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9 Discrete Devaluation as a Signal to Price Setters: Suggested Evidence from Greece

Louka T. Katseli

9.1 Introduction

The origin of this paper can be traced back to early February 1983, following my visit to a small shoe repair shop in a suburb of Athens. The owner of the shop had angrily protested the decision of the firm that supplied him shoe polish to issue a new price list, which effectively raised the prices of almost all of its main products by 20 to 34 percent. His anger was focused not so much on the extent of the price change but on the fact that, contrary to his expectations, the new price list was issued so soon after the last list in October. He maintained that this was a clear violation of the client-supplier relationship, since in the past the implicit price contract set between them left prices unchanged for a period of six to nine months. The justification provided by the firm for this "breach" of contract was the "unprecedented" devaluation of the drachma during the preceding month. To this the shoemaker replied that the price-surveillance department of the Ministry of Commerce should intervene because the polish firm used only domestically produced goods and thus had used the pretext of the devaluation to raise profits. In Okun's terms, "customers appear willing to accept as fair an increase in price based on a permanent increase in cost" (Okun 1975). To the Athenian shoemaker the January devaluation did not entail a permanent increase in cost to the shoe polish firm. This attitude was obviously not shared by the firm itself.

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On 9 January 1983 the Greek drachma was devalued against the U.S. dollar by 15.5 percent, raising the price of the dollar from 71 to 84 drachmas. On a monthly average, the devaluation of the drachma between December 1982 and January 1983 was 14.14 percent against the dollar and 14.77 percent in effective terms. As can be seen in figures 9.1 and 9.2, this was the largest discrete change both in the bilateral Dr/\$ rate (*BIE*) and in the effective exchange rate (*EFE*) since the Greek government's introduction of a crawling-peg system in March 1975. It was at that time that the drachma ceased to be pegged to the U.S. dollar and that a basket of 12 currencies became the basis for the conduct of the country's exchange rate policy. Thus, over a ten-year period of managed float, the January 1983 devaluation of the drachma was one of the few incidents of a discrete and large adjustment of the exchange rate as opposed to a daily smooth crawling.

The object of this paper is to investigate the effects of exchange rate management on price behavior and thus on the real exchange rate in a small, semi-industrialized country like Greece.

Traditionally, the main policy objective behind a nominal devaluation is to promote competitiveness in third markets and to improve the

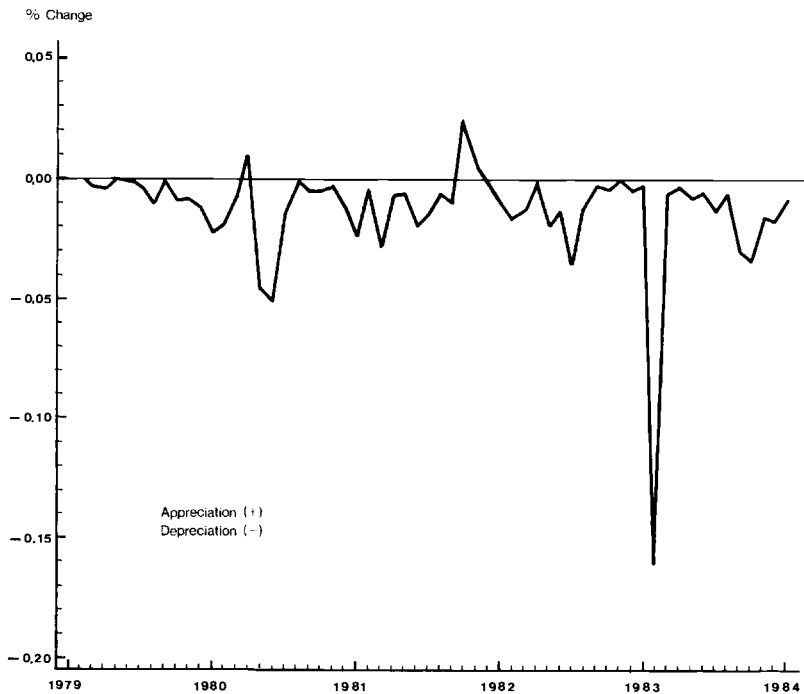


Fig. 9.1

The effective exchange rate in Greece, 1979–84.

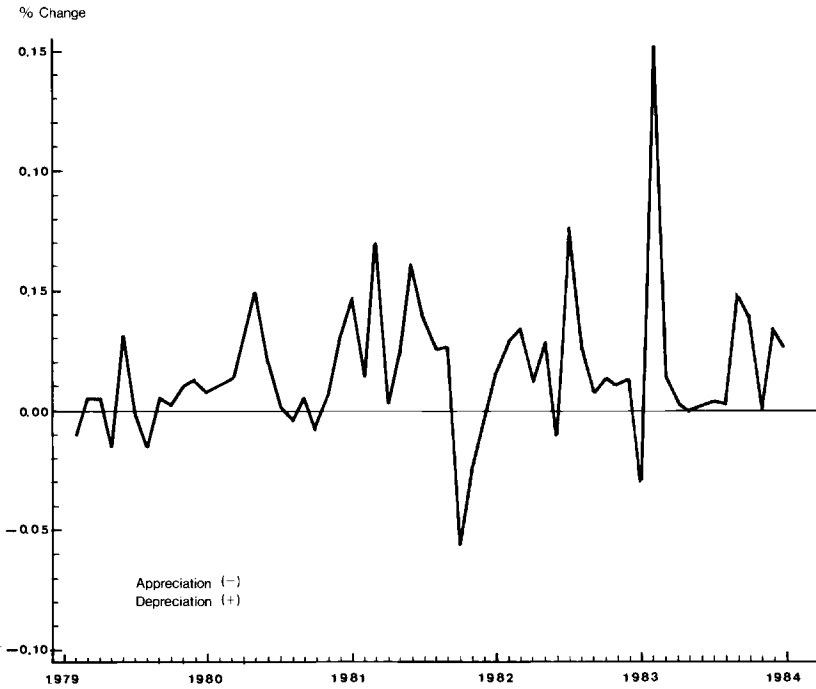


Fig. 9.2 The drachma/dollar exchange rate, 1979–84.

balance of payments. J-curve considerations aside, the balance-of-payments effects following a nominal devaluation depend on the extent to which the real exchange rate is depreciated and on the effects of the real exchange rate adjustment on net export receipts. Regarding the first factor there is already an extensive literature on the subject that focuses on the potential adjustment of the relative price of domestic to traded goods following a devaluation.¹ An increase in the price of traded goods relative to nontraded goods as a result of a devaluation shifts demand toward the nontraded goods sector, giving rise to a current-account surplus that increases reserves and the money supply. The degree of balance-of-payments improvement depends on elasticities, income and absorption effects, conditions in asset markets, and, finally, expectations. Eventually, the price of nontraded goods will rise to its steady-state level. In the meantime employment and output in the nontraded goods sector will increase (Katseli 1980).

As I have shown elsewhere (Katseli 1980) these results are sensitive to the underlying assumptions regarding the structural characteristics of the economy and, more specifically, to the degree of wage indexation and the presence of imported intermediate goods. In both these cases

the demand shift is coupled with a cost shift, making the effects on the real exchange rate, the output response, and the balance of payments at best ambiguous.

In the absence of an adjustment of the real exchange rate, a devaluation can work solely through a real balance effect. The increase in the price of foreign exchange then reduces real balances. If the demand for money is exogenously determined,² the excess demand for money is translated into a reduction in absorption and a balance-of-payments surplus that is the vehicle by which money balances are replenished (Katseli 1983). In this case, as absorption is reduced the improvement in the balance of payments is achieved at the expense of real consumption in the economy and output and employment in the nontraded goods sector. Given these considerations, it is important to look at the implications of exchange rate management for real exchange rate developments.

The central hypothesis of this paper is that both the extent and the speed of adjustment of the real exchange rate are influenced by the way in which the central bank manages the nominal exchange rate. Specifically, a large discrete adjustment of the nominal exchange rate is more likely to result in a rapid adjustment of prices than is a policy of a smooth and continuous crawling peg. To use Cooper's (1973) terminology, whether exchange rate policy occupies the "high-" or "low-politics realm" does in fact matter in a country's international competitiveness and in the output and employment effects during the adjustment period.

If domestic prices instantaneously adjust to their steady-state level, the improvement in the balance of payments can come about only through a natural or policy-induced squeeze in absorption. In both cases the effects of the devaluation will tend to be stagflationary, at least in the nontraded goods sector.

The channel through which management of the nominal exchange rate influences real exchange rate developments is the process of price adjustment. As will be shown in section 9.2, this process has at least two important features, namely, the magnitude and the frequency of price changes. The existing finance literature on exchange rate policy has in general focused on the first aspect only, that is, on the responsiveness of domestic prices to a nominal devaluation. The industrial organization and macroeconomics literature, on the other hand, has increasingly focused on sluggishness. As Barro (1972, 17) has noticed,

The firm's elastic demand curve must be discarded in disequilibrium if the firm is ever to change price. In this sense the response of prices to disequilibrium is essentially a monopolistic phenomenon even if the individual units perform as perfect competitors in equilibrium.

Therefore, it seems clear that a theory of monopolistic price adjustment is a prerequisite to a general theory of price adjustment.

Monopolistic price adjustment implies joint determination of two pricing features on the part of the firm: the length of the implicit or explicit "price contract," and the magnitude of the adjustment at the end of the contract period. As Gray (1976) has shown, analogous modeling can be applied to the workings of a labor market characterized by the existence of a strong union. In that case the contract length and the indexing parameter are the important contract characteristics.

In merging these two strands of the literature, this paper argues that exchange rate management can affect both the length of the price contract between firms and clients and the magnitude of the price adjustment. This hypothesis can be tested directly only through the use of micro or firm-level data, since the path of price adjustment varies across firms. These data are in fact available for Greek firms. As will be shown in section 9.3, the prices set by Greek firms for specific products exhibit properties of a step function. The contract length and the magnitude of the price adjustment can thus be investigated in relation to exchange rate management.

The econometric analysis of price behavior by firms is complicated, however, by the existence of special institutional characteristics of trading. More specifically, most developing countries are apt to employ some institutional mechanism for price surveillance or direct price controls.

In the case of Greece, price controls have existed since the mid 1930s. After World War II they covered only a small number of products and were intended to curb excessive profits earned from the sale of goods in short supply. Over time, those controls were extended to cover numerous other products by specifying price ceilings or maximum allowable markups over costs. The type of control that has been used has varied across goods and business operations and has been applicable to the industry, the wholesaler, or the retailer, that is, to any stage within the production and distribution systems (Lalonde and Papandreou 1984).

The complexity of the system thus seriously hinders an extensive analysis of price behavior by firms unless one investigates thoroughly the underlying institutional arrangements that affect each specific product or enterprise. In the presence of differentiated product controls, profit-maximizing behavior on the part of firms implies that the pricing of noncontrolled goods also departs from the expected pricing under free-market conditions. It has been observed, for example, that firms tend to price overall production in such a way as to ensure large enough profits in some lines of production and thus cover losses generated in

the production of price-controlled products. It follows that an increase in expected or actual costs affects not only the overall price level but also the relative prices of different commodities.

In view of these complexities, the central hypotheses of this paper can be formulated as follows. Section 9.2 argues that discrete adjustment of the exchange rate tends to shorten the implicit price contract between sellers and buyers and to augment the rate of price adjustment. This is so because firms tend to strengthen their expectations about an overall increase in costs and about an aggregate shift in the demand curve for the firms' output. A discrete change in the exchange rate thus acts as an "information signal" in the market that leads to a relatively rapid overall price adjustment of traded and nontraded goods alike. Given the presence of controls, the prices of noncontrolled goods should tend to adjust faster than those of controlled goods, even though sooner or later the regulatory agency itself is apt to allow price increases in the controlled part of the market. The output response to these effects depends not only on the expected increase in demand for the firm's output relative to its costs, but also on the ability of each firm to diversify production with commodities that are exempt from price controls.

The econometric analysis provided in section 9.3 should be interpreted with caution. Given the existing institutional complexities, it has to be conducted at the macro, sectoral, and product levels. Even though the existing evidence is not conclusive, the data do not reject the central hypotheses of section 9.2, making this line of research both interesting and promising.

9.2 The Magnitude and Frequency of Price Adjustment Following a Discrete Adjustment of the Exchange Rate

In the international finance literature exchange rate management has been analyzed in the context of the benefits and costs of alternative exchange rate regimes. As early as 1970, Cooper and other authors argued for greater exchange rate flexibility on three separate grounds: to provide smoother adjustment to changing fundamentals; to avoid speculative runs on the national currency; and to reestablish the effectiveness of monetary policy (Cooper 1973).

As consensus on the advisability of flexible exchange rates grew, the focus of attention shifted to the manner in which the "gliding parity" should be managed. It was demonstrated, for example, that exchange rate adjustment could be unstable if the rate of change in the nominal exchange rate followed the rate of change in foreign exchange reserves, as opposed to following developments in the current-account or the basic balance (Rodriguez 1981). The so-called shock treatment, namely,

an unexpected sudden devaluation or revaluation of the nominal exchange rate, was judged inferior to the "gradualist solution" because it was considered highly unlikely that central authorities would possess the necessary information to arrive at an equilibrium real exchange rate through discrete action (Rodriguez 1981).

Despite the advantages of continuous exchange rate adjustment to correct underlying fundamental disequilibria, a number of countries during recent years have chosen to pursue a discrete adjustment policy. Sweden, Spain, and Greece are the most recent examples.

Discrete adjustment of the nominal exchange rate has usually been associated with either political transitions or interruptions in the normal conduct of exchange rate policy. It is thus undertaken at the beginning of a new government's term in office in an attempt to slow the necessary rate of devaluation in the following year and to attribute the need for the adjustment to earlier government policy. This scenario probably applies to both Sweden and Spain. Discrete adjustment is also initiated during periods when, for various economic or institutional reasons, the real exchange rate becomes overvalued, giving rise to speculative runs on the currency. In both cases the discrete adjustment of the nominal exchange rate is a response to growing disequilibria in the economy. Finally, discrete adjustment is also used by policy makers to influence expectations about the future rate of devaluation and thus the rate of inflation. It is often a signal for a reversal in policy stance and is usually accompanied by other changes in fiscal or monetary policies. This is the most likely explanation for the Greek case. Such adjustment, if credible, could in fact have negative real effects on output and employment.

As Calvo (1981) has shown, an unanticipated devaluation always improves the balance of payments of a small, open economy, whereas below a certain critical deficit level, an increase in the rate of devaluation could bring about a deterioration. In the presence of nontraded goods, these results will continue to hold, especially if the relative price of traded to nontraded goods is altered. A devaluation of the real exchange rate³ thus strengthens the case for a balance-of-payments improvement (Katseli 1983). If, as a response to an unanticipated devaluation, the prices of nontraded goods jump to their steady-state value, then even the transitory improvement in the balance of payments could be questioned. This is especially true in developing countries, where the decrease in absorption might be limited by inflationary expectations that lead to an increase in consumption and imports of durables or to an accumulation of inventories. Furthermore, inflationary expectations and a decrease in output might reduce money demand, offsetting the excess demand for money that is necessary for a balance-of-payments improvement. It could therefore be argued that a deval-

uation of the real exchange rate is more necessary for a balance-of-payments improvement when the conditions for a smooth working of the real balance effect are unfavorable.

Can the process of price adjustment differ depending on the way the exchange rate is managed? The answer would be positive if one analyzes price behavior in price-setting markets instead of in simple auction markets. As Gordon (1981) has noted, the assumption of "pervasive heterogeneity" in the types and quality of products and in the location and timing of transactions is crucial for such a theory of price adjustment. This approach thus undermines "the new classical macroeconomic models based on a one-good economy postulated by identical price-taking yeoman farmers" (Gordon 1981), or Calvo's world of a one-family, one-good economy, in which "the price level is the exchange rate [that is, the relative price] of domestic currency in terms of some other given currency" (Calvo 1981).

There is already a fairly substantial literature on the microeconomic foundations of price adjustment. Apart from issues related to the existence of a "non-Walrasian" or "conjectural" equilibrium, as early as the 1960s another set of contributions attributed partial price adjustment to adjustment costs and incomplete information. In that tradition one could cite the works of Alchian (1969), Phelps and Winter (1970), Okun (1975), and more recently Blinder (1982) and others.⁴

From that viewpoint and in sharp contrast to the prototypical firm in traditional short-run market analysis, pervasive heterogeneity and the cost of information make each firm behave in the short and the medium run as a monopolist. In that role the firm acts as a quantity taker and price maker. As Okun has remarked, "Even firms with minuscule market shares put price tags on their commodities; in the short run, they are never surprised by the price, and always subject to surprise about the quantities they sell" (Okun 1975, 360).

Following this line of thought, Gordon has argued that the fundamental reason for gradual price adjustment is the "large local component of actual changes in demand and costs, together with the independence of those costs and demand changes" (Gordon 1981, 522). Combining price-setting behavior by a typical monopolist with Lucas's analysis of expectation formation Gordon has reached the following conclusions: that price adjustment will be complete if the perceived marginal cost responds fully to an aggregate shock but not if otherwise; that the expected cost mimics expected aggregate demand if the aggregate variance of a shock dominates the local variance; and that only in the extreme case when the aggregate component of the variance of both demand and cost shifts is very large relative to the local component, as during wartime or a hyperinflation, does price adjustment capture fully the aggregate demand shift.

In this view, therefore, heterogeneity of products makes firms behave as monopolists that purchase their inputs from and sell their output to other firms. The extent to which a particular shock that affects cost and demand is perceived as “local” or “global” critically affects pricing decisions. The adjustment of the price will be larger if a shock in demand is expected to affect other firms as well and thus in the end give rise to an increase in the firm’s input costs.

How can this framework be applied to exchange rate management? In the case of a discrete devaluation that is typically large, there is an “announcement effect.” A high-level official usually announces to all market participants that effective immediately the prices of all traded goods will be increased. That announcement thus stimulates or confirms expectations, even in the nontraded goods sector, that demand for output and the cost of inputs will increase. The increase in production cost is expected to take the form not only of an increase in the cost of imported inputs, but also in the cost of intermediate or capital goods purchased from other domestic firms. In the non-union sector labor costs are expected to rise concomitantly, while in the unionized sector, wages are expected to be adjusted at the end of the contract period or when contracts are renegotiated. Discrete adjustment of the exchange rate thus induces an expected increase in the overall cost of production, that is, in both its local and its aggregate components. On the demand side, the larger the discrete devaluation, the greater the likelihood of an overall demand shift in the economy and thus the smaller the perceived cost to each firm of raising its own price. A discrete adjustment of the exchange rate therefore strengthens expectations regarding inflationary pressures in the economy that will produce an increase in both demand and marginal costs.

The trade-off between price and output adjustment depends on firm specifics. The expected increase in marginal costs, however, is more likely to mirror the expected increase in demand in the case of a discrete change in the exchange rate than in the case of a crawling peg. Hence, in comparing these two regimes one would expect price rather than output adjustment to be dominant in the former case.

Discrete adjustment of the exchange rate induces not only an increase in the average expected cost of production, but also in the variance of the aggregate component as opposed to the local component. As the local component of actual changes in demand and costs becomes small, price adjustment in the specific firm tends to approximate the rate of devaluation.

With a simple cost-push model similar to that developed by Gordon (1981), it is easy to show that the percentage change in price (P_{it}) will be positively related to a discrete change in the exchange rate, defined

as the ratio of the unexpected change in the exchange rate relative to its variance, or $\frac{R_t - E_{-1}R_t}{\text{Var } R}$.

For the monopolist, P_i is a weighted average of the actual change in nominal revenue (α_{it}) and of expected changes at time t in the marginal costs at time $t + 1$, or $E_t(C_{it+1})$. Thus:

$$(1) \quad P_{it} = \psi\alpha_{it} + (1 - \psi)E_t(C_{it+1}),$$

where i refers to the specific firm, and E is the expectations operator.

The expected change in marginal costs for the individual firm i is a weighted average of the actual cost increase of imported inputs and of the expected costs of other inputs that are determined by a different set of agents, including labor and other firms (W). If the change in the price of imported inputs at time t is assumed to equal R_t and the mean of the local component of W is assumed to equal zero, it follows that:

$$(2) \quad E_t(C_{it+1}) = zR_t + (1 - z)(1 - \phi)E_t(W_{t+1}),$$

where ϕ is the ratio of the variance of the local component of the cost shift to the sum of the variances of the local and aggregate components.

Apart from a known component (\bar{W}) that captures information about existing contracts, past pricing behavior, and known institutional factors, expectations about non-firm-specific costs, $E_t(W_{t+1})$, are assumed to be positively related to the unexpected component of the exchange rate change, this being defined as the difference between the actual change at time t and that expected during the previous period, $E_{-1}(R_t)$, divided by the historical variance of exchange rate changes. Thus:

$$(3) \quad E_t(W_{t+1}) = \bar{W}_{t+1} + \beta \left[\frac{R_t - E_{-1}(R_t)}{\text{Var } R} \right],$$

Making all appropriate substitutions, we find that:

$$(4) \quad P_{it} = \psi\alpha_{it} + (1 - \psi)zR_t + (1 - \psi)(1 - z)(1 - \phi) \left\{ \bar{W}_{t+1} + \beta \left[\frac{R_t - E_{-1}(R_t)}{\text{Var } R} \right] \right\}.$$

Given equation (4) it is easy to see that P_{it} is positively related to $\frac{R_t - E_{-1}(R_t)}{\text{Var } R}$. More specifically if we assume that $E_{-1}(R_t) = 0$, then:

$$(5) \quad \partial P_{it} / \partial (R_t / \text{Var } R) = (1 - \psi)z\text{Var } R + (1 - \psi)(1 - z)(1 - \phi)\beta > 0.$$

From equation (5) it follows that for any given unexpected change in the exchange rate, P_i becomes larger as the aggregate component of the variance of costs becomes larger in relation to the local component,

or $\phi \rightarrow 0$. This is probably the case when there is a switch in regimes from a smooth crawling peg to that of a discrete exchange rate adjustment. If this is so, then both $E(W_{t+1})$ and $(1 - \phi)$ are positively related to $\frac{R_t - E_{-1}(R_t)}{\text{Var } R}$.

Finally, it should be noted that the increase in price will be even larger if $E(W_{t+1})$ is made to represent the expected aggregate change in income. In that case, as in Gordon (1981), equation (3) could be replaced by:

$$(3') \quad E(W_{t+1}) = \theta \left\{ \bar{W}_{t+1} + \beta \left[\frac{R_t - E_{-1}(R_t)}{\text{Var } R} \right] \right\} + (1 - \theta) \alpha_{it},$$

where the demand shift is assumed to consist of a local component and an aggregate component. In (3'), θ , like ϕ , is the ratio of the local component of the demand shift to the sum of the local and aggregate variances. The replacement of (3) by (3') does not change the qualitative nature of the results.

The analysis so far is limited to the magnitude of the price response to a discrete devaluation. One would expect, however, that implicit price contracts will also be arbitrarily shortened or renegotiated.

In analyzing labor market contracts, Gray argued that the "optimal contract length is inversely related to the variance of the industry-specific shock" (Gray 1978, 11). Firms are assumed to determine the degree of indexation and the length of the labor contract by minimizing a loss function (z) of the form:

$$(6) \quad z = 1/l \left(\lambda \int_0^l E [(\ln Y_t - \ln Y_t^0)^2] dt + C \right),$$

where l is the contract length, and λ is a relative price that converts losses expressed as squared output deviations into losses expressed in the units of the contracting cost (C).

Intuitively, the optimal contract length in Gray's analysis is determined by a condition that at the margin "balances the per period savings on transactions costs that could be achieved by lengthening the contract against the concomitant increased losses in the form of larger expected output and employment deviations." Thus, whereas "increased uncertainty brings about a shortening of contract length, increased contracting costs lead to a lengthening of contracts" (Gray 1978, 7).

In the case of the monopolistic firm that determines both price and output, it is the cost of information that includes the costs of prediction and of establishing reliability and permanence that leads to implicitly long-term contractual relationships. These considerations have to be weighed against the profit losses that would be incurred if underpricing

were to continue for too long. A large discrete adjustment of the exchange rate both reduces the cost of information as defined above and establishes, as we have seen, firms' expectations about the prospective increase in costs. Since cost-oriented pricing with a markup offers the "most typical standard of fairness in buyer-seller relationships" (Okun 1975) a discrete devaluation allows sellers to pursue cost-oriented price increases. Thus, a discrete devaluation, as opposed to a crawling peg, reduces the cost the firm bears in explaining to its customers the reason for the price increase leading to a renegotiation of existing contracts with those customers.

The length of the new contracts is probably indeterminate as firms attempt to guess the intentions of the central bank. This is especially true if the discrete adjustment is a break from past exchange rate management practices. If after some initial period firms believe that the policy marks a switch in regimes from a crawling peg toward a regime of discretely adjustable exchange rates and that the established rate is in fact tenable, implicit price contracts will again be renegotiated for corresponding periods of time.

Uncertainty as to the central bank's intentions, on the other hand, calls for short-period adjustment lags. Finally, the length of the renegotiated contracts will probably be the same as before if after the discrete adjustment the exchange rate continues to crawl. In all cases the contract length will also be affected by expectations about economic fundamentals and the ability of policy to correct existing disequilibria.

In summary what can be said unambiguously is that a discrete exchange rate adjustment will give rise to recontracting and also, in the absence of a clear signal by the government as to its intentions, to an increased tendency for contracts of shorter duration. This conclusion is similar to that of Aizenmann (1982), who in a different context argued that "the optimal frequency of wage recontracting depends on measures of aggregate volatility."

9.3 The Econometric Analysis

The purpose of this section is to investigate empirically whether the responsiveness of nontraded goods prices to exchange rates was more rapid in the period following the January 1983 Greek devaluation than in the previous periods. The analysis is therefore conducted at the aggregate, sectoral, and product levels, using monthly data for two distinct periods: the period January 1979 to December 1983 (the long period), and the period January 1979 to December 1982 (the short period).

Table 9.1 presents a summary of Greek exchange rate statistics. The definitions of the notations for all the variables therein are given in

table 9.2. It can readily be seen that both the standard deviations and the coefficients of variation of the effective and bilateral exchange rates were greater in the long period than in the short period. This can largely be attributed to the January 1983 devaluation (see again figures 9.1 and 9.2), which was the largest discrete adjustment of the exchange rate since the beginning of the crawling-peg period.

As shown in table 9.3, the nominal devaluation of the exchange rate in January 1983 produced a real exchange rate devaluation during the first quarter of the year on the order of 7 to 12 percent, depending on the index used to calculate the real effective exchange rate. By the second quarter of 1983, however, the real effective exchange rate returned to roughly its 1980 level as relative prices deteriorated, thereby dissipating some of the effects of the nominal adjustment.

Looking more closely at the time-series properties of exchange rates before and after the discrete adjustment of January 1983, tables 9.4 and 9.5 present the autoregressive structure of the relevant series for

Table 9.1 Greek Exchange Rate Statistics

	Level of the Exchange Rate	
	1979.1–1982.12	1979.1–1983.12
<i>EFE</i>		
Mean	52.875	49.415
STD	7.501	9.687
CVAR	0.142	0.196
	1978.6–1982.12	1978.6–1983.12
<i>BIE</i>		
Mean	48.702	55.754
STD	12.227	18.949
CVAR	0.251	0.340
	Percentage Change in the Exchange Rate	
	1979.2–1982.12	1979.2–1983.12
<i>EFE</i>		
Mean	-0.009	-0.011
STD	0.013	0.023
CVAR	-1.444	-2.091
	1978.7–1982.12	1978.7–1983.12
<i>BIE</i>		
Mean	0.012	0.015
STD	0.025	0.030
CVAR	2.083	2.000

Note: For definitions of notations used, see table 9.2. 1979.1 denotes January 1979; 1982.12 denotes December 1982, for example.

Table 9.2 Definitions of Notations Used in the Tables

Notation	Definition
<i>EFE</i>	The effective exchange rate: the 12-currency basket as defined by the Bank of Greece. An increase in the index represents a nominal appreciation of the exchange rate. <i>Source:</i> Bank of Greece.
<i>BIE</i>	The bilateral Dr./U.S.\$ exchange rate. An increase in the index represents a nominal depreciation of the exchange rate. <i>Source:</i> Bank of Greece, <i>Monthly Statistical Bulletin</i> , various issues.
<i>STD</i>	Standard deviation.
<i>CVAR</i>	Coefficient of variation.
<i>RCPI</i>	The consumer price index (CPI) of Greece relative to the weighed CPI of twelve trading partners, adjusted for exchange rate changes. Both indexes are expressed in dollars. 1970 = 1.000. <i>Source:</i> Bank of Greece.
<i>RWPI</i>	The wholesale price index (WPI) of Greece relative to the weighted WPI of 21 competitor countries. Both indexes are expressed in dollars. 1980 = 1.000. <i>Source:</i> Bank of Greece.
<i>L</i>	The natural logarithm of a variable.
ΔL	The differenced natural logarithm of a variable.
<i>D</i>	A change in the variable.
<i>ER</i>	Exchange rate.
<i>C</i>	The contracting cost.
<i>D.W.</i>	Durbin-Watson statistic.
<i>SEE</i>	Standard error of the estimation.
<i>P</i>	Price level.
<i>PM</i>	The wholesale price index of finished products of foreign origin. 1970 = 1.000. <i>Source:</i> National Statistical Service of Greece, <i>Statistical yearbook of Greece</i> , various issues.
<i>PE</i>	The wholesale price index (WPI) of exported products of domestic primary and industrial production. 1970 = 1.000. <i>Source:</i> <i>ibid.</i>
<i>NT</i>	The WPI of finished products of domestic industrial production for domestic consumption. 1970 = 1.000. <i>Source:</i> <i>ibid.</i>
<i>GI</i>	The WPI of finished products of domestic and foreign origin for domestic consumption. 1970 = 1.000. <i>Source:</i> <i>ibid.</i>
<i>K20</i>	The WPI of domestically produced foodstuffs for domestic consumption. 1970 = 1.000. <i>Source:</i> <i>ibid.</i>
<i>CPI</i>	The consumer price index. 1970 = 1.000. <i>Source:</i> <i>ibid.</i>

Table 9.4 Time-Series Properties of the Level of the Exchange Rate

<i>DEP</i>	<i>C</i>	<i>LER</i> ₋₁	<i>LER</i> ₋₂	<i>R</i> ²	\bar{R}^2	<i>D.W.</i>	<i>SEE</i>
1. <i>LEFE</i> 1979.8–1983.12	-.0246 (0.05)	.9411 (5.65)	-.0072 (0.03)	.99	.98	2.06	.02
2. <i>LBIE</i> 1979.1–1983.12	.0660 (0.85)	.7971 (5.25)	.0898 (0.46)	.99	.99	1.98	.04
3. <i>LEFE</i> 1979.8–1982.12	1.5944 (1.49)	1.0188 (4.84)	-.4536 (1.52)	.99	.99	1.87	.003
4. <i>LBIE</i> 1979.1–1982.12	.1735 (1.67)	.9575 (4.88)	-.0217 (0.08)				

Note: The estimated equation is of the form $LEFE = C + \alpha_1 LEFE_{-1} + \dots + \alpha_6 LEFE_{-6} + Lt +$ dummy variables. Only the estimated coefficients *C*, α_1 , and α_2 are reported here. The numbers in parentheses are t-statistics.

products (*PE*) exhibited higher-order autoregressive properties, probably as the result of a conscious pricing policy. The coefficient of the first-month lag of nontraded goods (*LNT*) was typically smaller than that of traded goods but rose considerably between the two periods under consideration. The same is true for all the other price indices, implying that the adjustment of prices is on average faster when 1983 is included in the sample period. This is also reflected in the fact that the coefficients of the constant terms in table 9.7 are higher in all cases in the long period than in the short period. In the case of the *NT* index, the average monthly rate of change increased from 1.7 to 1.9 percent across periods, implying an even larger rate of increase in 1983 alone. In both the *DLPM* and the *DLPE* autoregressions, the inclusion of 1983 raises the coefficients of the constant terms and reduces the coefficients of the significant lagged terms.

These results support the hypothesis that the adjustment of the prices of both traded and nontraded goods was faster in 1983 than in the previous years. The relationship of this development to exchange rate behavior thus provides further evidence that the discrete devaluation of 1983 produced an almost instantaneous reaction in the prices of traded and nontraded goods alike.

When *DLGI* is regressed against lagged values of itself and against current and lagged values of the exchange rate (effective and bilateral), the coefficient of the current exchange rate change term becomes large and significant only in the period that includes 1983, as shown in table 9.8. The same is true in the case of *DLNT*, where the current effective exchange rate change (*DLEFE*) seems to influence the current change in nontraded goods prices only in the long period. The results are more mixed when the bilateral exchange rate is used instead, as shown in table 9.9a. What these results suggest is that the adjustments of non-

Table 9.5 Time-Series Properties of Changes in the Exchange Rate

<i>DEP</i>	<i>C</i>	<i>DLEF</i> ₋₁	<i>DLEF</i> ₋₂	<i>R</i> ²	\bar{R}^2	<i>D.W.</i>	<i>SEE</i>
1. <i>DLEF</i> 1979.8–1983.12	– .0226 (3.78)	– .0405 (0.28)	– .1574 (1.10)	.13	.01	1.97	.03
2. <i>DLBIE</i> 1979.1–1983.12	.0185 (2.86)	– .0113 (0.08)	.0368 (0.27)	.03	– .08	2.00	.05
3. <i>DLEF</i> 1979.8–1982.12	– .0109 (2.44)	.3033 (1.76)	– .1636 (0.91)	.14	– .01	1.99	.01
4. <i>DLBIE</i> 1979.1–1982.12	.0102 (1.85)	.1749 (1.10)	.1568 (0.98)	.11	– .02	1.85	.02

Note: The estimated equation is of the form $DLEF = C + \alpha_1 DLEF_{-1} + \dots + \alpha_6 DLEF_{-6} + v_t$. Only the coefficients C , α_1 , and α_2 are reported here. The numbers in parentheses are t-statistics.

Table 9.6 Time-Series Properties of the Level of Prices

Dependent Variable	Constant	LP_{t-1}	LP_{t-2}	LP_{t-3}	R^2	\bar{R}^2	<i>D.W.</i>	<i>SEE</i>
1. <i>LPM</i> 1979.7–1983.12	.0671 (3.24)	1.2855 (6.93)	– .3965 (– 1.35)	.1190 (0.40)	.997	.996	1.80	.017
2. <i>LPE</i> 1979.7–1983.12	.0374 (1.13)	1.3886 (7.70)	– .5953 (– 2.05)	.4937 (1.67)	.995	.993	1.64	.019
3. <i>LNT</i> 1979.7–1983.12	.0837 (4.93)	.8250 (5.24)	.0232 (0.11)	– .1166 (– 0.56)	.999	.998	1.80	.012
4. <i>LGI</i> 1979.7–1983.12	.0675 (4.05)	1.1260 (6.39)	– .2557 (– 0.99)	– .0527 (– 0.20)	.999	.998	1.89	.011
5. <i>LPM</i> 1979.7–1982.12	.0727 (3.06)	1.2691 (5.70)	.4113 (– 1.25)	.1942 (0.64)	.999	.997	2.06	.012
6. <i>LPE</i> 1979.7–1982.12	.1448 (3.16)	.9453 (4.64)	– .2001 (– 0.72)	.4393 (1.63)	.996	.993	1.54	.015
7. <i>LNT</i> 1979.7–1982.12	.1210 (3.81)	.6704 (3.48)	– .0065 (– 0.03)	– .0710 (– 0.31)	.998	.997	1.83	.012
8. <i>LGI</i> 1979.7–1982.12	.0912 (3.46)	.8765 (4.47)	– .1218 (– 0.48)	.1182 (0.47)	.999	.998	2.05	.008

Note: The estimated equation is of the form $LP = C + \alpha_1 LP_{-1} + \dots + \alpha_6 LP_{-6} + Lt +$ dummy variables. Only the estimated coefficients of C , α_1 , α_2 , and α_3 are reported here. The numbers in parentheses are t-statistics.

Table 9.7 Time-Series Properties of Price Changes

<i>DEP</i>	<i>C</i>	<i>DLP</i> ₋₁	<i>DLP</i> ₋₂	<i>DLP</i> ₋₃	R ²	\bar{R}^2	<i>D.W.</i>	<i>SEE</i>
1. <i>DLPM</i> 1979.8–1983.12	.0183 (3.09)	.3883 (2.56)	–.1645 (1.03)	.0274 (0.17)	.22	.11	1.91	.018
2. <i>DLPE</i> 1979.8–1983.12	.0149 (2.83)	.2568 (1.81)	–.1306 (0.94)	.2251 (1.61)	.14	.03	1.83	.015
3. <i>DLNT</i> 1979.8–1983.12	.0187 (2.62)	.0542 (0.39)	–.0879 (0.63)	–.2492 (1.76)	.10	–.02	1.91	.009
4. <i>DLGI</i> 1979.8–1983.12	.0200 (3.39)	.1940 (1.31)	–.0624 (0.42)	–.1320 (0.87)	.09	–.03	1.91	.008
5. <i>DLPM</i> 1979.8–1982.12	.0115 (2.12)	.6364 (3.65)	–.1823 (0.91)	.1315 (0.70)	.36	.25	1.93	.014
6. <i>DLPE</i> 1979.8–1982.12	.0085 (1.73)	.2446 (1.56)	.0668 (0.45)	.4022 (2.69)	.25	.12	1.82	.008
7. <i>DLNT</i> 1979.8–1982.12	.0166 (1.96)	.0480 (0.30)	–.0990 (0.61)	–.1890 (1.15)	.10	–.06	1.94	.007
8. <i>DLGI</i> 1979.8–1982.12	.012 (1.80)	.2237 (1.29)	–.0201 (0.11)	–.0354 (0.20)	.06	–.11	1.91	.005

Note: The estimated equation is of the form $DLP = C + \alpha_1 DLP_{-1} + \dots + \alpha_6 DLP_{-6} + u_t$. Only the estimated coefficients, *C*, α_1 , α_2 , and α_3 are reported here. The numbers in parentheses are t-statistics.

traded goods prices and exchange rates become contemporaneous when 1983 is included in the estimation. This can be seen clearly in figures 9.3 and 9.4, in which the exchange rate and price adjustments in January 1983 are completely synchronized.

Two additional points concerning the price adjustment of nontraded goods are also worth noting. The evidence presented in figures 9.3 and 9.4 is also confirmed by the relatively low explanatory power of equations 1 and 2 in table 9.9. Over the entire period in question, the exchange rate was only partially responsible for the observed variation in nontraded goods prices, as other factors, such as imported inflation, wage rate adjustment, monetary developments, and the position of the economy over the business cycle, became more important. It was only in January 1983 that the devaluation of the currency became the dominant factor explaining most of the variation in *LNT*. Unfortunately, the lack of consistent monthly data prevents a disaggregated analysis along these lines. With quarterly data, however, it can be shown that for the entire period 1979.II–1983.IV, the price of imported goods in the domestic currency is the most important explanatory variable for *DLNT*. This variable reflects changes in both foreign prices and exchange rates and thus picks up the significant terms-of-trade shocks undergone during the period, such as the second oil price increase. As one would expect, the explanatory power of the estimated equation (equation 5 in table 9.9b) is raised considerably when this variable is included.

The lack of sufficient disaggregation in data available also prevents an effective analysis of the relationship between pricing behavior and expectations regarding exchange rate adjustment. According to the evidence presented in table 9.9, a 10 percent devaluation of the effective exchange rate was expected to raise the prices of nontraded goods by 1.4 percent during the same month. The unexpected component of the price change between two consecutive months is picked up by the residual in the estimated equation. The vector of estimated residuals from the estimated price equation can thus be correlated or regressed against the current and lagged values of the residuals obtained from an exchange rate adjustment equation. This exercise allows an analysis of the responsiveness of prices to news of an impending change in the exchange rate. When monthly and quarterly data are used, however, the results are completely uninformative. For example, although the correlation coefficient of the residuals was positive, it was low, never exceeding 0.12. Similarly, the coefficients of the current and lagged unexpected changes in the exchange rate never proved to be significantly different from zero.

These results probably reflect the structure of expectations regarding exchange rate developments. Since exchange rates are announced daily,

Table 9.8 Monthly Data on Aggregate Price Adjustment and Exchange Rate Adjustment

<i>DEP</i>	<i>C</i>	<i>DLGI</i> ₋₁	<i>DLGI</i> ₋₂	<i>DLBIE</i>	<i>DLBIE</i> ₋₁	<i>DLEFE</i>	<i>DLEFE</i> ₋₁	R ²	\bar{R}^2	<i>D.W.</i>	<i>SEE</i>
1. <i>DLGI</i> 1979.4–1983.12	.0103 (3.64)	.0748 (0.55)	.0314 (0.27)			-.2622 (4.76)	-.1368 (2.06)	.39	.34	2.0	.010
2. <i>DLGI</i> 1979.4–1983.12	.0107 (3.41)	.1546 (1.10)	-.0274 (0.22)	.1792 (3.57)	.0433 (0.78)			.24	.18	2.0	.011
3. <i>DLGI</i> 1979.4–1982.12	.0117 (3.33)	.0870 (0.59)	-.0573 (0.40)			-.1421 (1.2)	-.3141 (2.56)	.24	.17	2.0	.010
4. <i>DLGI</i> 1979.4–1982.12	.0128 (3.38)	.1684 (1.05)	-.0631 (0.40)	.0665 (0.95)	.0622 (0.86)			.09	.00	1.97	.011

Table 9.9a Monthly Data on Nontraded Goods Price Adjustment and Exchange Rate Adjustment

<i>DEP</i>	<i>C</i>	<i>DLNT</i> ₋₁	<i>DLNT</i> ₋₂	<i>DLNT</i> ₋₃	<i>DLBIE</i>	<i>DLBIE</i> ₋₁	<i>DLBIE</i> ₋₂	<i>DLEFE</i>	<i>DLEFE</i> ₋₁	<i>DLEFE</i> ₋₂	<i>R</i> ²	\bar{R}^2	<i>D.W.</i>	<i>SEE</i>
1. <i>DLNT</i> 1979.5–1983.12	.0169 (3.54)	.0311 (0.22)	-.1043 (0.75)	-.1635 (1.21)				-.1427 (1.88)	-.0814 (1.04)	-.1157 (1.47)	.19	.09	1.95	.013
2. <i>DLNT</i> 1979.5–1983.12	.0206 (3.90)	.0541 (0.39)	-.1266 (0.92)	-.2263 (1.60)	.0096 (0.52)	-.0096 (0.15)	.0788 (1.24)				.10	.01	1.93	.014
3. <i>DLNT</i> 1979.5–1982.12	.0163 (2.91)	-.0210 (0.13)	-.0647 (0.44)	-.1127 (0.74)				.1255 (0.77)	-.3326 (1.96)	-.2427 (1.4)	.24	.12	1.90	.014
4. <i>DLNT</i> 1979.5–1982.12	.0163 (3.45)	.0704 (0.43)	-.0924 (0.57)	-.2005 (1.27)	-.1457 (1.64)	.0237 (0.24)	.1339 (1.41)				.15	.02	1.86	.014

Table 9.9b Quarterly Data on Nontraded Goods Price Adjustment and Exchange Rate Adjustment

<i>DEP</i>	<i>C</i>	<i>DLNT</i> ₋₁	<i>DLW</i>	<i>DLPM</i>	<i>DLEFE</i> ₋₁	<i>R</i> ₂	\bar{R}^2	<i>D-W</i>	<i>SEE</i>
5. <i>DLNT</i> 1979II–1983IV	.0497 (2.67)	-.3354 (1.29)	-.0544 (0.35)	.3465 (2.40)	-.1176 (0.83)	.34	.13	1.5	.0207

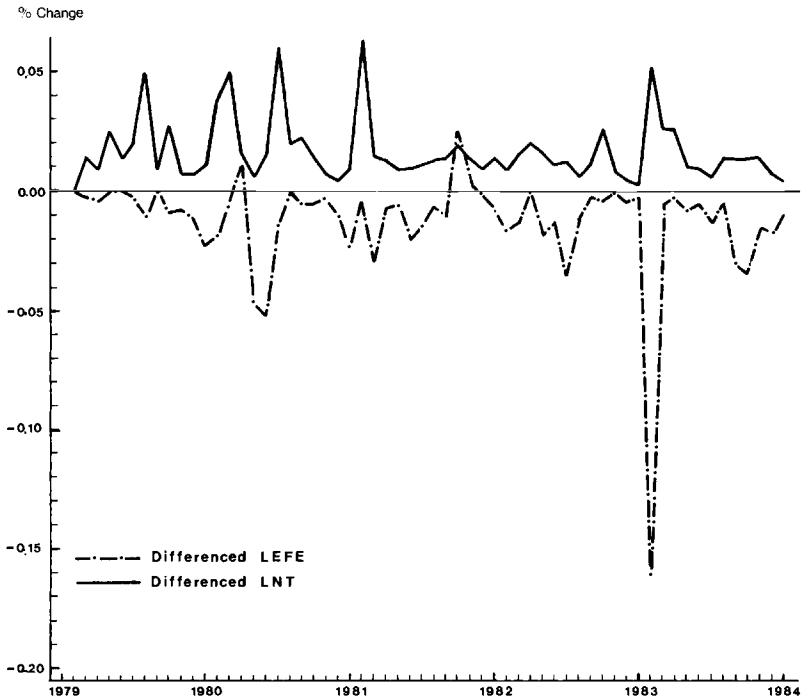


Fig. 9.3 The effective exchange rate and nontraded goods prices.

expectations are formed or revised on a daily basis as well. It therefore would be interesting to proceed with the above analysis using daily data; unfortunately, only anecdotal evidence of price adjustment following the January 9th devaluation exists, precluding an econometric analysis of the second-order autoregressive system. Furthermore, since most of the price adjustment was completed within a few days following the devaluation, the adjustment of prices can be adequately explained by the expected component of the exchange rate change when monthly data are used.

The wholesale price index for nontraded goods is a weighted average of sectoral indices. The food industry sector (*K20*), excluding beverages, possesses the largest weighting coefficient, 18.1 percent. In 1980 only 6.6 percent of the total consumption of processed food was imported, whereas 90 percent of the total production originating in 51 domestic firms was directed toward the domestic market. Moreover, the ratio of imported intermediate and capital goods to total production costs was 19.2 percent, one of the lowest ratios in all of Greece's industrial sectors.⁵ The food industry can therefore be classified on all grounds as in the nontraded goods sector.

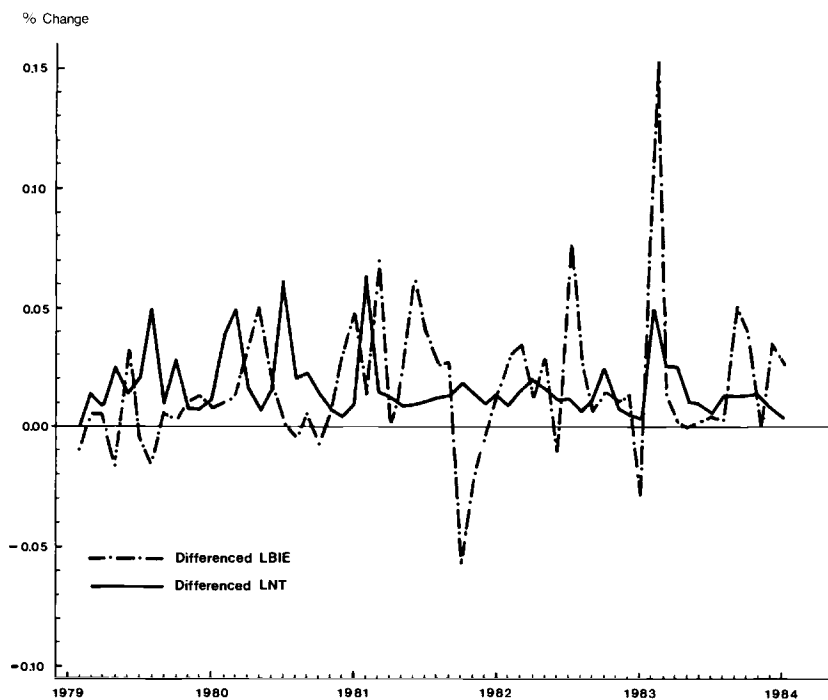


Fig. 9.4 The drachma-dollar exchange rate and nontraded goods prices.

Figures 9.5 and 9.6 present the monthly variation of the price index (*DLK20*) against that of the effective and bilateral exchange rate. It is relatively easy to see that the change in the exchange rate almost systematically preceded price adjustment by two months. This observation is confirmed by the econometric evidence presented in table 9.10, where *DLK20* is regressed against previous values of itself and against current and lagged values of the exchange rate. In both time periods (1979.5–1982.12 and 1979.5–1983.12) price adjustment was relatively sluggish, with the own first- and second-month lag generally significant and the second lag on the drachma-dollar exchange rate significant in both periods.

There is no clear evidence, however, that the responsiveness of the price to an exchange rate change is significantly altered in the long period, even though the coefficient of the constant term and the overall explanatory power of the regression increase when 1983 is included.

The ambiguity in the results as one moves from the aggregate to the sectoral data has to do with the composition of the index and with the institutional factors affecting price behavior. The sectoral index is a

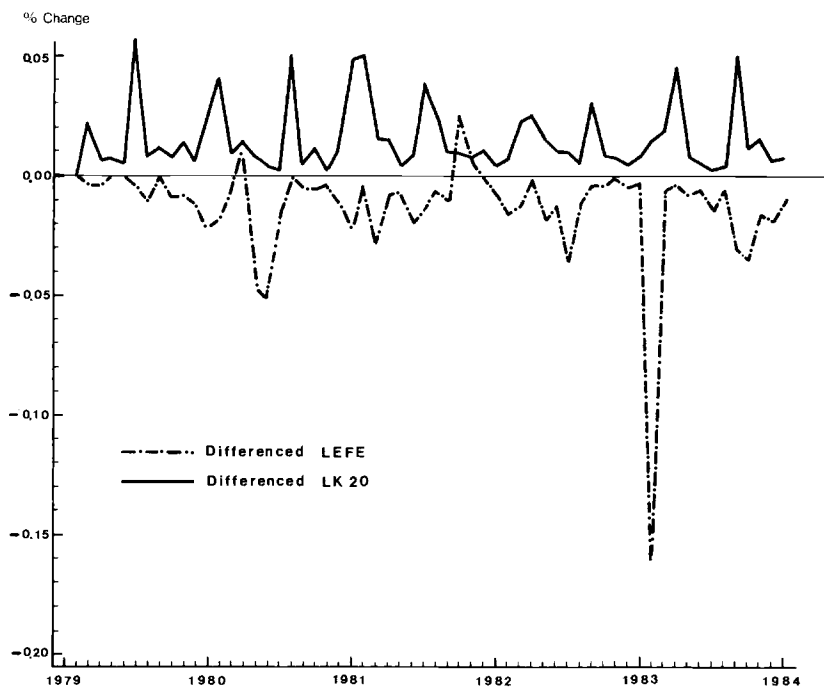


Fig. 9.5 The effective exchange rate and the food industry price index.

weighted average of the price of products that might or might not be exempt from price controls. The legal basis for price controls in Greece is the Market-Law Code, which essentially classifies products into three categories: essential and in short supply; essential and not in short supply; and nonessential. The first category includes basic consumer goods for which, in most cases, a maximum price is set. For some goods in this category, and for all goods in the second category that are considered essential but not key consumer goods, the Greek Ministry of Commerce sets a maximum allowable markup over average unit costs. The third category includes goods that are essentially exempt from controls (Lalonde and Papandreou 1984).

The behavior of product prices and hence of the aggregate sectoral index is thus affected by the ministry's actions in adjusting the price ceiling as a result of pressure from firms. This is especially true in the food sector, a large number of whose products fall in the first category.

Figure 9.7 illustrates the rate of change in flour prices over the period 1973–84. Since flour is considered an essential commodity a price ceiling for it is set by the ministry. Effective prices are almost always set at the price ceiling. As shown in the figure, the price has been typically adjusted once a year during the summer months. The 1983

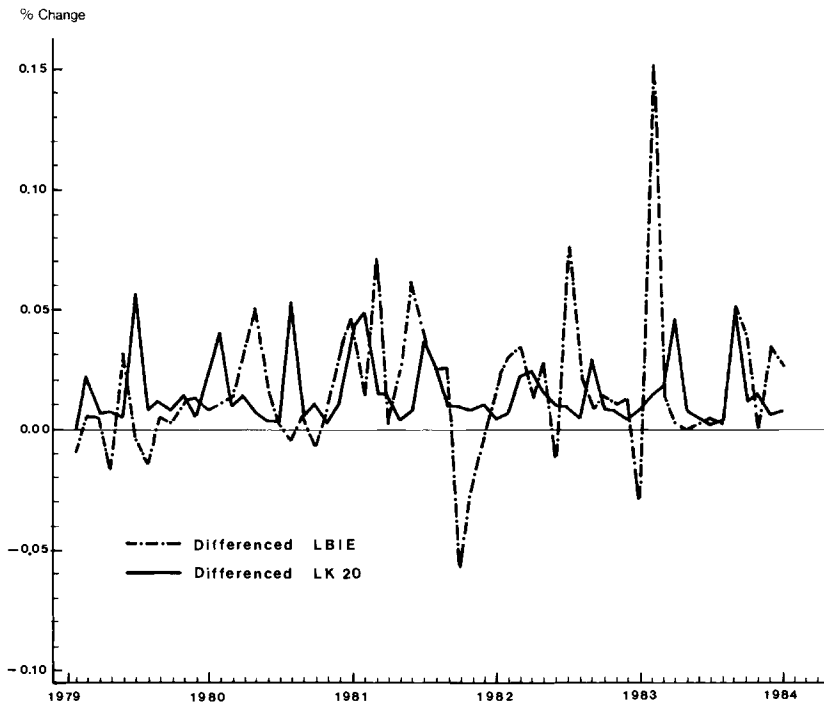


Fig. 9.6 The bilateral exchange rate and the food industry price index.

price adjustment in August was the largest one in three years—18.7 percent. Since firms producing flour have limited possibilities to diversify their production,⁶ the increase in perceived costs implied by the devaluation gave rise to a fall in profits and a reduction in output or quality. As shown in table 9.11 the average production of grain mill products during the first six months of 1983 was 4.5 percent lower than the corresponding average in 1982.

A different type of response is evidenced by firms that can diversify their production across control categories, such as dairy product firms. Dairy firms usually produce milk, butter, cheese, and yogurt—all items under price controls—as well as ice cream, which is not subject to controls. Although these firms still exercise pressure to adjust the price ceiling, any losses they suffer in profits and output are mitigated by rapid price adjustment in the noncontrolled items. As indicated in table 9.12, while the prices of all controlled dairy products increased between 12 and 14 percent within the first quarter of 1983, ice-cream prices rose by almost 10 percent between December 1982 and January 1983 and by almost 33 percent between December 1982 and March 1983 (also see figure 9.8). As there is no reason to attribute the increase in the

Table 9.10 Food Price and Exchange Rate Adjustment

<i>DEP</i>	<i>C</i>	<i>DLK</i> ₋₁	<i>DLK</i> ₋₂	<i>DLK</i> ₋₃	<i>DLBIE</i>	<i>DLBIE</i> ₋₁	<i>DLBIE</i> ₋₂	<i>DLEFE</i>	<i>DLEFE</i> ₋₁	<i>DLEFE</i> ₋₂	<i>R</i> ²	<i>R</i> ²	<i>D.W.</i>	<i>SEE</i>
1. <i>DLK</i> ₂₀ 1979.5–1983.12	.0254 (4.24)	-.3455 (2.54)	-.2604 (1.86)	-.2041 (1.49)				-.0083 (0.72)	-.0315 (0.28)	-.1987 (1.74)	.19	.06	2.2	.021
2. <i>DLK</i> ₂₀ 1979.5–1983.12	.0247 (4.29)	-.3463 (2.67)	-.2696 (2.02)	-.2469 (1.89)	-.0154 (0.17)	.0231 (0.26)	.2510 (2.80)				.25	.16	2.1	.020
3. <i>DLK</i> ₂₀ 1979.5–1982.12	.0244 (3.28)	-.3646 (2.27)	-.2520 (1.53)	-.1725 (1.08)				.0045 (0.02)	-.1164 (0.42)	-.2423 (0.90)	.16	.03	2.1	.023
4. <i>DLK</i> ₂₀ 1979.5–1982.12	.0244 (3.64)	-.3533 (2.29)	-.2434 (1.54)	-.2227 (1.44)	-.0375 (0.27)	-.0168 (0.12)	.3007 (2.14)				.22	.10	2.1	.022

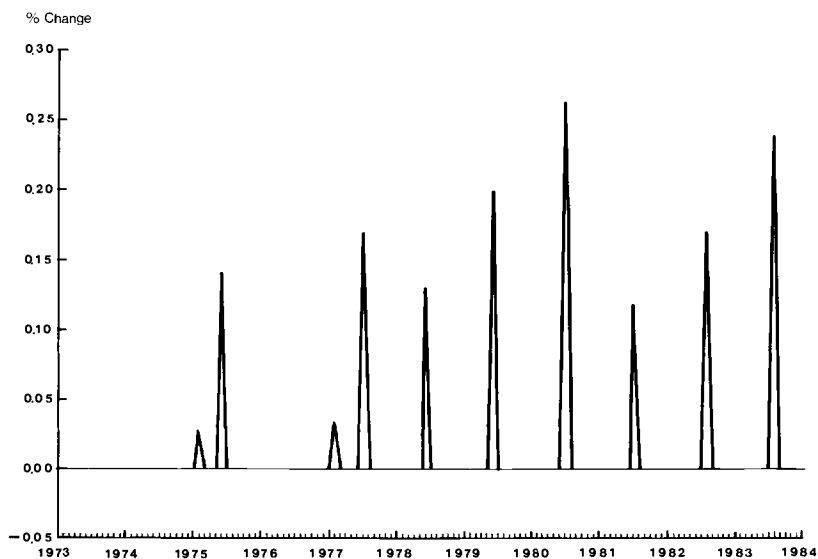


Fig. 9.7 The differenced log of flour prices, 1973-84.

relative costs of ice-cream production during that period to any other factor, it is reasonable to argue that the perceived increase in costs resulting from the devaluation was met by price overshooting of the noncontrolled goods. The output of dairy products stayed roughly constant in the two periods.

Finally, within the same sector some firms produce commodities in the second and third categories of the Market Code, for example, tomato juice, tomato pulp, canned fruits, and fruit juices. In that case, price adjustment is distributed more evenly across goods. As indicated in table 9.12 between February and March of 1983 the prices of tomato juice and tomato pulp rose by 8.70 percent and 2.90 percent, respectively, whereas the prices of canned fruits rose sharply in January and February and fell in March, that is, when the prices of the controlled items were allowed to increase. As shown in Table 9.11 the production of canned fruits and vegetables was 30 percent higher in the first half of 1983 than in the first half of 1982 as domestic firms were able to capture a larger share of the domestic market from foreign firms.

The analysis so far suggests that firms responded to the discrete devaluation in a predictable fashion. If institutional or other factors prevent prices from changing, the expected increase in costs implied by a devaluation brings about a decrease in profits and a decrease in output. The drop in output could be mitigated by the expected increase in demand, depending on the cross-elasticity of substitution of domestic and imported final goods. In diversified firms, on the other hand, the

Table 9.11 Monthly Indices of the Industrial Production of Specific Products

	Grain Mill Products	Dairy Products	Fruit Juices	Canned and Preserved Fruits and Vegetables
1982.1	148.8	154.7	176.3	11.2
2	142.3	198.2	247.4	14.6
3	154.0	233.1	207.2	15.6
4	149.2	238.6	50.3	29.9
5	141.0	288.8	22.1	30.4
6	145.6	325.0	5.1	75.7
7	142.6	314.1	17.0	119.8
8	85.5	248.3	0.0	1118.5
9	115.2	202.4	45.9	1043.8
10	103.9	158.7	46.2	403.3
11	113.0	155.3	40.4	54.8
12	106.5	145.2	106.0	32.2
1983.1	114.9	158.2	255.6	22.3
2	143.8	199.9	258.4	21.4
3	159.0	220.3	115.7	21.9
4	152.5	274.3	37.6	29.2
5	130.6	286.5	156.7	54.4
6	140.6	288.6	11.3	81.0
7	132.2	257.8	24.0	452.5
8	138.7	235.3	56.9	1494.3
9	142.1	193.4	109.8	515.3
10	126.6	171.5	0.0	68.6
11	126.7	162.4	9.5	30.3
12	117.8	151.4	30.4	23.5

Table 9.12 The Price Adjustment of Specific Products in the Food Sector

Food Stuffs	1982.12–1983.1	1982.12–1983.2	1982.12–1983.3
Price Controlled			
Yogurt	0.00	0.0	14.3
Milk	0.00	1.7	13.0
Soft Cheese	0.07	3.5	13.8
Butter, Creams	0.13	3.6	12.7
Flour	0.00	0.0	0.00
Farina	0.00	0.0	0.00
Markup Regulated			
Chicken	-0.74	0.24	0.59
Tomato Juice	0.00	0.00	8.70
Tomato Pulp	0.00	2.90	2.90
Noncontrolled			
Ice Cream	9.82	28.21	32.41
Fruit Juices	0.00	1.31	7.36
Canned Fruits	5.09	6.10	2.00

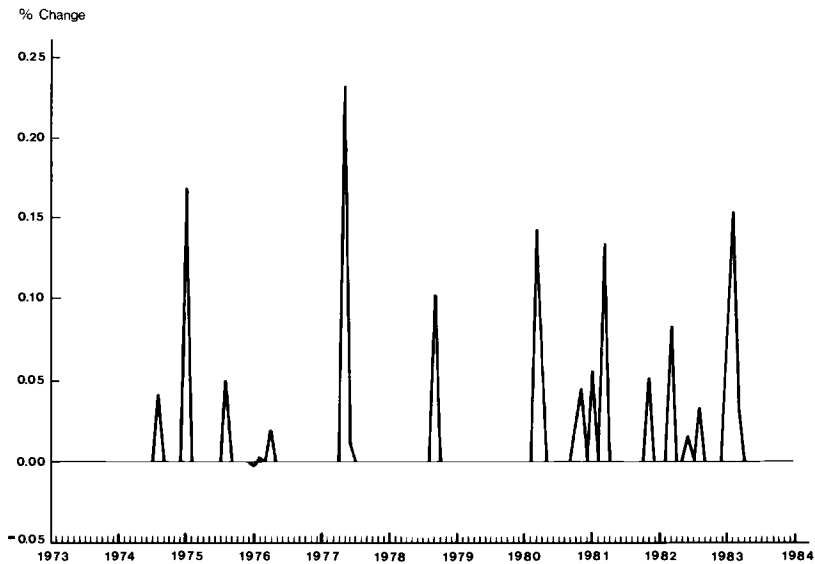


Fig. 9.8 Differenced log of ice-cream prices.

loss in profits is cushioned by selective increases in the prices of non-controlled goods and in output expansion of those goods for which the demand has increased.

The analysis also confirms the hypothesis that, regardless of the category of price control, price adjustment is generally sluggish, so that a monopolistic price adjustment model is a suitable one for the pricing behavior of firms. "Price contracts" are evidenced in all the product cases examined here. Even though their length depends on institutional factors, a cursory look at pricing behavior suggests that at least in the noncontrolled sector contracts were in fact shortened as aggregate exchange rate variability rose, as shown in figures 9.8 and 9.9. The evidence also suggests that recontracting occurred almost instantly in the noncontrolled sector, and organized pressure by firms to relax price ceilings was successful within a few months, especially in the second product category (essential and not in short supply).

Overall, the arbitrary control of prices by central authorities in Greece did not seem to mitigate in the medium term the inflationary consequences of the 1983 devaluation. After a large and discrete adjustment of the exchange rate, the price level was adjusted earlier than expected, thereby lessening the increase in the demand for nontraded goods and exacerbating the stagflationary effects of the devaluation.

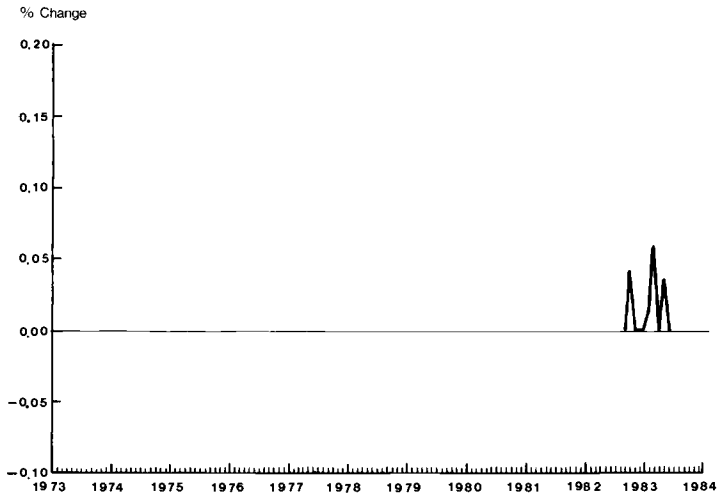


Fig. 9.9 Differenced log of fruit juice prices.

Notes

1. For a review of this literature, see Katseli (1983).
2. This is usually guaranteed by the perfect substitutability of all goods and assets in a small, open economy and by the perfect flexibility of wages and prices.
3. Defined as the ratio of the prices of traded to nontraded goods.
4. For an excellent review of those works, see Gordon (1981).
5. The data on those 51 firms were obtained from a sample of 423 firms gathered annually by the Bank of Greece.
6. Flour mills usually produce flour and farina, which is also included in the first category of products.

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Comment Stanley W. Black

The paper by Louka Katseli offers us a stimulating new idea concerning the effects of exchange rate changes on the economy. Earlier in the NBER–World Bank conference Carlos Díaz-Alejandro told us that “Juan Valdez the coffee picker” knows that changes in coffee prices affect real income and the terms of trade in Colombia. Katseli seems to be telling us that “Zorba the shoemaker” knows that a discrete exchange

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rate adjustment signals that inflation has increased in Greece. Perhaps this tells us that changes in inflation are as significant for Greek shopkeepers as changes in coffee prices are for Colombian coffee pickers.

The basic hypothesis of the paper has two components. First, the *speed of adjustment* of domestic prices to discrete changes in the exchange rate depends on the *size* of the exchange rate change; equivalently, the effect on prices is faster, the larger the changes in costs. Second, the *frequency* of price changes rises with the size of the change in the exchange rate. If this hypothesis is true, a crawling peg would allow exchange rate changes to have larger real effects than would a discretely adjustable peg, *ceteris paribus*.

There are some other hypotheses, not mentioned by Katseli, that also bear on this question. Discrete adjustment is often thought to reflect “reluctant” adjustment, with the exchange rate lagging behind domestic inflation. It thus distorts the real exchange rate, imposing reallocation costs of the type discussed by Johnson (1966), Hause (1966), and more recently Coes (1981), as resources are first driven away from and then pulled back into the traded goods sectors. There is also the “quantum” effect first discussed in Orcutt’s famous (1950) article. Orcutt argued that large, discrete exchange rate changes will have *larger* real effects on trade than smaller changes will because fixed costs of adjustment will prevent any response to small changes.

Katseli derives her hypotheses from contemporary theory. The speed-of-adjustment hypothesis is derived from Gordon’s (1981) theory of sluggish adjustment to local versus global changes in demand and costs. Gordon used the (1973) Lucas argument that the response to global demand shocks will take the form of a price increase, whereas local demand shocks will lead primarily to changes in real output. According to Katseli, a large change in the exchange rate signals a global shock, implying a large price response. The frequency-of-adjustment hypothesis is based on Gray’s (1978) model of optimal contract length, which shows that the frequency of recontracting increases as the variance of industry-specific or local shocks increases. Katseli argues that a discrete exchange rate adjustment may raise uncertainty about the central bank’s future intentions and hence shorten the average life of contracts. Since a discrete, reluctant exchange rate adjustment should imply a higher variance of aggregate shocks, *a la* Johnson and Hause, it would have been useful if the paper had examined the effect of aggregate shocks on the degree of *indexation* or automatic pass-through of cost increases, as suggested by Gray.

Let us turn to the evidence Katseli brings forward to test the hypotheses on price adjustment. I would have liked to test the speed of response of prices to costs by fitting markup equations. The time-series autoregressions on prices presented in the paper are somewhat less

satisfactory, particularly since they are based on only 60 monthly observations. And the results in tables 9.4 and 9.6 for price *levels* involve nonstationary time series. Tables 9.5 and 9.7 for price *changes* show increases in the constant terms relative to the coefficients of lagged price changes and therefore in the speed of adjustment, if the period of the large exchange rate adjustments is included. But the increases in the constant terms are not statistically significant. The constant term in the nontraded goods equation of table 9.7 increases by 0.0021, which is only about 25 percent of the standard error. Thus, the results do not really support the hypothesis in a statistically significant way.

Table 9.8 shows that the change in the exchange rate adds significantly to an autoregressive aggregate price equation in the longer time period that includes the large devaluation. The results for nontraded goods in table 9.9 also show that the lag of prices behind exchange rate changes shortens when 1983 is included. These statistically significant results appear, however, to be due to only one observation, the January 1983 devaluation. Their robustness is therefore open to question.

The subsequent analysis of detailed price changes for flour and dairy products is fascinating and suggests that the *frequency* of price changes rose in 1983, again apparently due to the single observation. It is interesting to observe that a Johnson-Hause reallocation effect begins to appear for flour milling, in which the industry controlled price only reluctantly adjusted to increased costs.

I am quite in sympathy with the paper's overall conclusion that a crawling peg is better than a reluctant adjustment with large discrete changes in the exchange rate. "Exchange rate management matters," one could say. Certainly, the desire to avoid resource allocation costs would argue for a crawling peg. And Katseli has provided some suggestive, if not conclusive, evidence that a crawling peg might minimize a pass-through into prices and strengthen the resulting real adjustment.

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Comment John Williamson

I am always pleased to find a paper that assumes that firms set prices, rather than that prices are set by some mysterious auctioneer who is determined to clear all markets. The former corresponds to the way I think most of the world works. I have to confess that at various times in the last 15 years I have felt intellectually isolated because the bulk of the profession appeared to have abandoned contact with reality on this point.

The main conclusions that Katseli lists at the end of her paper also seem to me eminently reasonable. So is the observation that changes in the exchange rate are (or ought to be) undertaken to influence the real exchange rate, and not just to reduce absorption. There are other, and generally better, instruments to reduce absorption, namely, fiscal and monetary policy. Hence, I like the main features of the paper.

The main subject of the paper is a problem I first concerned myself with 15 years ago when I was fighting a one-man battle in Her Majesty's Treasury to persuade members of the British government that if they wanted to save the Bretton Woods system they had better support the limited flexibility of exchange rates to complement the introduction of the special drawing rights (SDR). One of the devastating charges then made against the crawling peg was that it would be neutralized by induced inflation, since an announcement that a necessary devaluation would be implemented gradually by a crawl would cause all wage adjustments to go up in proportion and would prevent any change in the real exchange rate. I was invited to contrast this with the heroic way the British public was accepting Harold Wilson's assurance that the pound in its pocket had not been devalued in November 1967. The argument did not seem to me very convincing, but my lack of conviction had no empirical evidence to back it up, which doubtless contributed to my loss of the battle for limited flexibility.

I was not, incidentally, impressed at that time by the Orcutt argument mentioned in Black's comment above. I think this was because I re-

called a paper of Harberger's in the 1950s that made the point that though many agents might not respond to a small devaluation, others might be pushed over a threshold. Hence, there is really no very convincing reason to expect a nonlinearity of the type Orcutt was postulating.

In any event the 1969 debate in the British Treasury was not satisfactory. The question continued to trouble me, so that ten years later, when I organized the conference in Rio on the crawling peg, I invited the authors of the country papers to present any relevant evidence on the subject. I was not rewarded for that invitation.

My claim used to be that there is no good reason to expect a greater neutralization of a nominal exchange rate change with a crawl than with a discrete devaluation. Katseli makes a much stronger claim in her paper. She argues that a large change in the exchange rate is actually *more* likely to generate neutralization.

I did not find her evidence in support of this convincing; indeed, she herself describes it as inconclusive. Some evidence in the paper, in fact, seems to point in the opposite direction to her thesis. Table 9.3, for example, seems to say that the change in the nominal exchange rate was offset by about 50 percent within six months after the big devaluation in early 1983. Subsequently, the crawl was accelerated and the real exchange rate went down a bit more. It is not clear that there is any difference in the pass-through coefficient between the two cases. I therefore remain unconvinced that there is any evidence to suggest that the extent of the pass through differs systematically between crawling and discrete changes.

When I first started thinking about this issue, some 20 years ago, the equation that represented a conventional way of describing profit-maximizing behavior in the context of imperfect competition was:

$$P = \alpha \bar{p} + (1 - \alpha)c = \alpha ep^* + (1 - \alpha)c,$$

where \bar{p} represents the average price being charged by competitors, and c represents unit costs. In the context of the impact of a devaluation on the prices of differentiated manufactured products (McKinnon's tradables I), the natural interpretation of the price of competitors is the exchange rate (e) times the foreign price of similar products (p^*). The question arose as to the value of α . This was answered in the empirical literature on pass-through coefficients. It turns out that α varies from something modest like 0.1 in the case of a large country like the United States to something like 0.9 in a small, open economy like Costa Rica, but typically it is not equal to unity even then. This suggests that the imperfect competition framework is an appropriate and useful one, and that the "law of one price" is not an adequate description of price-setting behavior.

In applying this framework to devaluation, one notes that the prices of competitive goods rise and thus pull up the prices of competing goods, thereby reinforcing the cost-push effects that come via imported intermediate goods and the wage pressures generated as workers try to restore their real incomes when faced with the price increases. One would expect that when applying this type of equation to nontraded goods, the reaction to an exchange rate change would be much less pronounced; and that also seems to be empirically confirmed (Corbo 1983).

But applying this approach today, as opposed to 20 years ago, one would do some things differently. One would no longer include simply the previous values of \bar{p} and c but would also specify the expected future values of those variables over the contract period. One might even analyze whether the contract period would be expected to remain constant. Nonetheless, the basic approach is still valid.

The relevance of these recollections to the Katseli paper is to explain the theoretical basis of my longstanding presumption that there is no systematic difference between discrete and crawling devaluations in effectively changing real exchange rates. If price setting is determined (rationally) by the twin influences of competitive prices and own costs, the manner in which a given change between the two is accomplished should have no effect on the price set. My presumption that it does not has not been overturned by Katseli's paper.

Let me finally remark that there is one interesting case that reinforces my view and is encouraging for those of us with a prejudice in favor of the crawling peg. Three years ago Colombia set out to devalue its currency with the express purpose of restoring the country's competitiveness, not by a discrete devaluation but instead by accelerating the crawl. Unfortunately it set out too late—it is not clear that Colombia will get by without an economic crisis similar to that now facing most of the rest of Latin America. But the crawl *has* achieved a more competitive real exchange rate. That is perhaps the most persuasive evidence so far that a crawl can in fact increase competitiveness.

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