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Are Devaluations Contractionary? Evidence from Turkey

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This paper examines the contractionary devaluation hypothesis in Turkey for 1960-1990 by dist nguishing the groweh effects of ant c pated and unant c pated devaluations. Account ng for supply shifts, the empir cal framework employed evaluates the effects of devaluation on output groweh on two grounds. First, the degree by wh ch real output groweh responds to given underlying demand shock. Second, the degree by wh ch aggregate demand curve shifts in response to unant c pated changes in the exchange rate. The empir cal results suggest that unant c pated devaluations have a posit ve impact on real economic act vity, wh le ant c pated devaluations do not exert any significant effect on output. The findings also highlight the w dely accepted notion that devaluations w ll be effect ve when accompanied by appropriate monetary and fiscal polic es.

I. Introduct on

Devaluations are usually an important component of conventional stab lization programs prompted by international inst tutions and are believed to be a primary policy option in balance of payments stab lization. Traditional views such as the elast c t es, absorption, and the Keynesian argue that devaluations have a posit ve effect on output.[1] The monetary approach, however, argues that exchange rate changes influence real magnitudes mainly through the real balance effect in the short-run, but leave all variables unchanged in the long-run.

The relative merits of devaluation in developing countries, however, have been challenged in recent years by the New Structuralist Economists. Even prominent members of the IMF executive board expressed their concern over the enthusiasm for devaluation and an active exchange rate policy on the grounds that, by relying too heavily on exchange rate adjustments (including those described by frequent small devaluations), Fund programs became excessively inflationary.[2] A study conducted by Khan (1988), investigated the experience of 67 developing countries w th IMF programs and concluded that they were successful in improving the current account, balance of payments, and in curbing inflation, but at the cost of a decline in the growth

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1. The elast c t es approach states that a devaluation w ll be effect ve as long as the Marshall-Lerner condition is satisfied. The Keynesian approach, in wh ch output is assumed to be demand determined and the economy operates below its potential (less than full-employment condition), states that a devaluation w ll have a posit ve impact on output and employment. According to the absorption approach, through its expenditure sw tching and expenditure reducing effects, a devaluation w ll generate an increase in real output.
2. See, for instance, Aghevli, Khan and Montiel (1991).

rate. The upshot is that the concept of *growth-oriented adjustments* appears to be a euphemism if the programs lead to low growth rates.

There are numerous explanations why, contrary to the traditional view, a devaluation can be contractionary. Earlier studies which focused on the demand-side indicated that devaluation may contract aggregate demand if: (i) income is redistributed to groups w th lower marginal propensities to consume; (ii) the trade balance is initially in deficit and real income decreases; (iii) higher tax revenues realized by the government are not spent; (iv) real wealth or real balances decline; (v) nominal interest rates increase; (vi) investment declines; (vii) the domestic currency value of foreign debt and debt service rise; and (viii) foreign profit income increases.

In addition to these demand-related effects, there are a number of supply side channels through which devaluations can lead to a contraction in output if: (i) the cost of imported inputs to production increases; (ii) the cost of working capital increases as real balances decline; and (iii) wages are indexed to foreign and domestic goods prices. Once these supply channels are incorporated into the analysis, it is possible for devaluations to be contractionary even if the net effect on aggregate demand is expansionary. This becomes the case when aggregate demand shifts by less than aggregate supply.

As indicated by many studies, the impact of a devaluation on output is theoretically ambiguous and the relevant empirical evidence is largely inconclusive.[3] On one hand, a devaluation generates an expansionary effect via aggregate demand; on the other hand, through its effect on the cost of imported intermediate inputs, it has a negative impact on the aggregate supply.

Agenor (1991) attempted to tackle this ambiguity by developing a rational expectations model of output determination, which distinguishes the effect of anticipated and unanticipated changes in the real exchange rate, and estimated the model on a cross-section data set for 23 developing countries. The intuitive explanation of his model is that an anticipated devaluation would lead to an increase in prices which, in turn, would push nominal wages up under the assumption that labor supply depends on expected real wage (Friedman-Phelps hypothesis). As a result, the demand for labor and imported inputs would decline, and consequently output would also decline. On the other hand, an unanticipated depreciation would have no impact on prices and real wages. However, it would lead to an unexpected increase in domestic demand as the relative price of domestic output (unexpectedly) falls. This implies that an unanticipated increase in prices would, in turn, stimulate supply.[4] He concluded that anticipated devaluations have a negative impact on output, whereas unanticipated devaluations have a positive impact.

Considering the important policy implications, it is quite surprising that relative little attention has been given to the effects of anticipated and unanticipated devaluation on output.[5] Moreover,

3. See, for instance, Lizondo and Montiel (1991) and Gylfason and Schmid (1983).
4. The assumption is that unanticipated inflation fools suppliers into thinking that the higher prices they are receiving for their products are higher relative prices rather than an increase in the general price level. This is indicated by the well-known Lucas supply function:

$$Y = f(\frac{p}{p^e}),\ \frac{dY}{d(p/p^e)} > 0.$$

5. For instance, the authorities may want to reconsider the implementation of an exchange rate policy in which devaluations are preannounced, so called tablita, if expected devaluation has a negative impact on output.

since the distinction between anticipated and unanticipated changes in variables also constitutes a crucial component of theory of rational expectations, this issue deserves further attention. To the best of my knowledge, Agenor's study is the only empirical investigation attempting to analyze the effects of anticipated and unanticipated devaluations on output. However the two-step procedure he employs suffers from a bias in its variance-covariance estimates, leading possibly to inappropriate inference.[6] This study attempts to correct this problem and throw more light on validity of the New Structuralist view by examining the Turkish case.

Evidence from past devaluations in Turkey make it an appealing candidate for an investigation of the validity of the contractionary devaluation hypothesis. Furthermore, considering the fact that almost all of the empirical studies investigating the effects of devaluation on output employed pooled-time series data, consisting of a large sample of heterogeneous countries, an investigation of the individual experience of Turkey can be a valuable addition to the contractionary devaluation literature. This paper develops a simple empirical framework which makes a distinction between anticipated and unanticipated devaluations when investigating the effect of devaluation on output. The organization of the paper is as follows: Section II presents an overview of the studies on the contractionary devaluation hypothesis. Section III describes the analytical framework, Section IV provides the empirical model and results, and Section V makes conclusion.

II. The Empirical Evidence in Developing Countries

A review of existing studies indicates that four major empirical approaches have been utilized to investigate the effects of a devaluation on output: *the before and after approach* studies changes in country performance at the time of devaluation; *the control group approach* aims at separating the effect of devaluation from other factors on output; *the econometric approach* applies econometric methods to time series to investigate the effect of devaluations on output; and *the macro-simulation approach* employs simulation models to analyze the impact of exchange rate changes on output.

Below, Table 1, 2, 3, and 4 present a summary of empirical studies by differentiating the methodology used:[7]

As illustrated in the tables above, the results of the studies concerning the effect of devaluation on output have been quite mixed; while some studies suggest that devaluations have an expansionary effect on output, others argue that they lead to a contraction in the economy. The relative merits and drawbacks of these approaches are discussed by Nunenkamp and Schweickert (1990), who also described the poor state of the empirical research on the growth effects of real devaluation. They pointed out the appealing properties of the econometric approach which utilizes a reduced form equation. This approach enables researchers not only to capture the net growth effect of devaluation, but also to account for external factors other than devaluation.

6. This bias is extensively discussed in relevant studies (see, for instance, Kandil (1991)). As with many other studies investigating the validity of rational expectation hypothesis, the author erroneously claims that the problem is merely one of efficiency (see Lee and Zilberfarb (1993) for more on this).
7. Tables draw on Rouis, Razzak, and Molinedo (1994).

Table 1 Control Group Approach

Author(s)	Countries Examined	Results
Cooper (1971)	24 devaluations (1959-66) in LDCs	contraction of output; trade balance and B&P improve
Donovan (1982)	78 IMF supported devaluations	output declines more than LDCs' average in one year comparisons, but by less in 3 years comparisons
Gylfason (1987)	IMF supported programs (1977-79)	B&P improves, effect on output ambiguous
Kamin (1988)	107 devaluations in LDCs	expansion or no effect. Contraction takes place prior to devaluation and continue after devaluation
Edwards (1989)	18 devaluations in Latin America	found decline in growth not as a result of devaluation but instead of accompanying measures
Khan (1990)	69 LDCs (1973-88)	contractionary but not statistically significant

Table 2 Before and After Approach

Author(s)	Countries Examined	Results
Diaz-Alejendro (1965)	Argentina	contractionary in the short-run
Bhagwat and Onitsuka (1974)	LDCs (1960-70)	positive effect on exports, little evidence of import response
Salant (1976)	10 devaluations in LDCs and DCs	devaluation improves the B&P in 76 cases, whereas balance of trade improves only in 46 cases

Table 3 Macro Simulation Approach

Author(s)	Countries Examined	Results
Ahluwalia and Lysy (1981)	Malaysia	Contraction when export demand elasticity is below 0.5
Gylfason and Schmid (1983)	5 DCs (including Turkey)	output increase in response to devaluation in 8 of 10 countries
Gylfason and Risager (1984)	8 LDCs, 7 DCs	output declines in LDCs, expands in DCs in response to devaluation
Gylfason and Radetzki (1985)	12 LDCs	support for contractionary devaluation hypothesis in LDCs
Solimano (1986)	Chile	contraction both in the short-run and in the medium-run
Branson (1986)	Kenya	support for the hypothesis of contractionary devaluation
Roca and Priale (1987)	Peru (1977-78, 1980-82)	devaluations are contractionary

Table 4 Econometric Approach

Author(s)	Countries Examined	Results
Taylor (1979)	22 Countries	devaluations are expansionary
Sheehey (1986)	16 Latin American countries	support for the hypothesis of contractionary devaluation
Edwards (1986)	12 devaluations in LDCs (1965-80)	devaluations are contractionary in the short-run, however, neutral in the long-run
Faini de Melo (1990)	Large number of LDCs	devaluations have no effect on output for exporters of primary goods, whereas expansionary for exporters of manufactured goods
Nunnenkamp and Scweickert (1990)	48 DCs (1982-87)	rejection of the hypothesis of contractionary devaluation
Agenor (1991)	23 LDCs	expected devaluations are contractionary, however unexpected devaluations are expansionary

Almost all of the econometric studies (see e.g., Edwards (1986), Khan (1990), Agenor (1991)) used pooled time-series cross-country analyses involving a large sample of countries - the empirical results were quite mixed. For instance, while Nunnenkamp and Schweickert (1990) rejected the hypothesis of contractionary devaluation, Sheehey (1986) found that devaluations have a negative impact on output. Edwards (1986), on the other hand, concluded that devaluations have a negative effect on output in the short-run; however, they are neutral in the long-run. The large sample of countries used in pooled time-series analyses consists of a very heterogeneous set of countries in which the different growth effects of devaluation between the countries in question may undermine the reliability of the empirical findings.[8] This makes a country-specific empirical study more desirable when investigating the effects of devaluations on output.

In sum, the above discussion underscores the need to improve the current state of the empirical investigation concerning the effects of devaluation on output. The following section attempts to achieve this in two ways. First, the impact of devaluation on output is tackled by using an empirical framework that distinguishes the growth effects of anticipated and unanticipated devaluations. Second, in response to the above-mentioned criticism of the use of pooled time-series, I specifically focus on the experience of Turkey which, both recently and historically, experienced episodes of sharp devaluations.

8. Introduction of country specific dummies is not an adequate solution of the problem of structural divergences. Edwards (1986), in his widely quoted paper, employs the Goldfeld-Quandt test to detect the possible presence of heteroskedasticity and his results indicate the absence of heteroskedasticity. However, in the presence of autoregressive disturbances, which is very likely to exist in the presence of the time-series data, the Goldfeld-Quandt test is not a reliable test for heteroskedasticity. This problem can be tackled by using a cross-sectionally heteroskedastic and time-wise auto regressive model.

III. Analytical Framework

The response of real output growth, y, to a given underlying demand shock generated by a devaluation, e, can be expressed as follows:

$$\frac{\partial y}{\partial e} = \frac{\partial y}{\partial n}\frac{\partial n}{\partial e} \tag{1}$$

A devaluation will cause a shift of the aggregate demand curve and, in turn, a change in nominal GNP. The final impact of the shock on real output growth generated by a devaluation will be determined by two factors:

- the response of real output growth to a given shift of the aggregate demand curve $(\partial y/\partial n)$,[9]
- the size of the shift of the aggregate demand curve in response to the underlying demand shock $(\partial n/\partial e)$.

Ignoring the response of real output growth to a given shift in aggregate demand, the traditional framework argues that a devaluation will lead to an increase in aggregate demand $(\partial n/\partial e > 0)$ which, in turn, will have a positive impact on real output growth $(\partial y/\partial e > 0)$. New Structuralist Economists, on the other hand, argue that the final effect of devaluation on real output growth is negative $(\partial y/\partial e < 0)$. As previously explained, this is either caused by a contraction of aggregate demand $(\partial n/\partial e < 0)$ or by a negative supply response to a given devaluation.

The distinction between anticipated and unanticipated devaluation in empirical investigations has important policy implications for the implementation of a preannounced rate of devaluation (so called *tablita*). If, as implied by Agenor's study, anticipated devaluations have a negative impact on output, the authorities should think twice about its implementation. It is thus quite surprising that relatively little attention has been paid to the effects of anticipated and unanticipated devaluation on output.

To provide evidence on the validity of the contractionary devaluation hypothesis, this investigation will focus on two issues by differentiating the growth effects of anticipated and unanticipated devaluations. First, the degree by which real output growth responds to a given shift of the aggregate demand curve. Second, the degree by which aggregate demand shifts in response to the underlying demand shock (generated by a devaluation). Except for Agenor (1991), previous empirical studies did not make any distinction between anticipated and unanticipated devaluations when investigating the effects of devaluation on output. Agenor implements a two-step procedure using a cross section data set for 23 countries which yields consistent estimates of the second stage parameters, but incorrect standard errors. In order to avoid using first-stage

9. According to sticky wage contracting models (e.g., Gray (1978)), the response of real output to a given demand shock depends on wage and price rigidity. An exogenous increase in wage and price rigidity increases the response of real output to a given demand shock.

regression proxies, however, the present study estimates the expectation equations jointly with the rest of the empirical models developed in the next section using ***non-linear 3SLS*** for Turkey.

IV. Empirical Models

To investigate the response of real output growth to a given shift of the aggregate demand curve ($\partial y/\partial n$), I consider the following empirical models:

$$y_t = \alpha_0 + \alpha_1 NS_t + \alpha_2 QS_t + \alpha_3 E_{t-1} Q_t \quad (2)$$

$$NS_t = n_t - E_{t-1} n_t \quad (3)$$

$$QS_t = Q_t - E_{t-1} Q_t , \quad (4)$$

where NS_t is the aggregate demand shocks, $E_{t-1}n_t$ is the anticipated changes in nominal GNP, Q_t is the real energy price, $E_{t-1}Q_t$ is the anticipated changes in the real energy price, and QS_t is unanticipated changes in the real energy prices.[10] I approximate unanticipated demand-side shifts by unanticipated changes in nominal GNP (NS). Based on the neutrality assumption, anticipated demand shifts ($E_{t-1}n_t$) are excluded from the empirical model for real output. Anticipated shifts are absorbed fully in nominal values without affecting real magnitudes; however, unanticipated demand shifts are expected to have a significant impact on real output. In fact, α_1 captures the response of real output growth to demand shocks which should increase as the degree of nominal rigidity increases. I use unanticipated and anticipated changes in the real energy price as a proxy for supply-side shifts which are expected to have a negative impact on output.

The second step of the empirical investigation aims at studying the effect of expected and unexpected devaluations on output. I utilize the following empirical models:

$$y_t = \gamma_0 + \gamma_1 ES_t + \gamma_2 E_{t-1} RER_t + \gamma_3 MS_t + \gamma_4 FS_t + \gamma_5 QS_t + \gamma_6 E_{t-1} Qt \quad (5)$$

$$MS_t = M_t - E_{t-1} M_t \quad (6)$$

$$ES_t = RER_t - E_{t-1} RER_t \quad (7)$$

$$FS_t = RG_t - E_{t-1} RG_t \quad (8)$$

$$QS_t = Q_t - E_{t-1} Q_t \quad (9)$$

Equation (5) is the empirical model of real output growth which accounts for monetary shocks

10. E(.) denotes expectations in the period before the variable is realized.

(MS), unanticipated changes in the exchange rate (ES), unanticipated changes in real government spending (FS), unanticipated changes in the real energy price (QS), anticipated changes in the real energy price ($E_{t-1}Q_t$), and anticipated devaluations ($E_{t-1}RER_t$). RER and RG denote changes in the real exchange rate and real government spending.[11] Once again, unanticipated and anticipated changes in the real energy price are included in order to account for supply side shifts. Empirical models are specified in first difference form since the results of the Augmented Dickey-fuller (ADF) test and the Phillips-Perron (PP) test (see Dickey and Rossana (1994)), reported in Appendix 1, indicate that variables of interest are integrated order of one.

As argued by Agenor (1991), it is expected that $\gamma_1 > 0$ and $\gamma_2 < 0$; an unanticipated devaluation has a positive effect on real output growth, whereas that of anticipated devaluation is negative. According to the rational expectations hypothesis, unanticipated changes in money supply and government spending are expected to have a positive effect on real output growth; γ_3 and $\gamma_4 > 0$. Finally, anticipated and unanticipated changes in the real energy price are predicted by theory to be negatively correlated with real output. Therefore, I expect the parameter γ_5 and γ_6 to be negative.

I estimate the empirical model for real output growth, together with the equations that produce my empirical proxies for agents' forecasts of the growth of the money supply, real government spending, real exchange rate, the real energy price, and nominal GNP jointly using non-linear 3SLS. In the estimation, *it is assumed that agents are rational and the information set used to construct the proxy for expectations and the set employed by the agents are identical*. As widely recognized now, the use of regression proxies requires an adjustment of the covariance matrix of the estimators of the parameters of the model containing expectational variables. I, therefore, estimate the expectation equations jointly with the rest of the model in order to avoid using the first stage regression proxies. This procedure will yield efficient estimates and assure correct inferences (i.e., consistent variance estimates).

The empirical models are estimated using annual data for Turkey over the sample period 1960-1990.[12] Details of the econometric methodology are described in Appendix 2. The results are summarized in Table 5 and 6.[13]

The results presented in Table 5 indicate that unanticipated aggregate demand shifts have a positive and statistically significant effect on real output growth in Turkey. As mentioned earlier, the coefficient associated with NSt, α_1, reflects the response of real output growth to demand shocks whose value is expected to increase as the degree of nominal rigidity increases. Indeed, the coefficient of 2.9 points out a fairly high degree of nominal rigidity in Turkey. It exceeds that of the econometric estimates of countries characterized by high degree of nominal rigidity:

11. Real exchange rate is defined as the relative price of tradable with respect to non-tradable goods (an increase in the RER represents a RER depreciation). In order to be consistent with the literature, this variable is proxied by the ratio of the nominal exchange rate times the U.S. WPI to domestic CPI. The selection of WPI and CPI is appropriate since the former contains mainly tradable goods, while the latter includes a larger share of non-traded goods (mainly services), thus making them a good proxy for price of tradable and non-tradable goods.
12. The period 1960-1990 was chosen because of data availability.
13. In equations (2) and (5), I included y_{t-1} in order to capture the degree of persistence in real output growth. However, the estimated coefficients were small and statistically insignificant. Their inclusion did not affect the empirical results.

Table 5 The Effects of Aggregate Demand Shocks on Real Output Growth

Independent Variables	y_t
Constant	0.0542 (0.0104)[a]
NS_t	2.9009 (0.1569)[a]
QS_t	0.7199 (0.0550)[a]
$E_{t-1}Q_t$	-0.0250 (0.0982)
ρ	-0.0167 (0.0401)

Notes: Numbers inside the parentheses are the standard errors. The error term follows an autoregressive process of order 1 : ρ is the estimate of the first order serial correlation parameter. a and b denote significant at 99 percent and 95 percent levels.

Table 6 The Effects of Anticipated and Unanticipated Devaluations and Aggregate Demand Shifts

Independent Variables	y_t	y_t	NS_t
Constant	0.0547 (0.0059)[a]	0.0545 (0.0061)[a]	-0.0012 (0.0151)
MS_t	2.9999 (0.0966)[a]	3.0911 (0.0974)[a]	
FS_t	1.3875 (0.0736)[a]	1.4285 (0.0730)[a]	
QS_t	-0.3088 (0.0200)[a]	-0.3056 (0.0198)[a]	
$E_{t-1}Q_t$	-0.0360 (0.0440)	-0.0417 (0.0449)	
ES_t	0.1517 (0.0399)[a]	0.1274 (0.0409)[a]	0.1227 (0.0958)
ES_{t-1}	-	-	-0.1348 (0.0923)
ES_{t-2}	-	-	0.1608 (0.0784)[b]
$ERER_t$	-0.0191 (0.0530)	-0.0334 (0.0562)	
$ERER_{t-1}$	-	0.0234 (0.0507)	
ρ	0.0071 (0.0084)	0.0054 (0.0089)	

Notes: Numbers inside the parentheses are the standard errors. The error term follows an autoregressive process of order 1 : ρ is the estimate of the first order serial correlation parameter. a and b denote significant at 99 percent and 95 percent levels.

Denmark (1.27), Canada (1.57), Germany (1.38), and Japan (1.42).[14] Unanticipated energy price shift has the right expected sign (negative) in explaining output movements in Turkey. This finding highlights the importance of unanticipated changes in the real energy price in Turkey which relies heavily on imports of raw materials (oil is one of the most important items) for the production of non-traded goods as well as exportables. Anticipated energy price shifts also have a negative but statistically insignificant effect on real output growth.

The impact of anticipated and unanticipated devaluations on real output growth, as well as the influence of unanticipated devaluation on aggregate demand are demonstrated in Table 6. In line with the theory of rational expectations, unanticipated changes in money supply and government spending have a strong positive effect on real output growth in Turkey. More precisely, a money shock of MS=1 percent increases output by almost 3 percent, while a fiscal shock of

14. See Kandil (1991) for more on this.

FS=1 percent raises output by almost 1.5 percent. These findings highlight the noticeable impact of cyclical components of fiscal and monetary policies on real economic activity. In line with our previous findings presented in Table 5, unanticipated changes in the real energy price have a negative and statistically significant effect on real output growth.

The empirical findings point out the positive impact of unanticipated devaluations on real output growth. The estimated coefficient of unexpected devaluation indicates that an unanticipated devaluation of ten percentage points increases real output growth by 1.5 percentage points. As suggested by Agenor's study (1991), anticipated devaluations, however, have a negative but statistically insignificant effect on output. Since previous studies included the lagged value of the real exchange rate, I also included the once lagged value of anticipated devaluations for comparison purposes. The results are summarized in Table 6. The lagged value of anticipated changes in real exchange rate is positive but statistically insignificant.[15] A formal test of the joint significance of anticipated devaluations indicates that anticipated devaluations are jointly insignificant in affecting real economic activity.[16]

In addition to the rationale provided earlier, there may be another factor explaining the negative effect of anticipated devaluations on real economic activity. An anticipated devaluation would give incentive to Turkish importers to accelerate their purchases from abroad in order to avoid future price increases as a result of devaluation. On the other hand, an anticipated devaluation would undermine Turkish exports to the extent that importers of Turkish goods postpone their orders in order to benefit from an expected appreciation of their currency. The overall effect of this phenomenon on the trade balance of Turkey will be negative which, in turn, via conventional multiplier effects, will have a negative impact on output.

The above results indicate that only unanticipated devaluations have a significant positive impact on real economic activity, while anticipated devaluations do not exert any statistically significant effect on real output. These findings lend some support to Agenor's findings and offer some policy recommendations in terms of implementing a preannounced devaluation, known as tablita, in Turkey. The empirical results indicate that the implementation of an exchange rate policy in which devaluations are preannounced may lead to a contraction of output or at best will have no effect on economic activity in Turkey. Unanticipated devaluations, however, have a positive impact on output.

The summary of empirical findings is demonstrated below:

$$\underset{[0.15]}{\frac{\partial y}{\partial e}} = \underset{[2.90]}{\frac{\partial y}{\partial n}} \underset{[0.12]}{\frac{\partial n}{\partial e}} \tag{10}$$

The response of real output growth to aggregate demand shocks is fairly high (2.90), underlining the high degree of nominal rigidity in Turkey. However, the final impact of unanticipated devaluations on real output appears to be modest (0.15) as a result of the relatively

15. This finding somehow in line with Edwards' (1986) findings in which devaluations are contractionary in the first year, this effect is reversed in the second year. However, in the present study both the contemporaneous and once lagged values of anticipated devaluations are not statistically significant

16. The test involves computing the change in the least squares criterion function which is asymptotically valid χ^2 test.

small increase in aggregate demand generated by an unanticipated devaluation (0.12).[17] The policy implication of this finding is that the implementation of a stabilization program that heavily relies on the exchange rate will not be very effective in terms of influencing real economic activity in Turkey. On the other hand, the empirical results highlight the importance of fiscal and particularly monetary policies in affecting real output, pointing out their significant role in stabilization programs. Indeed, the findings indicate that a money-based stabilization program would be more effective in influencing the real economic activity compared to an exchange rate-based stabilization program in Turkey.

V. Summary and Conclusions

The present study explores the contractionary devaluation hypothesis in Turkey over the period 1960-1990 by distinguishing the growth effects of anticipated and unanticipated devaluations. Considering the important policy implications, it is quite surprising that existing empirical studies have devoted relatively little attention to this subject. The final impact of unanticipated devaluation on output is evaluated in two steps. First, the response of real output growth to given underlying demand shock is investigated. Second, the size of the shift of the aggregate demand curve in response to the underlying demand shock caused by unanticipated change in exchange rate is analyzed. The empirical findings point out the high response of real output growth to demand shocks as a result of the significant degree of nominal rigidity in Turkey. However, the final impact of unanticipated devaluation on output is discovered to be moderate, due to the relatively small increase in aggregate demand in response to an unanticipated devaluation. Anticipated devaluations, on the other hand, are found to be contractionary in the first year and expansionary in the second year, but statistically insignificant in affecting real economic activity in Turkey. The results suggest that a stabilization package that relies heavily on the exchange rate will have little success in affecting output if it is not accompanied by consistent monetary and fiscal policies whose impact on real economic activity is found to be very significant.

The empirical findings, therefore, do not lend support to the existence of contractionary devaluation hypothesis in Turkey. The empirical results highlight the positive impact of unanticipated devaluation on real economic activity. Furthermore, contrary to the findings of Edwards (1986) and Agenor (1991), the empirical results indicate that anticipated devaluations do not exert any significant effect on output. Consequently, maintaining an overvalued currency in Turkey cannot be justified on the grounds that devaluations are contractionary which, in turn, combined with restrictive fiscal and monetary policies, would increase the output and employment costs of a stabilization program. The output and employment costs are likely to increase unless the appropriate fiscal and monetary policies are complemented by real devaluation.

In evaluating the results of this study, however, one must keep in mind that it is not possible to generalize the findings here for other developing countries. The final impact of devaluation on output hinges on, *inter alia*, the response of real output growth to a given shift of the aggregate demand curve (which, in turn, depends on the degree of nominal rigidity), and accompanying

17. The result of the F-test indicates that unanticipated changes in the real exchange rate are jointly significant in influencing aggregate demand.

monetary and fiscal policies. Country-specific factors play a crucial role as far as the investigation of the effects of devaluation on output is concerned. Unfortunately, almost all of the studies concerning this subject employed pooled time series analysis in which the different growth effects of devaluation between countries may undermine the reliability of their conclusion. In sum, individual case studies are needed to complement and perhaps supersede the cross-country studies.

Appendix 1

The Results of Unit Root Tests and Agents' Forecast Equations

Table A1.1 Order of Integration: Unit Root Test Statistics

Variables	ADF test		PP test	
	Level	First Difference	Level	First Difference
Real Exchange Rate	-2.79 [1]	-3.36 [0]^{c}	-2.37	-3.48^{c}
Real Output	-0.31 [1]	-3.32 [0]^{c}	-0.51	-3.27^{c}
Real Energy Price	-1.68 [1]	-5.11 [0]^{c}	-1.75	-5.11^{a}
Real Government Spending	-2.68 [1]	-13.18 [0]^{c}	-2.65	-15.15^{a}
Money Stock (M2)	-1.01 [1]	-3.42 [0]^{c}	-0.54	-3.37^{c}
Interest Rate	-1.74 [1]	-4.28 [0]^{c}	-1.70	-4.26^{b}

Notes: Variables are as defined in the text over the 1960-1990 period. Each Regression includes a constant term and a time trend. Number inside the number of lags in the ADF test whose selection was determined through t-ratios. a, b, and c indicate rejection of the null hypothesis of a unit root at the 99%, 95%, and 90% significance levels. Critical values are from MacKinnon (1991).

Table A1.2 Estimation Results of Agents' Forecasts

Independent Variables	RER_t	M_t	RG_t	Q_t	ny_t
Constant	0.1161[b] (0.0529)	0.1082[a] (0.0309)	0.0863[a] (0.0176)	0.2412[b] (0.1034)	0.1304[a] (0.0432)
NER_{t-1}	0.3283[a] (0.1232)				
$(m^*-m)_{t-1}$	0.8033[a] (0.1950)				
$(y-y^*)_{t-1}$	1.3409[b] (0.7782)				
ny_{t-1}					0.3674 (0.4410)
M_{t-1}		0.0219 (0.1252)			-0.1643 (0.2991)
M_{t-2}					-0.0583 (0.1907)
G_{t-1}		0.1132[a] (0.0225)			0.1507[a] (0.0224)
y_{t-1}		0.4095 (0.4081)			
P_{t-1}		0.6471[a] (0.1142)			0.4546 (0.3378)
RG_{t-1}			-0.2044[a] (0.0416)		
RG_{t-2}			-0.0745[b] (0.0380)		
$(y-y^p)_{t-1}$			-0.0437 (0.4262)		
Q_{t-1}				-0.1778 (0.1433)	-0.0784 (0.0621)
Q_{t-2}					-0.1153[b] (0.0533)
d_t				0.4030[b] (0.1653)	
tr				-0.0242[a] (0.0096)	

Notes: Numbers inside the parentheses are the standard errors. a and b denote significant at 99 percent and 95 percent levels. ny, G, and y^p stand for growth rates of nominal GNP, nominal government expenditures, and potential GNP.

Appendix 2

Econometric Methodology

In order to estimate the empirical models in (2)-(4) and (5)-(9), proxies for nominal GNP, money supply, real exchange rate, real government spending, and real energy price are needed. Following Kandil (1991), anticipated changes in nominal GNP are generated by taking the fitted values of a reduced form equation for nominal GNP which contains a constant, lagged values of change in: money stock, government spending, the price level, the real energy price and nominal GNP itself as explanatory variables. The proxy for nominal GNP surprises is computed by subtracting these forecasts from actual values for nominal GNP.

Anticipated changes in money supply are approximated by using the lags of the change in relevant variables which are expected to determine the money supply process: constant, the money supply itself, government spending, real output, and the price level. The proxy for monetary surprises is formed by subtracting these forecasts from the actual values of money supply.

Anticipated changes in real government spending are computed by using the lags of the change in relevant variables: constant, real government spending itself, and the output gap (the difference between potential output and actual output).[18] The proxy for fiscal surprises is obtained by subtracting these forecasts from the actual values of real government spending.

Following the monetary approach, the real exchange rate, RER, is defined as: $RER_t = f(NER_t, (m^*-m)_t, (y-y^*)_t)$ where NER, m, y, and * stand for nominal exchange rate, domestic money growth, domestic real output growth and their foreign counterparts. In this study, growth rates of money supply and real output in the United States are employed for foreign m and y. The proxy for unanticipated devaluation is constructed by subtracting these forecasts, which utilized the lagged values of above-mentioned variables, from the actual values for the real exchange rate. I also used an alternative specification in which RER is expressed as a function of lagged values of real money supply, inflation tax, real government spending, real interest rate, and real output. The qualitative results of the estimated models, available upon request, are similar to the ones reported in this paper. I employed two formal tests to detect the presence of the structural break in the RER equation, namely cumulative sum test (CUSUM) and generalized Chow test proposed by Dufour (1982). The results are that these tests rejected the possibility of a structural break in the process generating agent's forecast of the RER.

The proxy for real energy prices are complicated if one considers the structural change that occurred between 1973 and 1974. I employ the methodology introduced by Dufour which indicates that the structural break occurred in 1974. My forecasting procedure utilizes the following expression:

$$Q_t = c_0 + c_1 Q_{t-1} + c_2\ tr + c_3\ d_t$$

where tr and d stand for trend and dummy variable (which takes a value of zero until 1974 and take 1 elsewhere).

18. The potential GNP is generated from predicted values from the regression of the log of the real GNP on a constant, and a time trend with first order autocorrelation correction.

I estimate the expectation equations jointly with the rest of the model, thus avoiding the use of the first stage regression proxies, using *non-linear 3SLS*. The results are robust with respect to experiments that vary the choice of variables in the forecast equations. The instrument list for the estimation includes constant, time, three lags each of real output, GNP deflator, interest rate, nominal exchange rate, nominal GNP, current and three lagged values of money supply, government spending, real energy prices, and real exchange rates.

I used the Final Prediction Error (FPE) criterion (Akaike(1969)) to determine the optimal lag lengths of variables in empirical models that produce agents' forecasts. The optimal lag length, L, is the one that minimizes the FPE which is defined as follows:

$$FPE = \frac{n+L+1}{n+L-1} \frac{SSE(L)}{n}$$

where n is the number of observations and SSE(L) defines that regression sum of squared residuals.

Finally, to ensure consistency of the parameter estimates, I employ a formal test for serial correlation in a simultaneous-equation model, as suggested by Engle (1982). The test statistic is asymptotically distributed as chi square with the degrees of freedom equal to the order of serial correlation being tested. Where the results indicate the presence of serial correlation, the empirical models are transformed to filter out the error term from serial correlation.

Appendix 3

Data Description and Sources

Real Output (y): is defined as real GNP growth.

Real Exchange Rate (RER): is defined as relative price of tradables to non-tradables. Following many other studies (see, for instance, Haberger (1986) and Edwards (1986)) this variable is proxied as the following:

$$RER = \frac{EP^*}{P}$$

where E, P^*, and P denote the nominal exchange rate defined as units of domestic currency per unit of foreign currency, U.S. WPI, and domestic consumer price index.

Real Energy Price (Q): is the price of oil (crude price US$/barrel) deflated by the GNP deflator.

Real Government Spending (RG): is computed as total government expenditure deflated by the GNP deflator.

Money Stock (M): M2 definition of money stock.

Interest Rate: is the discount rate.

All data are taken from the International Financial Statistics yearbooks issued by the International Monetary Fund, Washington, D.C.

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