; d]; UNCTAD [1988]; World Bank [a, 1989]; own calculations.



exchange rate changes show large variances in the data sample. Systematic effects on the real exchange rate multiplier are thus obscured. Furthermore monetary expansion experienced an upward trend in the period 1978-1986, whereas nominal exchange rates were devalued on average. Any systematic effects on the multiplier would have neutralized each other. High variability and opposing trends of  $N$  and  $M$ , explain why their significant impact on the multiplier did not result in a significant average multiplier of the real exchange rate on economic growth.

Contrary to the growth equation  $RxM$  and  $RxN$  remain insignificant in the investment equation. The significant coefficient of  $R$  in the second version of the investment equation indicates that real devaluation per se has an positive effect on investment activity. Presumably, the indeterminate impact of monetary and exchange rate policies and the variability of these policy variables rendered the average multiplier insignificant in the first investment equation.

What matters in the first place, however, is the relative advantage of the alternative strategies which is determined by the differences between the coefficients of  $RxM$  and  $RxN$ . In both equations, the coefficient is significantly larger for  $RxM$  (Table A1). Consequently, the monetary contraction strategy seems to be better suited to enhance positive and to reduce negative economic growth and investment effects of a real devaluation. This result strongly supports the hypotheses of favourable economic performance effects of the monetary contraction strategy, namely that it avoids a sharp increase of import prices, that it can lead to a reallocation of disposable income in favour of the private sector, and that it does not squeeze investment activity.

## 2. Economic Structure and Real Devaluation

Contrary to structural policies, a country can not change its economic structure in the short run in order to optimize a reform package. In this perspective, structural characteristics provide the given background for each reform program. By and large the

regression results presented in Table 3<sup>1</sup> support the hypotheses raised in the theoretical part of the paper.

As was to be expected, the inflationary impact of the nominal devaluation strategy is greater in more industrialized countries with a low share of agricultural products in total exports (EXPA).<sup>2</sup> Additionally, the effectiveness of this strategy is smaller when the share of imported intermediate and capital goods in total imports (IIC) is high.

But the same results are to be observed in the case of a monetary contraction strategy so that the relative advantages of the alternative strategies are not affected significantly. Economies with high shares of agricultural exports can expect a more favourable development of inflation rates and the effectiveness of both strategies is higher if import dependency is relatively low, irrespective of the real devaluation strategy adopted.<sup>3</sup> Moreover, expansionary production and investment responses to a real devaluation are more likely in agricultural economies as was hypothesized. This is shown by the significantly negative coefficients of RxEXPA and RxPSA in the growth and investment equations.

Contrary to trade and production structures, the openness of an economy impact on the relative advantage of the real devaluation strategies. Openness is not an impediment to the nominal devaluation strategy. Obviously, the stronger competitive pressure compensates for the higher sensibility of the overall price level to nominal devaluations. But the disinflationary effect of monetary contraction is significantly reduced in the case of high

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<sup>1</sup> The reserve equation is not presented here because it turns out again that the reserve position is determined by the control variables exclusively.

<sup>2</sup> The results are less clear-cut if production and export shares of manufacturing industries are used to characterize the structure of an economy (see also Tables A2 and A3 in the Appendix).

<sup>3</sup> Additionally, deficit reduction in the case of a monetary is more likely in agricultural economies and economies with high import dependency.

Table 3 - Economic structure and real devaluation in developing countries, 1979-1986<sup>a,b</sup>

Dependent variables	Explanatory variables										
	Const.	M	MxEXP	MxPSA	MxIIC	MxOP	N	NxEXPA	NxPSA	NxIIC	NxOP
DEF	1.513** (2.028)	0.207 (1.623)	0.000 (0.249)	-0.001* (-1.942)	-0.002* (-1.744)	-0.000 (0.461)	0.235 (1.355)	-0.000 (-0.658)	-0.000 (-0.094)	-0.003 (-1.518)	-0.000 (-0.316)
INF	6.430*** (3.417)	1.618*** (2.875)	0.011*** (2.782)	-0.008 (-0.894)	-0.011* (-1.859)	-0.010*** (-3.208)	0.190 (0.195)	0.011* (1.797)	-0.008 (-0.489)	-0.009 (-0.884)	0.002 (0.578)
R	-0.758 (-0.434)	1.303*** (2.605)	0.004 (1.570)	0.002 (0.359)	-0.013** (-2.086)	-0.005** (-2.289)	1.919** (2.251)	0.005 (1.427)	0.006 (0.776)	-0.203* (-1.955)	-0.000 (-0.190)

Dependent variables	Explanatory variables					
	Const.	R	RxEXPA	RxPSA	RxIIC	RxOP
Y	-0.042 (-0.055)	0.313 (0.915)	-0.001 (-0.760)	-0.002** (-2.139)	-0.003 (-0.717)	-0.001 (-0.869)
INV	1.567** (2.169)	0.268 (1.619)	-0.001* (-1.684)	-0.001* (-1.700)	-0.003 (-1.469)	-0.001 (-1.180)

t-values in parentheses: \* significant at the 10 per cent level; \*\* significant at the 5 per cent level; \*\*\* significant at the 1 per cent level (two-tailed t-test). -<sup>a</sup> For the specification of regression equations and the definition of variables see equations (2), (4)-(7), and (12) in the text. -<sup>b</sup> The complete regression results are presented in Table A2 and A3 in the Appendix.

Source: INF [a; b; d]; UN [a]; UNCTAD [1988]; World Bank [a, 1989]; own calculations.

openness, reflecting the strong impact of world market conditions on the price level. Consequently, the effectiveness of the monetary contraction strategy is impaired in open economies.

### 3. Structural Policies and Real Devaluation

The next step is to test for the influence of trade, exchange control, and capital market policies on the effectiveness, sustainability and costs of a real exchange rate devaluation (Table 4).<sup>1</sup> The results are important for the design of consistent reform packages. They are clear-cut for trade and exchange control

<sup>1</sup> The reserve and fiscal deficit equations are not reported in Table 4 because they show no significant impact of structural policies.

Table 4 - Structural policies and real devaluation in developing countries, 1979-1986<sup>a,b</sup>

Dependent variables	Explanatory variables											
	Const.	N	MxTP	MxFEC	MxRMP1	MxRMP2	N	NxTP	NxFEC	NxRMP1	NxRMP2	.....
INF	4.983** (2.575)	0.750*** (3.362)	0.009 (0.893)	0.100*** (3.273)	-0.035*** (-4.382)	0.003 (0.433)	-0.313 (-0.974)	0.009 (0.800)	0.033 (0.349)	0.010 (0.907)	-0.009 (-1.211)	.....
R	-2.849* (-1.852)	0.272 (1.630)	-0.023* (-1.863)	0.088*** (2.651)	0.007 (0.924)	-0.001 (-0.238)	0.357 (1.104)	-0.044* (-1.902)	0.193 (1.594)	0.042** (2.570)	0.011 (-1.148)	.....

Dependent variables	Explanatory variables						
	Const.	R	RxTP	RxFEC	RxRMP1	RxRMP2	.....
Y	0.250 (0.301)	-0.039 (-1.005)	0.004* (1.940)	-0.006*** (-2.840)	-0.003 (-1.094)	0.003*** (2.614)	.....
INVR	1.960*** (2.715)	0.007 (0.571)	0.002* (1.778)	-0.003** (-2.088)	-0.003** (-2.137)	0.001 (0.717)	.....

t-values in parentheses: \* significant at the 10 per cent level; \*\* significant at the 5 per cent level; \*\*\* significant at the 1 per cent level (two-tailed t-test). - <sup>a</sup> For the specification of regression equations and the definition of variables see equations (2) -(7) and (13) in the text. - <sup>b</sup> The complete regressions are presented in Table A4 in the Appendix.

Source: IMF [a; b; c; d]; Cowitt [a]; UNCTAD [1988]; World Bank [a, 1989]; own calculations.

policies. A restrictive trade policy seems to be unfavourable for a real devaluation whereas a restrictive exchange control policy seems to support the devaluation process. The picture is less clear for capital market policies.

The external competition provided by a liberal trade regime enforces the adjustment of relative prices to external shocks or policy changes and enhances allocative efficiency. Consequently, a low level of import tariffs (TP) makes both real devaluation strategies more effective and leads to better economic performance effects of a real devaluation. This is clearly demonstrated by the significant coefficients for MxTP, NxTP, and RxTP respectively. The result supports the view that trade liberalization should not be postponed until a macroeconomic reform has been launched.

On the contrary, a liberal exchange control policy can have negative effects on the real devaluation process. With stable interest rates at home and abroad, a real devaluation provides an incentive for capital inflows because it reduces overvaluation and therefore the probability of future devaluations. A rise in the price level or an nominal appreciation of the currency is the likely consequence of such a shift of short-term financial funds into the country. Table 4 reveals that especially the effectiveness of the monetary contraction strategy can be increased by the use of exchange controls. The higher significance level of  $MxFEC$  compared with  $NxFEC$  in the real exchange rate equation reflects the fact that in developing countries with more or less fixed nominal exchange rates the inflationary impact of capital movements figures more prominently. More restrictive capital controls significantly strengthen the inflation reducing effect of a monetary contraction. This effect, however, has been shown before to be a necessary condition for the effectiveness of a monetary contraction with respect to a real exchange rate depreciation.

The higher stability of the real exchange rate adjustment provided by exchange controls leads to better economic performance effects of a real devaluation. This is reflected in the negative coefficients for  $RxFEC$  which show that short-run contractionary effects of a real devaluation are reduced and expansionary effects enforced by exchange controls. The benefits of reducing exchange controls can be expected to rise when inconsistencies in economic policy have been removed. Consequently, their liberalization should possibly be postponed until expectations of real exchange rate devaluations are reduced substantially by a macroeconomic reform.

The conclusions are less clear-cut with respect to capital market policies. The estimated coefficients reveal that a low level of money supply  $M1$  relative to GDP ( $KMP1$ ), i.e. strong financial repression, weakens the effectiveness of the nominal devaluation strategy and enhances the disinflation effect of a monetary contraction. These results point to an advantage of the monetary

contraction strategy in financially repressed economies which is further supported by the complementarity of monetary contraction and financial liberalization. The levels of savings and time deposits relative to GDP (KMP2) is shown to affect only the growth impact of real exchange rate changes. It can thus be assumed that relatively high interest rates, which are at least necessary for high levels of KMP2, negatively affect short-run economic growth effects of a real devaluation by raising adjustment costs. Nevertheless, the balance is in favour of capital market liberalization due to the positive effects of low financial repression on investment activity. Especially financial liberalization via reducing inflation seems to be suitable for supporting a real devaluation.

#### V. Summary and Policy Conclusions

The theoretical arguments and the empirical results presented in this paper have shown that there are two basic strategies for real exchange rate devaluation - monetary contraction and nominal devaluation. Therefore, the present discussion about macroeconomic reform programs is actually a discussion about real devaluation strategies. "Stabilization programs" are typically based on monetary contraction, whereas "adjustment programs" rely on nominal devaluation in the first place. Consequently, the relevant problem is not the sequencing of price stabilization and real exchange rate adjustment, but the decision on the appropriate real devaluation strategy which should be based on meaningful efficiency criteria.

It is the basic hypothesis of this paper that the efficiency of real devaluation strategies depend on

- their effectiveness, i.e. the speed and extent of the real exchange rate devaluation achieved,
- their sustainability, i.e. their effects on the foreign exchange reserves, the fiscal deficit, and inflation rates, and

- their potential costs, i.e. the economic performance effects of a real exchange rate devaluation measured in terms of economic growth and investment activity.

The relative efficiency of the alternative strategies is likely to be affected by the sequencing of real devaluation and structural reforms encompassing trade, exchange control, and capital market liberalizations. Additionally, the impact of trade and production structures on the efficiency of real devaluation is to be considered. The theoretical analysis of these issues reveals that an a-priori superiority can neither be established for a nominal devaluation nor for a monetary contraction.

The empirical results on the effectiveness and sustainability of the real devaluation strategies can be summarized as follows:

- Both monetary contraction and nominal devaluation lead to a real devaluation in the short run, but effectiveness is higher in the case of a nominal devaluation.
- The nominal devaluation strategy should be preferred if foreign reserves represent a binding constraint. Changes in monetary policy are neutral with respect to the reserve position, whereas a nominal devaluation increases foreign exchange reserves. The opposite conclusion is arrived at if high inflation is the major problem: A monetary contraction dampens inflation, whereas a nominal devaluation has an inflationary impact.
- In the case of a monetary contraction, favourable effects on inflation rates and the real exchange rate can above all be expected in countries with repressed financial markets, restrictive exchange controls, and a relatively small external sector. Additionally, fiscal discipline is enforced by a monetary contraction if the share of expenditure financed by domestic credit is high.
- In the case of a nominal devaluation effectiveness will be high in countries with low and stable inflation rates. But revenues from trade taxes will rather decline than rise after a nominal devaluation. Consequently, rising fiscal deficits due to a

nominal devaluation can be expected for countries depending on trade taxes to finance government expenditure in the first place.

- Both monetary contraction and nominal devaluation are shown to be more effective and to result in lower inflation rates if import tariffs are low, the share of agricultural products in total exports is high, and dependence on intermediate and capital goods imports is low.

The hypothesis of contractionary effects of real exchange rate devaluations on economic growth and investment is not confirmed for the fairly wide spectrum of developing countries covered by our analysis. More specifically the results for the economic performance effects of real exchange rate devaluation show that

- a monetary contraction is better suited to enhance expansionary effects and to reduce contractionary effects;
- a liberal trade regime enforces expansionary effects;
- at least under present conditions of inconsistent economic policies, the opposite result turned out for exchange restrictions;
- low and stable inflation rates lead to a higher investment activity by reducing financial repression;
- high interest rates can dampen positive supply responses;
- agricultural economies can generally expect better economic performance effects from a real devaluation policy, compared with more industrialized economies.

All in all, it can be concluded that an unique optimal strategy for real exchange rate devaluation does not exist. The relative advantage of the alternative strategies heavily depends on the severity of macroeconomic constraints limiting the feasibility of policy options, basic characteristics of the economies concerned, and the economic policy framework with respect to structural reforms. In order to derive definite policy conclusions, the most binding constraints have to be identified in each particular



case. In other words, detailed country studies are required in order to devise appropriate policy options. Country studies are particularly required to explain why the effectiveness, the feasibility and economic performance effects of real devaluations are generally better for agricultural compared with more industrialized economies, irrespective of the real devaluation strategy adopted.

Further research is also required as far as the sequencing of macroeconomic and structural reforms is concerned. It is safe to assume that macroeconomic reform, i.e. real devaluation, is of high priority in the typical developing country context. However, our results strongly conflict with the widespread belief that microeconomic liberalization should be postponed until after macroeconomic disequilibria have been removed. Particularly, trade liberalization should not be postponed. It rather helps the real devaluation process irrespective of the devaluation strategy adopted. By contrast, the evidence of this paper suggests that the real devaluation process is rendered more difficult by an immediate relaxation of capital controls. However, it has to be evaluated in ongoing research whether the maintenance of exchange restrictions for the adjustment period is a first best solution, or whether this result is due to exchange rate regimes adopted and inefficiencies in domestic markets. In any case, successful real devaluation may help a first step towards capital market liberalization, namely a reduction in inflation rates. In this context, monetary contraction is clearly superior to the nominal devaluation strategy.

Again in contrast to common belief, our analysis shows that monetary contraction has important merits in achieving real devaluation. This raises the question whether the principal flaw of this strategy, i.e. being subject to serious financial constraints, may be overcome by additional policy measures. The sustainability of monetary contraction heavily depends on the availability of foreign exchange and on fiscal discipline. The scope for a monetary contraction thus depends on the possibility

to relax external and domestic financial bottlenecks by means of external assistance, by promoting private savings or through a reduction of fiscal deficits. The decision about external assistance is mainly under control of the IMF and the World Bank unless private foreign creditors relax the strict credit rationing. International financial institutions may consider to grant more assistance to countries striving for real devaluation through monetary contraction in order to assure the feasibility of this strategy. Assistance may be conditioned on internal efforts to raise domestic savings and to cut fiscal deficits. Moreover financial constraints may be eased by transforming non-tariff trade barriers into tariffs thereby raising revenues from trade taxes. Such a conversion is generally acknowledged as a first important step towards trade liberalization so that the effectiveness and economic performance effects of real devaluation will be improved along with the feasibility and credibility of the reform program.

Appendix Tables

Table A1 - Efficiency of Alternative Real Devaluation Strategies in Developing Countries: Test on Differences between Coefficients<sup>a</sup>

Hypotheses <sup>b</sup>	Dependent Variables <sup>c</sup>					
	RES	DEF	INF	R	Y	INV
M=N	F(1.249)= 18.609***	F(1.241)= 0.004	F(1.254)= 663.709***	F(1.249)= 79.324***	-	-
RxM = RxN	-	-	-	-	CHI <sup>2</sup> (1)= 7.326***	CHI <sup>2</sup> (1)= 2.723*

Number of restrictions and degrees of freedom (F-statistic) and number of restrictions respectively (CHI<sup>2</sup>-statistic) in parentheses. - \* significant at the 10 per cent level; \*\* significant at the 5 per cent level; \*\*\* significant at the 1 per cent level. - <sup>a</sup>Regressions with and without restrictions are compared. The restrictions are given by the hypothesis. The hypothesis is rejected if the test statistic is significant. The relevant test statistic is the CHI<sup>2</sup>-statistic in the case of regression with variable coefficients and the F-statistic otherwise. - <sup>b</sup>The coefficients of these variables are equated. - <sup>c</sup>The tests were run for the equations with these dependent variables.

Source: See Table 1; own calculations.

Table A2 - Sustainability and Effectiveness of Real Devaluation Strategies and Economic Structure of Developing Countries, 1979-1986<sup>a</sup>

Explanatory Variables	Dependent Variables							
	RES	RES	DEF	DEF	INF	INF	R	R
Const.	4.186* (1.800)	6.209*** (2.590)	1.513** (2.028)	1.283* (1.675)	6.430*** (3.417)	5.250*** (3.447)	-0.758 (-0.434)	-1.261 (-9.859)
M	0.638 (0.771)	0.647 (0.720)	0.207 (1.623)	0.134 (1.019)	1.618*** (2.875)	1.274*** (2.137)	1.303*** (2.605)	1.472** (2.394)
MxEXPA	-0.002 (0.634)		0.000 (0.249)		0.011*** (2.782)		0.004 (1.570)	
MxEXPM		0.004 (1.276)		0.000 (0.050)		-0.003 (-0.803)		-0.007* (-1.684)
MxPSA	0.003 (0.763)		-0.001* (-1.942)		-0.008 (-0.894)		0.002 (0.359)	
MxPSM		-0.009 (-0.816)		-0.001 (-0.434)		-0.008 (-0.451)		-0.002 (-0.142)
MxOP	0.001 (0.156)	-0.001 (-0.186)	-0.000 (0.461)	0.000 (0.477)	-0.010*** (-3.208)	-0.014*** (-4.542)	-0.005** (-2.289)	-0.008*** (-3.265)
MxIIC	-0.007 (-0.832)	-0.007 (-0.628)	-0.002* (-1.744)	-0.002 (-1.187)	-0.011* (-1.859)	-0.000 (-0.067)	-0.013** (-2.086)	-0.007 (-0.962)
N	-0.385 (-0.495)	0.087 (0.113)	0.235 (1.355)	0.171 (0.904)	0.190 (0.195)	-0.883 (-0.876)	1.919** (2.251)	1.953* (1.752)
NxEXPA	-0.000 (-0.108)		-0.000 (-0.658)		0.011* (1.797)		0.005 (1.427)	
NxEXPM		-0.003 (-1.118)		-0.000 (-0.320)		0.002 (0.042)		-0.010 (-1.631)
NxPSA	-0.000 (-0.073)		-0.000 (-0.094)		-0.008 (-0.489)		0.006 (0.776)	
NxPSM		0.027** (2.146)		-0.000 (-0.237)		-0.026 (-1.187)		-0.005 (-0.270)
NxOP	0.001 (0.212)	-0.005 (-1.254)	-0.000 (-0.316)	0.001 (1.502)	0.002 (0.578)	0.008*** (2.157)	-0.000 (-0.190)	-0.001 (-0.340)
NxIIC	0.003 (0.330)	-0.005 (-0.584)	-0.003 (-1.518)	-0.002 (-1.084)	-0.009 (-0.884)	0.009 (0.737)	-0.203* (-1.955)	-0.010 (-0.754)
TOT	-0.092 (-0.480)	-0.134 (-0.632)					0.066 (0.477)	0.291** (1.975)
NCF	-0.090 (-1.629)	-0.141** (-2.426)					0.016 (0.378)	0.004 (0.090)
DLxNCF	0.099 (1.268)	0.146* (1.731)					0.008 (0.162)	-0.003 (-0.055)
YR			0.297* (1.832)	0.323* (1.847)				
GE			-0.120** (-2.416)	-0.123** (-2.452)				
INFC					-0.319 (-2.366)	-0.317*** (-2.604)		

Table A2 -continued

Explanatory Variables	Dependent Variables							
	RES	RES	DEF	DEF	INF	INF	R	R
INFC1					0.398 (2.958)	0.401*** (3.209)		
RES1	0.875*** (19.913)	0.854*** (19.534)						
DEF1			0.794*** (5.555)	0.807*** (5.716)				
R1						(0.648)	0.037 (2.139)	0.112**
D1	-4.400 (-1.600)	-4.025 (-1.390)	-0.385 (-0.807)	-0.260 (-0.537)	5.732*** (2.957)	7.143*** (3.307)	1.965 (1.129)	3.238* (1.919)
$\bar{R}^2$	0.80	0.80	0.74	0.73	0.95	0.95	0.44	0.46
D.F.	195	177	188	170	199	181	195	177

t-values in parentheses; \* significant at the 10 per cent level; \*\* significant at the 5 per cent level; \*\*\* significant at the 1 per cent level (two-tailed t-test). - <sup>a</sup>For the specification of regression equations and the definition of variables see equations (2)-(5) and (15) in the text; EXPM = share of manufactured goods in total exports (in per cent); PSM = share of manufactured goods in GDP of factor costs (in per cent).

Source: See Table 3; own calculations.

Table A3 - Economic Performance Effects of Real Exchange Rate Changes and Economic Structure in Developing Countries, 1979-1986<sup>a</sup>

Explanatory Variables	Dependent Variables			
	Y	Y	INV	INV
Const.	-0.042 (-0.055)	-0.510 (-0.582)	1.567** (2.169)	2.004*** (2.602)
R	0.313 (0.915)	0.161 (0.478)	0.268 (1.619)	0.127 (0.821)
RXEXPA	-0.001 (-0.760)		-0.001* (-1.684)	
RxEXPM		-0.001 (-0.745)		-0.000 (-0.011)
RxPSA	-0.002** (-2.139)		-0.001* (-1.700)	
RxPSM		0.008** (2.438)		0.003 (1.506)
RxOP	-0.001 (-0.869)	-0.001 (-1.283)	-0.001 (-1.180)	0.001 (1.284)
RxIIC	-0.003 (-0.717)	-0.003 (-0.696)	-0.003 (-1.469)	-0.002 (-1.405)
TOT	-0.075 (-1.548)	-0.768 (-1.523)	0.016 (0.420)	0.015 (0.422)
NCF	-0.009 (-0.607)	-0.006 (-0.407)	0.011 (1.277)	0.013 (1.499)
D1xNCF	0.069** (1.850)	0.069* (1.849)	-0.004 (-0.302)	-0.003 (-0.278)
GE	0.020 (0.749)	0.040 (1.412)		
UMS	0.012 (1.049)	0.015 (1.205)		
Y1	0.432*** (5.015)	0.396*** (4.608)	0.023 (0.367)	0.040 (0.604)
INV1			0.872*** (26.352)	0.846*** (22.897)
D1	-1.589* (-1.765)	-1.432 (-1.572)	1.238*** (2.678)	1.348*** (2.814)
$\bar{R}^2$	0.29	0.30	0.82	0.80
D.F.	191	173	202	184

t-values in parentheses; \* significant at the 10 per cent level; \*\* significant at the 5 per cent level; \*\*\* significant at the 1 per cent level (two-tailed t-test). - <sup>a</sup>For the specification of regression equations and the definition of variables see equations (6), (7), and (15) in the text; EXPM = share of manufactured goods in total exports (in per cent); PSM = share of manufactured goods in GDP of factor costs (in per cent).

Table A4 - Structural Policies and the Efficiency of Real Devaluation Strategies in Developing Countries, 1979-1986<sup>a</sup>

Explanatory Variables	Dependent Variables					
	RES	DEF	INF	R	Y	INV
Const.	8.035*** (3.829)	-0.449 (-0.343)	4.983** (2.575)	-2.849* (-1.852)	0.250 (0.301)	1.960*** (2.715)
M	0.013 (0.161)	-0.011 (-0.482)	0.750*** (3.362)	0.272 (1.630)		
MxTP	0.003 (0.651)	0.001 (0.700)	0.009 (0.893)	-0.023* (-1.863)		
MxFEC	-0.018 (-1.640)	0.005 (1.460)	0.100*** (3.273)	0.088*** (2.651)		
MxKMP1	-0.004 (-0.656)	-0.002 (-1.027)	-0.035*** (-4.382)	0.007 (0.924)		
MxKMP2	-0.002 (-0.638)	0.000 (0.221)	0.003 (0.433)	-0.001 (-0.238)		
N	-0.158 (-1.246)	-0.008 (-0.258)	-0.313 (-0.974)	0.357 (1.104)		
NxTP	-0.004 (-0.463)	0.001 (1.071)	0.009 (0.800)	-0.044* (-1.902)		
NxFEC	0.045 (1.112)	0.000 (0.015)	0.033 (0.349)	0.193 (1.594)		
NxKMP1	0.002 (0.266)	-0.001 (-0.312)	0.010 (0.907)	0.042** (2.570)		
NxKMP2	-0.001 (-0.218)	-0.001 (-1.128)	-0.009 (-1.211)	-0.011 (-1.148)		
R					-0.039 (-1.005)	0.007 (0.571)
RxTP					0.004* (1.940)	0.002* (1.778)
RxFEC					-0.006*** (-2.840)	-0.003** (-2.088)
RxKMP1					-0.003 (-1.094)	-0.003** (-2.137)
RxKMP2					0.003*** (2.614)	0.001 (0.717)
TOT	-0.292* (-1.768)			0.169 (1.157)	-0.010 (-0.231)	0.023 (0.906)
NCF	-0.123*** (-2.640)			-0.021 (-0.518)	-0.012 (-0.802)	0.007 (0.959)
DLxNCF	0.130** (2.020)			-0.084 (1.384)	0.067* (1.889)	0.001 (0.061)

Table A4 continued

Explanatory Variables	Dependent Variables					
	RES	DEF	INF	R	Y	INV
YR		0.288* (1.946)				
GE		-0.028 (-0.421)			0.009 (0.291)	
INFC			-0.278** (-2.332)			
INFC1			0.389*** (3.464)			
UMS					0.013 (1.193)	
RES1	0.875*** (20.898)					
DEF1		0.883*** (6.610)				
R1				0.028 (0.640)		
Y1					0.406*** (5.175)	0.254 (0.426)
INV1						0.867*** 26.679)
D1	-4.262* (-1.805)	-0.153 (-0.305)	7.497*** (3.416)	4.147 (2.167)	-1.511* (-1.708)	1.011** (2.275)
$\bar{R}^2$	0.81	0.69	0.94	0.64	0.29	0.81
D.F.	228	228	233	228	228	232

t-values in parentheses; \* significant at the 10 per cent level; \*\* significant at the 5 per cent level; \*\*\* significant at the 1 per cent level (two-tailed t-test). - <sup>a</sup>For the specification of regression equations and the definition of variables see equations (2)- (7), and (14) in the text.

Source: See Table 4; own calculations.



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