DEVALUATION AND AGGREGATE ECONOMIC ACTIVITY: AN EMPIRICAL ANALYSIS OF THE CONTRACTIONARY DEVALUATION ISSUE

by

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I. Introduction

The main policy goal of nominal devaluations is to generate a readjustment in the relative price of tradables and nontradables -- or a real devaluation -- and to improve the external position of the country.[1] Results obtained in recent empirical studies indeed show that if nominal devaluations are supplemented by adequate macroeconomic policies, it is possible to achieve, in the short to medium run, quite significant real devaluations (see Edwards 1985a and the references therein).

Recently, however, a number of authors have questioned the effectiveness of devaluations as policy tools. It has been argued that even though nominal devaluations may achieve their goal of generating a relative price readjustment, they may do so at a high cost. In particular it has been pointed out that one of such (indirect) costs is the decline in total output generated by a devaluation. This critique has come to be known as the contractionary devaluation problem.[2]

From an analytical point of view, devaluations can affect the economy through a number of channels. According to the more traditional views a devaluation will either have an expansionary effect on aggregate output or, in the worst of cases, will leave aggregate output unaffected. If there is unutilized capacity a nominal devaluation will be expansionary, and total aggregate output will increase. On the other hand, if the economy is operating under full employment, the nominal devaluation will be translated into equiproportional increases in prices, with the real exchange rate and aggregate output not being affected.[3] This particular aspect of the more traditional approaches has recently been challenged by the neo-structuralist critique. The point made by Taylor (1983), Katseli (1982), van Wijnbergen (1986) and others is that in the less developed countries it is highly

probable that real output will decline after an exchange rate adjustment.

There are several theoretical reasons why, contrary to the traditional views, a devaluation can be contractionary, and generate a decline in aggregate real activity, including employment. First, it can generate depressing forces over aggregate demand that would offset the traditional expenditure switching effect. For example, through its effect on the price level, a devaluation can generate a negative real balance (or Pigou) effect. This, in turn, will result in lower aggregate demand and output.[4] Also, a devaluation can generate a redistribution of income from groups with a low marginal propensity to save to groups with a high marginal propensity to save, resulting in a decline in aggregate demand and output. (See, for example, Diaz-Alejandro, 1965. See also Krugman and Taylor, 1978.) Finally, if the price elasticities of imports and exports are sufficiently low, the trade balance expressed in domestic currency may worsen, generating a recessionary effect. Second, in addition to these demand-related effects, there are a number of supply-side channels through which devaluations can be contractionary. For example, van Wijnbergen (1985) has recently developed a model with intermediate goods and informal (curb) financial markets, where a devaluation results in an increase in the domestic currency price of intermediate inputs, and in an upward shift of the aggregate supply schedule.[5]

In this paper the issue of contractionary devaluations is empirically analyzed in detail, using extensive data sets for the developing countries. This is done in two ways. First, the real activity aspects of 30 devaluation episodes are closely scrutinized. The behavior of a number of important variables in the period elapsed between three years before the devaluation and three years after the devaluation is analyzed for all 30 devaluation episodes. Here, the emphasis is placed on real aggregate output, aggregate gross

investment and real growth. A problem with this type of analysis, however, is that it concentrates on the behavior of the key variables "before" and "after" the devaluation, without taking into account the possible role of other policies or external events. This problem is avoided by the second approach taken in this paper: A simple equation for aggregate output in an open economy is estimated for a group of 12 countries. In addition to the possible effect of the exchange rate on output, this equation incorporates the role of monetary policy, fiscal policy and exogenous terms of trade effects.

The paper is organized in the following form: In Section II the brief existing empirical literature on the subject is selectively reviewed. In Section III a broad analysis of the evidence related to contractionary devaluations is provided. In Section IV the results obtained in the regression analysis are presented. Finally in Section V some concluding remarks are provided, and some directions for future research are suggested.

II. Other Studies

In spite of the renewed theoretical interest on the possible contractionary effects of devaluations, the empirical analysis has been somewhat sketchy.[6]

A number of studies have used cross country data to simulate the effects of devaluations on real output. Gylfason and Schmidt (1983) have constructed a small macro model with intermediate goods, where a devaluation has two conflicting effects: On one hand it generates an expansion through aggregate demand; on the other hand, a devaluation results, through its effect on the cost of imported intermediate inputs, in an upward shift in the aggregate supply schedule. The final effect of a devaluation can be either expansionary or contractionary. This is illustrated in Figure 1 where S and D are the aggregate supply and demand schedules before the devaluation. These curves

Figure 1

are parametric with respect to the (real) exchange rate. Assuming — as Gylfason and Schmidt (1983) do -- that on the demand side the expansionary effect dominates, after the devaluation the aggregate demand curve will shift to D_1. On the other hand, the existence of intermediate inuts implies that, as a consequence of the devaluation, the aggregate supply curve will shift backward to S_1 or S_2. Depending on the relative strength of the aggregate demand and aggregate supply effects, the final (after devaluation) equilibrium can be either at A -- with a higher output than before the devaluation — or at a point like B, with a contaction in aggregate output. In their article Gylfason and Schmidt establish the exact conditions required for the contractionary effect to dominate.

Gylfason and Schmidt empirically analyze the implications of their model by imputing plausible values to the corresponding parmeters for a group of five developed countries and five developing countries. With the exceptions of the U.K. and Brazil their results suggest that, as postulated by the more traditional views, devaluations have a positive overall effect on aggregate output.

Connolly (1983) considered a group of 22 countries and regressed for the cross-country data set the change in the rate of real growth on the change in the nominal exchange rate. The coefficient obtained was positive and marginally significant, providing some support to the hypothesis of expansionary devaluations. However, Connolly argues that his results are subject to a selectivity bias, since typically countries that devalue do so after having entered into a recession.

Gylfason and Risager (1984) developed a model for a small country, which stresses the effect of devaluations on interest payments on the foreign debt. Using imputed parameter data they find that while devaluations are generally

expansionary in developed countries, in developing countries they are likely to be contractionary. However, a problem with this type of approach is that the parameters used in the simulation are obtained from very different sources, and are likely to be inconsistent among themselves.

Gylfason and Radetzki (1985) developed a small macro model to investigate the effects of devaluations on real output, the current account and real wages. They show that in a world with no capital movements, in order for a devaluation to result in higher real output, real wages necessarily have to fall. They then show that if a devaluation is accompanied by an inflow of foreign funds, it is possible for real output to increase with unchanged real wages. Gylfason and Radetzki use a group of 12 poor countries to simulate their model. As in other papers, in the simulation analysis they use imputed values for the parameters. Thier results suggest that, for their group of countries, with nominal wages constant and no capital inflows a 10% devaluation will result in a decline of real GNP of 0.5%.

Other authors have constructed country-specific simulation models to analyze the effectiveness of devaluations as stabilization policy tools. Branson (1985), for example, has recently constructed a small simulation model for Kenya to investigate these issues. His results suggest that, contrary to the traditional view, a devaluation will have important contractionary effects in the Kenyan economy. Taylor and Rosensweig (1984), on the other hand, built a fairly large computable general equilibrium model for Thailand, and simulated the effects of a number of policy measures, including a devaluation, on the Thai economy. Their results indicate that a devaluation of the baht of 10 percent will have an expansionary effect and will generate an <u>increase</u> in real GDP of 3.3 percent.

Other studies have discussed the output effects of devaluations in a less formal way. Cooper (1971a), in his well-known study, analyzed 24 devaluations that took place between 1953 and 1966. After looking at the behavior of the principal components of aggregate demand he concluded that "devaluation itself often initially tends to depress economic activity in the devaluing country, contrary to what has normally been expected" (p. 504). Krueger (1978) analyzed output behavior during the periods surrounding major devaluation episodes in the countries considered in the NBER project on trade liberalization. She found that in most cases devaluations had been associated with expansions in the level of real activity.[7]

In sum, then, the existing evidence regarding the effect of devaluations on real economic activity is mixed; while some studies suggest that devaluations have an expansionary effect, others indicate that they generate a contraction in the economy.

Most studies that have investigated the effect of devaluations on economic activity suffer from at least one of the two following shortcomings: First, they use a "before" and "after" approach where they compare the performance of the economy around the devaluation period, without taking into account the behavior of other variables like monetary policy, fiscal policy, and external disturbances.[8] Second, in order to investigate the effects of devaluations on growth and output, they perform "indirect" tests, using simulation models with imputed parameter values obtained from other studies. In Section III of this paper the contractionary devaluation issue is analyzed using a regression procedure that is not subject to the above mentioned criticisms. In particular, the Khan and Knight (1981) formulation is expanded in order to take into account the roles of fiscal policy, terms of trade changes, money surprises and devaluations on real output.

III. Devaluations, Output, Investment and Growth: A First Look at the Cross-Country Evidence

In this section the behavior of real output, growth and the investment ratio in the period surrounding 30 devaluation episodes in a group of 22 developing countries is analyzed in detail.[9] The approach taken in this section corresponds, in essence, to a "before" and "after" analysis, and is consequently subject to all the relevant criticisms. In that regard, then, the discussion provided here should only be considered as a first look at the problem, and should be inpterpreted with caution.

In Table 1 the behavior of real GDP in the period comprised of three years prior to the devaluation crisis and three years after the crisis is presented. This table also contains information on the date and magnitude of the nominal devaluation. The real GDP data presented in this table are expressed in each country's currency at 1980 constant prices.

The information summarized in Table 1 is very revealing. First, contrary to what has been argued by some authors (Connolly, 1983), it shows that in most cases the years immediately preceding the devaluation have not been characterized by a drop in real aggregate production. Only in Egypt, 1982; India, 1966; Jamaica, 1978; Nicaragua, 1979; and Pakistan, 1972 was a decline in real GDP observed in the three years preceding the parity adjustment.

More important for the purposes of this paper, however, is the behavior of real GDP in the period following the devaluation. In only four out of the 30 episodes -- Bolivia, 1979; Iceland, 1968; Jamaica, 1979; and Nicaragua, 1979 -- real GDP declined after the crisis. In two of these four contractionary cases -- Jamaica and Nicaragua -- the devaluation took place during a period of intense political turmoil that had important negative effects on economic performance. Also, two of these cases -- Bolivia and Nicaragua -- correspond to countries where the nominal devaluation failed to generate, even

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Table 1. REAL GDP AND DEVALUATIONS IN SELECTED DEVELOPING COUNTRIES

Country	Year of Deval.	Percent Deval.	-3 Years	-2 Years	-1 Year	Year of Deval.	+1 Year	+2 Years	+3 Years
Argentina	1970	42.8	20.15	20.82	21.84	22.41	23.68	24.44	25.72
Bolivia	1972	68.4	76.83	82.81	86.87	91.91	98.05	103.09	109.90
Bolivia	1979	22.6	116.60	121.51	125.59	127.89	128.61	127.40	116.27
Colombia	1962	34.3	0.52	0.54	0.57	0.60	0.62	0.66	0.68
Colombia	1965	50.0	0.60	0.62	0.66	0.68	0.72	0.75	0.79
Costa Rica	1974	28.9	25.54	27.63	29.76	31.41	32.07	33.84	36.85
Cyprus	1967	20.0	0.30	0.37	0.39	0.45	0.47	0.52	0.53
Ecuador	1961	38.9	67.20	70.67	75.36	76.51	79.99	83.12	89.58
Ecuador	1970	16.7	110.31	114.75	117.43	125.01	132.84	152.00	190.50
Egypt	1962	24.4	5.83	5.71	5.82	5.92	6.23	6.60	7.13
Egypt	1979	78.9	11.39	12.30	13.54	14.71	15.09	16.80	17.74
Guyana	1967	15.7	0.97	1.08	1.08	1.18	1.18	1.23	1.28
Iceland	1967	104.6	7.03	7.50	8.14	7.55	8.39	9.46	10.08
India	1966	58.1	0.72	0.77	0.74	0.74	0.81	0.83	0.88
Indonesia	1978	50.6	31.05	33.19	36.09	38.92	41.36	45.45	49.05
Israel	1962	66.7	24.56	28.93	32.09	35.21	38.90	42.01	45.76
Israel	1967	16.7	42.01	45.76	46.29	47.46	54.90	61.80	66.76
Israel	1971	20.0	54.90	61.80	66.76	74.16	83.15	87.29	91.08
Jamaica	1967	16.7	3.76	3.97	4.06	4.25	4.45	4.52	5.06
Jamaica	1978	95.8	5.51	5.18	5.09	5.07	4.73	4.82	4.86
Malta	1967	16.7	86.71	92.87	102.87	109.99	120.95	128.76	145.06
Nicaragua	1979	43.0	27.08	29.35	27.05	19.90	21.89	23.05	22.78
Pakistan	1972	130.1	153.81	150.12	151.17	151.79	162.29	171.30	176.91
Peru	1967	42.6	2.72	2.86	3.06	3.17	3.17	3.30	3.54
Philippines	1962	93.1	87.29	88.59	93.55	98.03	104.85	108.49	114.18
Philippines	1970	63.6	126.52	133.55	139.97	146.38	153.59	160.90	174.83
Sri Lanka	1967	24.1	28.10	28.78	30.26	32.09	33.49	36.23	41.96
Trinidad	1967	15.7	8.01	8.23	8.50	8.97	9.30	9.31	9.92
Venezuela	1964	38.2	99.15	108.20	115.74	126.90	134.57	137.92	143.18
Yugoslavia	1965	66.7	0.52	0.58	0.64	0.65	0.71	0.73	0.76

Source: Percent of devaluation from Table 1, Chapter 8; Real GDP from International Monetary Fund. GDP figures are expressed in each country's currency at 1980 constant prices.

in the short run, a real devaluation (see Edwards 1985). Also, Bolivia, 1979; Nicaragua and Jamaica, 1979 failed to implement corrective macroeconomic policies along with the devaluations. All of this suggests that the data reported in Table 1 do not provide sufficient information to fully evaluate the effects of devaluation (only) on output.

The data presented in Table 1 have basically ignored any growth considerations. However, some authors have argued that the contractionary effects of devaluations will in fact be reflected in slower growth. (See, for example, Branson (1986).) In order to investigate this proposition, Table 2 presents data, for each country, on the rate of growth of real GDP in the year of the devaluation, the three years preceding the devaluation and the three years following the devaluation.

As can be seen from Table 2, when rates of growth are considered, the picture becomes significantly more complicated than when real GDP levels are used. Now it is more difficult to state categorically whether a contraction actually took place. This is because in some countries, the growth rate declines in only one of the years following the devaluation. Depending on how a contraction is defined we can get a larger or smaller number of contractionary cases. If, for example, a contraction is defined as a significant (i.e., at least one percentage point) drop in the rate of growth in the year of the devaluation, or one year after the devaluation, relative to the rate of growth in the year prior to the devaluation, we obtain 15 contractionary cases (Argentina; Bolivia, 1979; Colombia, 1962; Colombia, 1965; Costa Rica, 1974; Ecuador, 1961; Egypt, 1979; Iceland, 1967; Indonesia, 1978; Israel, 1962; Jamaica, 1978; Malta, 1967; Nicaragua, 1979; Peru, 1967; and Yugoslavia). If on the other hand, we define a contraction as a significant drop in the rate of growth in the year of the devaluation or one year after the devaluation,

Table 2. REAL GDP GROWTH AND DEVALUATION IN SELECTED DEVELOPING COUNTRIES
(Percent)

Country	Year of Deval.	-3 Years	-2 Years	-1 Year	Year of Deval.	+1 Year	+2 Years	+3 Years
Argentina	1970	0.78	3.36	4.89	2.60	2.20	3.23	5.21
Bolivia	1972	4.57	7.79	4.90	5.80	6.68	5.15	6.60
Bolivia	1979	6.10	4.21	3.36	1.83	0.57	-0.95	-8.73
Colombia	1962	7.22	4.27	5.09	5.41	3.29	6.17	3.60
Colombia	1965	5.41	3.29	6.17	3.60	5.35	4.20	6.10
Costa Rica	1974	6.78	8.18	7.71	5.54	2.10	5.52	8.90
Cyprus	1967	-8.28	23.89	6.16	13.63	5.42	9.69	3.08
Ecuador	1961	2.30	5.16	6.64	1.53	4.55	3.91	7.77
Ecuador	1970	6.87	4.03	2.33	6.46	6.26	14.42	25.33
Egypt	1962	--	-1.99	2.00	1.70	5.18	5.99	8.00
Egypt	1979	7.22	7.92	10.12	8.68	2.58	11.33	5.55
Guyana	1967	16.95	11.08	0.00	8.69	0.24	4.69	3.42
Iceland	1967	8.53	6.64	8.54	-7.26	7.82	12.74	6.48
India	1966	5.33	7.59	-4.32	1.13	8.16	2.83	6.38
Indonesia	1978	4.98	6.89	8.76	7.84	6.26	9.88	7.93
Israel	1962	12.75	17.82	10.92	9.70	10.50	8.00	8.91
Israel	1967	8.00	8.91	1.17	2.52	15.68	12.57	8.02
Israel	1971	15.68	12.57	8.02	11.08	12.12	4.98	4.34
Jamaica	1967	12.29	5.59	2.27	4.66	4.81	1.55	11.90
Jamaica	1978	-0.59	-6.07	-1.65	-0.35	-5.42	2.04	0.66
Malta	1967	1.93	7.11	10.77	6.92	9.96	6.46	12.66
Nicaragua	1979	5.21	8.41	-7.85	-26.43	10.00	5.30	-1.18
Pakistan	1972	5.26	-2.40	0.70	0.41	6.92	5.55	3.28
Peru	1967	6.94	5.08	7.05	3.51	0.00	4.13	7.31
Philippines	1962	6.73	1.49	5.60	4.78	6.96	3.47	5.24
Philippines	1970	6.09	5.56	4.80	4.58	4.92	4.76	8.66
Sri Lanka	1967	6.19	2.43	5.14	6.06	4.35	8.18	15.82
Trinidad	1967	5.57	2.79	3.21	5.53	3.73	0.13	6.56
Venezuela	1964	4.93	9.12	6.97	9.64	6.05	2.49	3.81
Yugoslavia	1965	4.35	12.50	11.11	1.11	8.79	3.03	3.92

Source: International Monetary Fund.

with respect to the average of the three years prior to the crisis, we obtain 16 (somewhat different) contractionary episodes (Bolivia, 1979; Colombia, 1962; Colombia, 1965; Costa Rica, 1974; Cyprus, 1967; Ecuador, 1961; Egypt, 1979; Guyana, 1967; Iceland, 1967; India, 1966; Israel, 1962; Israel, 1967; Jamaica, 1978; Malta, 1967; Nicaragua, 1979; and Peru, 1967). Even though these two criteria are arbitrary and imperfect, they clearly suggest that when rates of growth are considered, there is more support to the contractionary devaluation hypothesis than when the level of output is analyzed.

In Table 3, data on the gross investment ratio are presented. As can be seen in approximately one third of the episodes a decline in the gross investment ratio can be detected in the period immediately following the devaluation (Argentina, Bolivia, 1979; Colombia, 1962; Iceland, 1967; Israel, 1967; Nicaragua, 1979; Pakistan, 1972; Peru, 1967; Philippines, 1970; Trinidad, 1967; and Yugoslavia, 1965). However, as with all "before" and "after" studies, it is not possible to know whether this reduction in investment is a consequence of the devaluation itself, or if it is a result of other policies or events. In particular it is possible that these data are picking up the effect of demand management policies, that many times accompany devaluations. In fact, some of the existing evidence indicates that when "forced" to reduce expenditure, governments usually reduce investment (Hicks and Kubisch, 1984).

In sum, this broad preliminary data analysis provides some mixed results regarding the contractionary devaluation issue. First, when the level of real GDP is considered, there is very little support to the contractionary hypothesis; second, when the rate of growth of real GDP or the gross investment ratio are analyzed the evidence is somewhat more supportive to this hypothesis. In one third to one half of the episodes analyzed some signs of real activity contraction were observed in the period following the

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Table 3. DEVALUATION AND GROSS INVESTMENT RATIO IN SELECTED DEVELOPING COUNTRIES

Country	Year of Deval.	-3 Years	-2 Years	-1 Year	Year of Deval.	+1 Year	+2 Years	+3 Years
Argentina	1970	16.67	14.29	25.00	22.22	19.05	17.14	18.37
Bolivia	1972	15.76	14.49	14.41	15.21	17.34	15.12	18.40
Bolivia	1979	18.93	19.03	20.13	16.63	13.47	11.42	10.35
Colombia	1962	16.52	18.11	18.34	17.94	16.47	16.10	15.63
Colombia	1965	17.94	16.47	16.10	15.63	16.71	17.73	19.51
Costa Rica	1974	22.12	21.91	22.16	24.02	21.99	23.44	22.37
Cyprus	1967	16.40	18.34	19.47	18.52	20.39	21.81	23.52
Ecuador	1961	12.30	13.30	13.44	13.60	12.17	12.33	12.06
Ecuador	1970	13.60	14.36	16.01	16.68	21.73	18.01	17.49
Egypt	1962	13.16	12.43	15.49	16.59	17.80	19.70	16.17
Egypt	1979	21.98	22.39	26.97	29.72	29.08	29.68	30.15
Guyana	1967	15.79	19.33	22.21	24.68	20.90	19.66	21.14
Iceland	1967	28.05	25.69	27.25	30.73	24.71	24.07	28.94
India	1966	16.02	15.88	17.14	16.63	15.74	16.15	16.00
Indonesia	1978	20.34	20.72	20.13	20.53	20.93	20.87	21.38
Israel	1962	26.23	25.45	27.69	31.09	29.08	31.99	28.51
Israel	1967	31.99	28.51	21.95	16.78	20.86	24.53	26.64
Israel	1971	20.86	24.53	26.64	29.43	30.38	32.67	31.90
Jamaica	1967	18.99	19.54	21.13	22.82	27.00	31.77	31.36
Jamaica	1978	23.50	16.73	11.84	13.37	14.60	18.00	20.19
Malta	1967	22.97	22.39	22.28	24.49	27.91	31.10	29.32
Nicaragua	1979	20.75	24.55	15.28	6.66	13.16	19.61	15.14
Pakistan	1972	14.31	14.31	13.95	12.60	11.44	12.22	14.45
Peru	1967	15.93	16.71	16.52	14.91	12.97	12.39	12.42
Philippines	1962	14.66	13.47	14.93	14.40	15.76	17.89	17.57
Philippines	1970	18.09	17.18	16.23	15.78	16.26	15.75	15.39
Sri Lanka	1967	14.37	12.90	14.24	15.12	14.63	19.46	17.26
Trinidad	1967	22.48	25.93	21.02	15.99	16.04	16.18	24.26
Venezuela	1964	15.89	15.68	-15.53	17.59	18.38	18.80	19.05
Yugoslavia	1965	34.91	34.50	33.44	27.42	26.87	29.22	31.25

Source: International Monetary Fund.

devaluation. Since this "before" and "after" analysis has not explicitly incorporated the role of other factors, like monetary policy, fiscal policy and foreign shocks, these results should be interpreted cautiously.

IV. Regression Analysis

In this section the results obtained from a regression analysis that investigates the way in which devaluations affect real aggregate activity are presented. An open-economy, reduced-form equation for real GDP was estimated using data for 12 countries for 1965-80. This equation included, in addition to the exchange rate, measure of fiscal policy, money policy and foreign shocks as possible explanatory variables.[10]

IV.1 The Model

In their recent analysis of the effects of stabilization programs on aggregate production in developing countries Khan and Knight (1981) argued that the level of economic activity in these countries will be affected by a number of variables, including the existing disequilibrium in the money market, and the level of fiscal expenditure. In this section, the Khan and Knight (1981) formulation is modified in various respects. First, in accordance with the revent rational expectations literature their excess money supply term is replaced by a money surprise or unexpected money growth term. Second, the possible role of terms of trade changes on the level of activity are explicitly incorporated into the picture. And third, in order to investigate the contractionary devaluation issue, a real exchange rate term is added into the regression analysis.

The modified, reduced-form equation for real output considered in this paper is:

$$\log y_t = \alpha + \gamma \text{ time} + \beta_1 \log(GE/Y)_t + \beta_2[\Delta \log M - \Delta \log M^e]_t + \beta_3 \log \tau_t + \beta_4 \log e_t + \varepsilon_t \qquad (1)$$

where y is aggregate real output. Parameter γ captures the trend rate of growth of real output. (GE/Y) is the ratio of government expenditure to nominal income, and captures the effect of fiscal policy on real aggregate output. $\Delta \log M$ is the actual rate of growth of nominal money, $\Delta \log M^e$ is the expected rate of growth of nominal money, and it is assumed that expectations are formed rationally and conditional on all available information. $[\Delta \log M - \Delta \log M^e]$, then, is the unexpected rate of growth of money. On the other hand, τ is the terms of trade, defined as the ratio of export prices to import prices. e is the real exchange rate defined as the relative price of tradables to nontradables.[11] An increase in e, then, represents a real devaluation. Finally ε is an error term. Equation (1) can be considered as an open economy extension of the equation estimated by Barro (1978) in his influential paper on the role of monetary policy in the U.S. Since the $(\gamma \text{ time})$ term has been included, the coefficients of the other right-hand side variables should be interpreted as providing information on how those variables affect deviations of output from trend. In that regard the analysis presented in this section is more close, in spirit, to the view that states that whether devaluations are contractionary or not should be looked at within a growing economy context (see Branson, 1986).

In the estimation of (1) it is expected that $\beta_1 > 0$. To the extent that the rational expectations approach is correct $\beta_2 > 0$. The terms of trade coefficient (β_3) is also expected to be positive.[12] The β_4 coefficient captures the effect of real devaluations on real output and is the primary interest of this study. If devaluations are contractionary, as suggested by the neo-structuralist critique, β_4 will be significantly negative,

indicating that, with other things given, a real devaluation will result in a decline in aggregate real output. On the other hand if, as indicated by the more traditional approach, devaluations are expansionary the estimated value of β_4 would be positive.

In equation (1) only contemporaneous values of the independent variables have been included. In the estimation, however, and in order to analyze whether there are differences between short- and long-term effects, lagged values are also introduced. For the case of real exchange rate the inclusion of lagged values is important since some authors have argued that the contractionary effect of devaluations will be a short-run phenomenon (i.e., Cooper (1971a)).

IV.2 Results

Equation (1) was estimated using a variance-components procedure on data for 12 developing countries for 1965-80. The countries included are: India, Malaysia, Philippines, Sri Lanka, Thailand, Greece, Israel, Brazil, Colombia, El Salvador, South Africa and Yugoslavia. These countries were chosen because of data availability: They were the only developing countries that had long enough time series for all the variables of interest. All of these countries have experienced important real exchange rate changes (i.e., real devaluations and appreciations) during the period under consideration, and all but El Salvador had also gone through episodes of major nominal devaluations. Even though this group of countries is not exactly the same as that used in the analysis of Section III, it is a representative one. For the exact definition and sources of the data, see the Appendix.

Before estimating the real output equation (1) it is necessary to find adequate time series for the money surprises term $[\Delta \log M - \Delta \log M^e]$. In this paper, as in a number of other studies on the subject, this unexpected

money growth term was constructed, for each individual country, as the difference between actual money growth and the estimated rate of growth of money obtained from a money creation equation.[13] In principle, the equation used to generate the expected rate of growth of money should include variables that indeed convey information to the different economic agents about the central bank behavior. In a large number of developing countries the printing of money is an important source of fiscal deficit financing (Edwards (1983)). For this reason, in the money creation equations used in this study the ratio of the fiscal deficit to lagged high-powered money was used as an explanatory variable. Additionally lagged values of $\Delta \log M$ were also included in this equation.

For each individual country, then, the following money creation equation was estimated:

$$\Delta \log M_t = a_o + a_1 \Delta \log M_{t-1} + a_2 \Delta \log M_{t-2} + a_o \Delta \log M_{t-3} + a_4 DEH_t + \mu_t, \quad (2)$$

where M_t is broadly defined (M2) nominal money, DEH_t is the fiscal deficit term and μ_t is a white noise term. The results obtained from the estimation of (2) for the twelve countries considered in this section for 1963-80 are reported in Table 4. As can be seen in all cases the fits are quite good. In ten of the twelve cases the coefficients of the fiscal deficit term DEH_t are positive as expected. However, in only four cases — Greece, Israel, Brazil and Colombia -- this coefficient is significant at conventional levels. For all the countries the F-statistics indicate that these regressions do provide important information about the money creation process.[14] In all cases the residuals were closely examined in order to make sure that they were white noise, and consequently qualified as provies for money surprises in the estimation of the growth equation (2). Notice that while the output equation was estimated for 1965-80, the money creation equations were estimated for

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Table 4: MONEY CREATION PROCESSES IN 12 DEVELOPING COUNTRIES: 1963-80

$$\Delta \log M_t = a_0 + a_1 \Delta \log M_{t-1} + a_2 \Delta \log M_{t-2} + a_3 \Delta \log M_{t-3} + a_4 DEH_t + \mu_t$$

Country	CON	$\Delta \log M_{t-1}$	$\Delta \log M_{t-2}$	$\Delta \log M_{t-3}$	DEH_t	R^2	D.W.	F
India	0.029 (1.402)	0.944 (3.661)	-0.454 (-1.485)	0.388 (1.710)	-0.016 (-0.320)	0.792	1.194	12.37
Malaysia	0.026 (1.105)	0.648 (3.057)	-0.428 (-1.728)	0.509 (2.391)	0.037 (0.902)	0.764	1.940	10.51
Philippines	0.024 (0.790)	1.214 (5.282)	-1.003 (-3.270)	0.628 (2.577)	0.020 (0.882)	0.700	1.960	7.59
Sri Lanka	0.015 (0.647)	0.991 (2.673)	-0.558 (-1.466)	0.162 (0.350)	0.044 (0.872)	0.801	2.334	13.04
Thailand	0.031 (1.430)	1.410 (6.836)	-1.210 (-4.023)	0.579 (2.344)	0.025 (0.803)	0.828	1.710	15.00
Greece	0.101 (2.936)	0.712 (2.971)	-0.655 (-2.445)	0.106 (0.468)	0.250 (2.980)	0.799	2.101	12.95
Israel	-0.073 (-1.627)	0.789 (3.618)	0.038 (0.132)	0.472 (1.488)	0.017 (1.825)	0.945	2.020	55.47
Brazil	0.172 (1.949)	0.943 (3.710)	-0.577 (-1.708)	0.127 (0.484)	0.164 (1.951)	0.651	1.828	6.06
Colombia	-0.029 (-0.768)	0.842 (4.381)	-0.504 (-2.202)	0.783 (4.344)	0.175 (1.981)	0.781	2.246	11.58
El Salvador	0.042 (1.429)	1.041 (2.961)	-0.602 (-1.586)	0.214 (0.842)	-0.021 (-0.185)	0.585	1.697	4.58
South Africa	0.080 (2.134)	0.779 (2.803)	-0.659 (-1.879)	0.025 (0.088)	0.023 (0.663)	0.429	1.779	2.44
Yugoslavia	0.034 (0.612)	0.607 (3.300)	-0.359 (-1.957)	0.572 (3.174)	0.069 (0.996)	0.604	1.678	4.97

Note: Numbers in parentheses refer to t-statistics, R^2 is the coefficient of determination, D.W. is the Durbin-Watson statistic and F is the F-statistic for each regression.

1963-80. This was done in order to allow for the inclusion of lagged money surprises in the real output growth equation.[15]

The following output equation was estimated, where $n = 1,\ldots,12$ refers to the twelve countries and where $t = 1965,\ldots,1980$:

$$\log y_{n,t} = \gamma_n \text{ time} + \beta_1 \log (GE/Y)_{nt} + \sum_{i=0}^{2} \beta_{3i} [\Delta \log M - \Delta \log M^e]_{n,t-1} + \sum_{i=0}^{2} \beta_{3i} \log \tau_{n,t-1} + \sum_{i=0}^{2} \beta_{4i} \log e_{n,t-i} + v_n + \varepsilon_{nt} \qquad (3)$$

This equation differs from (1) by the inclusion of lagged values of the money surprises, the terms of trade and the real exchange rate terms. In this way the possibility of a different short- and long-run effect of these variables on real output is allowed. If, for example, devaluations only have a temporary contractionary effect β_{41} will be significantly negative with the coefficient of the lagged value of e being zero or positive.[16]

In the estimation of equation (3) the γ coefficient was allowed to differ across countries. In this way the differences in trend growth of real output across countries is accounted for. In the estimation of equation (3) v_n is a country dummy that captures all those elements that are specific to each country, including country size. Finally ε_{nt} is an error term which is assumed to have the traditional characteristics.

The results obtained from the estimation of the β coefficients in equation (3), and of some of its variants, are presented in Table 5. On the other hand, the country-specific γ's obtained in each of these cases are given in Table 6.

First, regarding Table 5, the coefficients of the money surprises are positive, as expected. Lagged money surprises turned out to be significantly

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Table 5: REAL OUTPUT GROWTH AND DEVALUATIONS IN 12 DEVELOPING COUNTRIES: 1965-80

	Equation Number			
	(3.1)	(3.2)	(3.3)	(3.4)
$[\Delta \log M_t - \Delta \log M_t^e]$	0.102 (1.146)	0.093 (1.057)	0.112 (1.300)	0.083 (0.913)
$[\Delta \log M_{t-1} - \Delta \log M_{t-1}^e]$	0.210 (2.331)	0.181 (1.998)	0.222 (2.473)	0.170 (1.961)
$\log(GE/y)_t$	0.112 (3.023)	-- --	0.101 (2.780)	-- --
$\log TOT_t$	0.044 (1.451)	-- --	-- --	0.027 (0.886)
$\log TOT_{t-1}$	0.008 (-0.265)	-- --	-- --	-0.009 (-0.274)
$\log RER_t$	-0.083 (-2.103)	-0.067 (-1.682)	-0.077 (-1.966)	-0.070 (-1.738)
$\log RER_{t-1}$	0.069 (2.086)	0.072 (2.123)	0.070 (2.127)	0.071 (2.100)
$\bar{R}^2$	0.998	0.998	0.998	0.998
SEE	0.038	0.038	0.038	0.039
N	192	192	192	192

Note: The numbers in parentheses are t-statistics. SEE is the standard error of the regression, $\bar{R}^2$ is the adjusted R^2, and N refers to the number of observations.

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Table 6: ESTIMATES OF COUNTRY-SPECIFIC γ's

	Equation Number			
	(3.1)	(3.2)	(3.3)	(3.4)
Brazil	0.081	0.080	0.081	0.080
Colombia	0.052	0.056	0.054	0.057
El Salvador	0.037	0.042	0.039	0.043
Greece	0.053	0.055	0.053	0.055
India	0.036	0.036	0.035	0.036
Israel	0.058	0.061	0.058	0.062
Malaysia	0.080	0.080	0.080	0.080
Philippines	0.058	0.056	0.056	0.057
South Africa	0.037	0.038	0.036	0.039
Sri Lanka	0.061	0.054	0.059	0.055
Thailand	0.069	0.069	0.068	0.069
Yugoslavia	0.057	0.057	0.057	0.059

positive. This result suggests that, according to the implications of the rational expectations hypothesis, unanticipated money growth has had a significant, but small, effect on these developing countries' level of real activity. When the money surprises terms are replaced by the actual rate of growth of money the resulting coefficients were small and insignificant, confirming the idea that money surprises only affect real activity in these countries.

As can be seen from Table 5, the coefficient of (GE/Y) was significantly positive in all equations where it was included, indicating that with other things given, higher government expenditure has a small but positive impact on output. Regarding the coefficients of τ the results show that according to previous findings (Barro 1978, Edwards 1983), changes in the terms of trade have no perceptive effect on real output in the developing countries.[17]

In equations (1)-(4) a contemporaneous and a lagged real exchange rate term were included. The results obtained are quite interesting. In all cases the coefficient of the contemporaneous real exchange rate term are negative as suggested by the contractionary devaluation view; moreover, in all cases this coefficient turned out to be significantly different from zero at conventional levels (5 percent and/or 10 percent). Interestingly enough, the coefficient of the lagged real exchange rate term is positive and in all cases it is significantly different from zero at the 5 percent level.

These results provide some statistical support to a restricted version of the contractionary devaluation hypothesis. They indicate that <u>in the short run</u> devaluations have a contractionary effect on aggregate output; on average a 10 percent real devaluation, with other things given, has resulted in these countries in a decline in output (around trend) of almost 1 percent. However, these results also indicate that the short-run contractionary effect is later

fully reversed, with after one year the devaluation having an expansionary influence on output.[18] Furthermore, according to these results the contemporaneous and lagged effects of the real devaluation cancel themselves. Indeed a formal test on the equality (with opposite sign) of these two coefficients indicates that the null hypothesis of equality cannot be rejected. This suggests that in the long run devaluations are neutral, and have no effect on output.[19]

A potential problem with the results reported in Table 5 is that the real exchange rate (RER) may not be a completely exogenous variable. In fact, it has been argued by a number of authors that higher growth will generally result in a real appreciation of the domestic currency (Balassa 1964). In order to take this potential simultaneity problem into account, equation (3) was also estimated using a two-stages least squares variance component procedure. The results obtained fully confirmed the conclusions that emerged from the analysis of Table 2. For example, when equation (1) was reestimated using the two-stages technique the following result was obtained:[20]

$$\log y_{tm} = \underset{(1.109)}{0.100}\,[\Delta \log M_t - \Delta \log M_t^e] + \underset{(2.494)}{0.244}\,[\Delta \log M_{t-1} - \Delta \log M_{t-1}^e]$$

$$+ \underset{(3.129)}{0.121} \log (GE/Y)_t - \underset{(-1.747)}{0.169} \log RER_t + \underset{(1.953)}{0.119} \log RER_{t-1}$$

$$+ \underset{(1.590)}{0.050} \log \tau_t - \underset{(-0.243)}{0.008} \log \tau_{t-1} \qquad \bar{R}^2 = 0.998 \quad SEE = 0.038$$

Another potential problem with these results is that they were obtained using pooled data. Even though care has been taken in using a variance components procedure, it is still possible that these data should not be aggregated. In order to check for this potential problem the sample was divided into two groups and homogeneity tests were performed. The first group corresponds to the relatively higher income countries, and includes Greece,

Yugoslavia, Israel, Brazil, South Africa and Malaysia. The second group corresponds to the poorer countries. The homogeneity tests performed indicate that for the purpose of the present regression these two groups can indeed be pooled -- the F-statistics obtained ranged from 0.14 to 0.37 (see Edwards 1985b).

The results reported in this section were obtained using an index of the real exchange rate as the relevant independent variable. Equivalent regressions, however, were also run replacing the real exchange rate by a nominal exchange rate index. Not surprisingly, in that case the coefficients of all the nominal exchange rate terms (contemporaneous and lagged) turned out to be insignificant.

V. Concluding Remarks

The main policy goal of nominal devaluations is to generate a readjustment in relative prices, or real devaluation. Recently, a number of authors have questioned the effectiveness of devaluations as policy tools. It has been argued that even though nominal devaluations may partially achieve their goal of generating a relative price readjustment, they do so at a very high cost. In particular it has been pointed out that one of such costs is the decline in total output generated by the devaluation. This critique has come to be known as the contractionary devaluation problem.

An increasing number of theoretical models have incorporated contractionary devaluation features. Surprisingly, however, very few empirical studies have tackled the subject by looking at the historical evidence. This was done in the present paper where the contractionary devaluation issue was analyzed from two perspectives. First, the behavior of output, investment and growth in the years surrounding 30 major devaluation episodes. It was found that depending on whether one looked at GDP levels or rates of growth,

the support to the contractionary devaluation hypothesis ranged from very low to moderate. The problem with this type of analysis, however, is that by concentrating on the behavior of the key real activity variables before and after the crisis, it ignores the potential role of other factors including fiscal policy, monetary policy and foreign shocks.

In Section III of this paper the results from a regression analysis, which is not subject to these criticisms, are presented. These results indicate that when other variables are taken into account a real devaluation has a small short-run negative effect on deviations of output around trend. In the longer run, however, this negative effect fully reverses itself, with devaluations having no long-term effect on real economic activity.

Footnotes

[1]Katseli (1986), Edwards and Ahmed (1986).

[2]See, for example, Taylor (1983), Katseli (1983) and Buffie (1984). See also Hanson (1983).

[3]In a Keynesian setting a devaluation will always be expansionary. On the other hand, in a strict monetary model with full employment, a devaluation will have no effect on aggregate production. In more general models, with an upward-sloping aggregate supply, devaluations will usually be expansionary. See, for example, the account of the effect of a devaluation in any traditional textbook. See also Johnson (1976).

[4]Paradoxically, perhaps, the real balance effect is also a central element of the monetary approach to devaluations. See Frenkel and Johnson (1976).

[5]The difference between demand and supply effects of a devaluation is an important one. A primary objective of almost every adjustment program that includes a nominal devaluation is to improve the current account. This, of course, implies a reduction of expenditure relative to output. If a devaluation reduced aggregate expenditure only, then it is an effective tool. The problem arises, however, when the devaluation also reduces aggregate output. In this case there is an indirect cost, related both to the decline in output and employment, and to the reduced effectiveness of the devaluation to help improve the current account.

[6]As mentioned above, the contractionary devaluation literature goes back, at least, to Diaz-Alejandro (1965). In the present review, however, we will concentrate on the more recent contributions.

[7]Also the numerous studies that have investigated the effects of IMF stabilization programs on output have looked at real activity behavior before and after major devaluations. See, for example, the discussion in Gylfason (1983).

[8]Section III of this paper is also subject to this criticism. However, in the present case, the "before" and "after" analysis is only considered as a first broad look at the evidence. It is then (Section IV) supplemented by a regression analysis, which is free from these criticisms.

[9]The devaluation figure reported in Table 1 corresponds to the accumulated devaluation during the devaluation episode. The episodes included here were chosen using the following criteria: (a) Data availability. It was required that there were data for at least three years after the devaluation. (b) Discrete devaluation. The order to concentrate on the period surrounding one devaluation, it was required that they were preceded and followed by two years (at least) of fixed rates. For a detailed discussion on the main characteristics of these devaluation episodes see Edwards (1985a).

[10]This section is partially based on Edwards (1985b).

[11]It is important to note that both from an analytical and empirical perspective, e and τ are different variables. This point is stressed by Williamson (1983) and Katseli (1984). The regression analysis was also performed using the (log of the) nominal exchange rate as the independent variable. See below.

[12]See, for example, Barro (1979) and Edwards (1983).

[13]See, for example, Barro (1977), Hanson (1980) and Edwards (1983). Barro (1977) discusses the assumptions implicit in the use of residuals as proxies for money growth surprises.

[14]The approach followed here has well-known shortcomings, including the fact that by using data on all the sample to generate the money creation equation parameters too much information is being considered (Barro, 1977). In the present case, however, the lack of long-enough data series makes use of rolling regressions or similar procedures impossible.

[15]Equations equivalent to (2) were also estimated for alternative definitions of nominal liquidity (high-powered money, domestic credit and M1). Surprises series obtained as residuals of these equations were also used in the estimation of the real output equations. Broadly speaking the results obtained under these alternative definitions of unexpected liquidity growth were very similar to those reported here.

[16]Note that some authors (i.e., McCallum (1980)) have argued that in a rational expectations setting only contemporaneous surprises should be included in the output growth equation. Barro (1977), however, has argued in favor of incorporating lagged values of unanticipated money. Hanson (1980) and Edwards (1983) have included lagged money surprise terms in their studies of output behavior in Latin America.

[17]Equation (4) was also estimated using the rate of change of the terms of trade instead of their level. No significant changes in the results were obtained.

[18]These results correspond exactly to what Cooper (1971b) suggested almost fifteen years ago.

[19]When additional lags of RER were incorporated, their coefficient was nonsignificant. The equations presented in Table 5 were also estimated with the rate of change of the real exchange rate instead of $\log e$ as an independent variable. The results obtained basically confirmed those reported in Table 5; in most cases the coefficient of the one-year lagged real devaluation

was positive and in a number of the regressions significant at the conventional levels. These results, as well as the data set, are available from the author upon request.

[20]The following instruments were used: All the exogenous variables in (1) plus twice-lagged money surprises, terms of trade, real exchange rate; and contemporary, lagged and twice-lagged changes in domestic credit.

Data Appendix

Real Output (y): Was defined as real GDP, and the data were taken from line 99b.p of the IFS.

Nominal Money (M): A broad definition (M2) of money was used. Average yearly values constructed from data obtained from IFS were used.

Fiscal Deficit: Data from line 80 of IFS were used.

Terms of Trade: Defined as the relative price of exports to imports; taken from the IFS supplement on international trade statistics.

Real Exchange Rate: Defined as the relative price of tradables to nontradables. This variable was proxied by a real exchange rate index constructed as the nominal exchange rate with respect to the U.S. dollar times the ratio of the U.S. WPI index to the domestic CPI index. A number of authors have recently adopted this index as the best proxy for the relative price of tradables and nontradables. In the present paper on the real exchange rate. Alternative indexes were also used as possible proxies for this relative price. The results, however, were not affected.

Government Expenditure: Defined as government current expenditure and taken from line 91f of the IFS.

References

Balassa, Bela. "A Reappraisal of the Purchasing Power Parity Doctrine." Journal of Political Economy (1964).

Barro, Robert. "Unanticipated Money Growth and Employment in the United States." American Economic Review 67 (1977), pp. 101-15.

_____. "Unanticipated Money, Output, and the Price Level in the United States." Journal of Political Economy 86(4) (1978).

_____. "Money and Output in Mexico, Colombia and Brazil" in J. Behrman and J. Hanson (eds.), Short-Term Macroeconomic Policy in Latin America. [City]: Ballinger, 1979.

Branson, William H. "Stabilization, Stagflation and Investment Incentives: The Case of Kenya 1975-80" in S. Edwards and L. Ahmed (eds.) Economic Adjustment and Exchange Rates in Developing Countries. Forthcoming 1985.

Buffie, Edward. "The Macroeconomics of Trade Liberalization." Journal of International Economics 17 (August 1984), pp. 212-38.

Clements, Kenneth W. and Peter D. Jonson. "Unanticipated Money, 'Disequilibrium' Modelling and Rational Expectations." Economic Letters 2 (1979), pp. 303-08.

Conolly, Michael. "Exchange Rates, Real Economic Activity and the Balance of Payment," in E. Classen and P. Salin (eds.), Recent Issues in the Theory of Flexible Exchange Rates, North-Holland, 1983.

Cooper, Richard. "Currency Devaluation in Developing Countries" in G. Renis (ed.) Government and Economic Development. New Haven, CT: Yale University Press, 1971a.

_____. "Currency Depreciation in Developing Countries." Princeton Essays in International Finance 86 (1971b).

Diaz-Alejandro, Carlos F. Exchange Rate Devaluation in a Semi-Industrialized Economy: The Experience of Argentina 1955-61. Cambridge, MA: MIT Press, 1965.

Dornbusch, Rudiger. Open Economy Macroeconomics. New York: Basic Books, 1980.

Edwards, Sebastian. "The Short-Run Relation Between Inflation and Growth in Latin America: Comment." American Economic Review (June 1983).

_____. "Exchange Rates in Developing Countries." UCLA: unpublished manuscript, 1985a.

_____. "Are Devaluations Contractionary?" National Bureau of Economic Research Working Paper No. 1676, 1985b.

_____ and Liaquat Ahamed, "Introduction," in S. Edwards and L. Ahamed (eds.) Economic Adjustment and Exchange Rates in Developing Countries (forthcoming 1986).

Frenkel, Jacob and Harry G. Johnson. The Monetary Approach to the Balance of Payments. Toronto: University of Toronto Press, 1976.

Gylfason, T. "Credit Policy and Economic Activity in Developing Countries: An Evaluation of Stabilization Programs Supported by the IMF 1977-79." IIES Seminar Paper 268, University of Stockholm (1983).

_____ and M. Schmid. "Does Devaluation Cause Stagflation?" Canadian Journal of Economics (1983).

_____ and O. Rislaer. "Does Devaluation Improve the Current Account." European Economic Review 25 (1984), pp. 37-64.

_____ and M. Radetzki. "Does Devaluation Make Sense in the Least Developed Countries?" IIES Seminar Paper 314, University of Stockholm (1985).

Hanson, James. "The Short-Run Relation Between Growth and Inflation in Latin America." American Economic Review 80 (1980), pp. 972-89.

_____. "Contractionary Devaluation, Substitution in Production and Consumption, and the Role of the Labor Market." Journal of International Economics 14 (February 1983, pp. 179-89.

Johnson, Harry G. "Elasticity, Absorption, Keynesian Multiplier, Keynesian Policy and Monetary Approach to Devaluation Theory." American Economic Review 60 (1976), pp. 448-52.

Katseli, Louka, T. "Devaluation: A Critical Appraisal of the IMF's Policy Prescriptions." American Economic Review Papers and Proceedings 73(2) (May 1983) pp. 359-64.

_____. "Real Exchange Rates in the 1970s" in R. Marston and J. Bilson (eds.) Exchange Rate Theory and Policy. Chicago: University of Chicago Press, 1984.

_____. "Discrete Devaluation as a Signal to Price Setters: Suggested Evidence From Greece," in S. Edwards and L. Ahamed (eds.) Economic Adjustment and Exchange Rates in Developing Countries (forthcoming 1986).

Khan, Mohsin S. and Malcolm D. Knight. "Stabilization Programs in Developing Countries: A Formal Framework." Staff Papers 28 (March 1981), pp. 1-53.

Krueger, A.O. Liberalization Attempts and Consequences. Boston: Ballinger, 1978.

Krugman, P. and L. Taylor. "Contractionary Effects of Devaluation." Journal of International Economics 8 (August 1978), pp. 445-56.

McCallum, B.T. "On the Observational Equivalence of Classical and Keynesian Models." Journal of Political Economy 87 (1979), pp. 399-402.

Taylor, Lance and Jeffrey Rosensweig. "Devaluation, Capital Flows and Crowding Out: A CGE Model with Portfolio Choice for Thailand." Working Paper, The World Bank, 1984.

van Wijnbergen, Sweder. "Exchange Rate Management and Stabilization Policies in Developing Countries" in S. Edwards and L. Ahamed (eds.) Economic Adjustment and Exchange Rates in Developing Countries (forthcoming, 1986).

Williamson, John. The Exchange Rate System. Cambridge, MA: MIT Press for the Institute of International Economics, 1983.