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The Simultaneity of the Effects of Devaluation: Implications for Modified Planned Economies

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Abstract

The paper attempts to provide a clearer conceptual basis for exchange rate policymaking in modified planned economies (MPEs), by clarifying the interactions involved in the simultaneous determination of the price level, terms of trade, real income and trade balance effects of a devaluation. Using a three-good model, it is shown that existing empirical estimates of trade elasticities in MPEs may be downwardly based, and that extreme pessimistic assessments of the effects of devaluation may not be entirely internally consistent. Although trade elasticities in MPEs probably are lower than in market economies, they could be raised by measures aimed at expanding factor mobility and enterprise autonomy.

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Contents

I. Introduction

With the partial decentralization of economic decision making and the establishment of direct links between many foreign currency and domestic prices in some planned economies, the potential significance of the exchange rate as an instrument of economic policy is enhanced. In particular, in "modified" planned economies (MPEs) such as Hungary and Poland, changes in the official exchange rate may be useful in helping to attain both internal and external balance. 1/

The addition of the exchange rate to the authorities' policy portfolio in MPEs has understandably led to increased discussion of issues of exchange rate policy, both within these economies and among outside observers. Given the long-held social and economic policy priorities of policy makers in planned economies, and in particular their commitment to relatively low rates of open inflation, they have tended to emphasize the unwelcome inflationary impact of devaluation. At the same time, in recognition of existing structural rigidities and the related unwillingness, heretofore, to permit the failure of inefficient enterprises, many policy makers appear to be skeptical that devaluation would have more than a negligible impact on the pattern of resource allocation, and therefore on the trade balance. Indeed, the perception of relatively low export supply and import demand elasticities only tends to reinforce the common view that devaluation will have mainly an inflationary impact in MPEs. 2/

In some cases it is explicitly recognized that the responsiveness of enterprises to a devaluation will depend on the imposition of strict financial discipline on firms as well as the elimination of excess demand pressures on the domestic market more generally. 3/ All too often, however, such a recognition is coupled with the perception that the successful shifting of resources into exports as a result of devaluation will cause the terms of trade to deteriorate and indeed will worsen rather than improve the convertible currency trade balance. 4/ A high degree of dependence on imported intermediate products is seen by some observers as yet another argument against devaluation. With most or all imported inputs priced on a "transaction price" basis, 5/ and with domestic enterprises permitted to incorporate in the prices of

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1/ This issue is explored in some detail in Wolf (1985b).

2/ This view is often encountered in the literature as well, as reflected for example in Portes (1979), Marer (1986) and Tarafas and Szabo (1985).

3/ See, for example, Botos and Riecke (1985).

4/ This impression is left, for instance, by Botos and Riecke (1985).

5/ See Wolf (1985b) for a discussion of transaction prices.

final products a given mark-up over costs or to set these prices equal to their transaction prices, devaluation is viewed as having mainly an inflationary effect and possibly as causing a deterioration in the terms of trade as well. 1/

Despite the growing literature on exchange rate policy in the MPE, there continues to be a disturbing lack of recognition of the complexity of interactions involving the impact of devaluation on the trade balance, the terms of trade, and the price level. For example, the necessary and sufficient conditions for devaluation to have its maximum impact on the price level are often not clearly specified. Or the mistaken impression may be conveyed that even if the maximum price level effect of a devaluation is experienced, the terms of trade may still deteriorate. 2/

This paper clarifies the relationships involved in the simultaneous determination of the trade balance, terms of trade, real income and price level effects of a devaluation. The objective of the paper is to contribute both to a clearer conceptual basis for exchange rate policy making, and to an improved basis for empirical work in this area for MPEs. In Section II, a simple three-good general equilibrium model is briefly outlined; the full model is elaborated in the Appendix. To facilitate analysis, two of the key characteristics of the MPE, the existence of fix-price goods and trade with a separate "ruble" area, are not included in the model. 3/ It bears stressing, however, that incorporation of these features would simply add to the very complexity of interactions which it is the purpose of this paper to highlight.

The main analytical findings using this model are summarized in Section III. In Section IV these findings are used to clarify our understanding of several of the key issues that tend to emerge in MPEs with respect to the use of the exchange rate as a stabilization instrument. The findings are particularly relevant to the case of Hungary, but they may also be applicable to other emergent MPEs as well, such as Poland. Brief concluding remarks are presented in Section V.

II. The Model

The model elaborated in the Appendix (Equations (A1) through (A18), and used to generate the findings of Section III is relatively simple. The economy is assumed to produce two composite goods, both final products: an exportable and a nontradable. An imported intermediate good, not produced domestically, is used in the production of both final

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1/ Marer (1986).

2/ This impression is left, for instance, by the analysis of Tarafas (1985).

3/ A preliminary model incorporating these features appears in Wolf (forthcoming).

products, in fixed proportions. The model therefore incorporates both the effects of substitution between tradable and nontradable goods, and the possibility of changes in the terms of trade arising from devaluation. It also permits analysis of the effects of imported inputs, a consideration stressed by many close observers of the East European MPEs. Although the extension of a model from two to three goods, with the prices of two being determined endogenously, normally vastly complicates the task of solution, it was facilitated here by assuming that the imported intermediate is used in fixed proportions and that these proportions are identical for the two final products. 1/ As discussed in Wolf (forthcoming), a more realistic stylized model of a MPE should also include a fixed priced good and a good which is traded only with the ruble area. 2/ Expansion of the model beyond two or three goods vastly complicates the mathematics as well as the interpretation of the results, however, and such additional complexity is not deemed useful in view of the intention of this paper to show the complexity of interaction that arises even within a simple three-good model. The purpose, in other words, is to focus on those interactions that exist independently of widespread adminstrative control of prices and the peculiarities of the foreign trade institutions of the CMEA. 3/

If simplicity were the only objective in the model, it would obviously be convenient to assume that the MPE is a price taker, with respect to both tradables, in the world market. But while the price taker assumption is probably reasonable regarding the convertible currency imports of most planned economies, many close observers of these economies question its validity on the export side. Although these countries' total exports in each case represent a negligible share of total world imports, it is plausibly argued by some that they are far from being price takers in many of the

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1/ Other models that attempt to incorporate most or all of the above effects include Schmid (1980), Steinherr (1981) and Dornbusch (1980). The Schmid and Steinherr models, however, only include one good with an endogenously determined price. The Dornbusch model has two endogenous prices, but is only partially elaborated and applies only to the case of variable employment.

Of course our model would be more representative of actual East European conditions if the import intensity of exportable production were assumed to be higher than that for the nontradable. Given the additional complexity and derivation time introduced by such an assumption, however, it must be saved for future work.

2/ The administrative control over many domestic prices, even in the MPE, greatly complicates the analysis of devaluation. As noted in Wolf (forthcoming), the presence of a fixed price composite good can both reinforce and work against the positive trade balance effects of a devaluation.

3/ The CMEA, or Council for Mutual Economic Assistance, consists of Bulgaria, Cuba, Czechoslovakia, the German Democratic Republic, Hungary, Mongolia, Poland, Romania, the U.S.S.R. and Viet Nam.

specific product markets in which their exports to the convertible currency area are concentrated. 1/ The model consequently allows for the possibility that the MPE may face a downward sloping rest-of-world demand curve for its exports. Foreign real income, however, is assumed to be fixed exogenously. This economy is therefore similar to the "semi-small" economy sometimes encountered in the international trade literature.

The economy is assumed to have one financial asset, domestic money. 2/ Real aggregate domestic expenditure is assumed to be positively related to real income and to be a negative function of the excess of desired over actual real money balances. The quantity of the exportable (nontradable) produced domestically is assumed to be determined by the economy's production possibilities and to be a positive (negative) function of the value added per unit of the exportable relative to that of the nontradable. 3/

The responsiveness of enterprises to relative value added rather than to relative price per se may well be a more realistic assumption for the MPE, in which value added rather than profits may effectively play the dominant role in the objective function of enterprises. Domestic demand for the exportable (nontradable) is assumed to be positively related to aggregate real expenditure and negatively (positively) related to the relative price of the exportable.

Again for simplicity, the existence of initial excess demand pressures and quantitative restrictions on trade are assumed away. The price of each good is determined solely by market forces, and domestic and foreign currency prices are linked by international commodity arbitrage. Foreign demand for the exportable, as mentioned, is assumed to be negatively related to its price expressed in foreign currency. The foreign supply of the import is considered to be infinitely elastic from the point of view of this economy. The foreign currency price of the imported intermediate is consequently invariant with respect to a devaluation by the home country, and its domestic currency price will rise proportionately with the exchange rate (defined as the domestic currency price of foreign currency). In this simple model, therefore, devaluation will either lead to a decline or to no change in the terms of trade.

1/ See, for example, Holzman (1979).

2/ The important distinction, particularly for planned economies, between household and enterprise holdings of money, is ignored in this paper, for simplicity.

3/ As long as the import intensity of the exportable is equal to or greater than that of the nontradable, relative value added per unit will necessarily be positively correlated with the relative price of the two goods.

For simplicity, the economy is assumed to be fully employed, and in an initial position of balanced trade. The focus of the model is on the short-run, when flow equilibrium is reattained after a devaluation. In particular, Section III examines the consequences of devaluation for the terms of trade, real income, the price level and the trade balance.

III. Price Level, Terms of Trade, Real Income and Trade Balance Effects of a Devaluation

The impact of devaluation on the domestic price of the exportable, the terms of trade, real income, the overall domestic price level, and the balance of trade is summarized in equations (A19) through (A31) in the Appendix. The impact of devaluation on each of these variables is seen to be determined simultaneously as a function of several "exogenous" elasticities and the other parameters of the model.

The exogenous elasticities include: (1) the elasticity of rest-of-world demand for the economy's exportable with respect to a change in the foreign currency price of the exportable (ε_x^d); (2) the elasticity of domestic demand for the exportable with respect to a change in its price relative to the price of the nontradable (ε_{xn}^d); (3) the elasticity of domestic output of the exportable with respect to its relative valued added per unit (ε_{xn}^s); (4) the elasticity of domestic demand for the exportable and nontradable with respect to a change in real aggregate domestic expenditure (ε_a^x and ε_a^n); (5) the elasticity of the nominal supply of money with respect to a change in the price level (ε_p^m)--essentially a policy variable; and (6) the elasticity of money demand with respect to a change in real income (γ), and with respect to a change in the price level (ϕ), respectively. The other parameters determining the impact of devaluation on prices and the trade balance are the domestic output and expenditure weights for the exportable (α_x^s, α_x^e), the ratio of domestic expenditure on, and output of, the exportable to actual exports (β_x, δ_x), the rate at which desired hoarding adjusts to a stock disequilibrium in the money market (λ), and the velocity of money (V).

1. The domestic price of the exportable

By raising the domestic currency price received for exports, and thereby increasing their relative value added per unit, devaluation will initially lead enterprises to bid up the price of the exportable domestically. When the effects of devaluation in the current period have run their course, the domestic price of the exportable will have risen proportionately to the exchange rate change in only three extreme cases (see equations (A22)-(A24)). One of these is when monetary policy is fully accommodative ($\varepsilon_p^m = \phi$), and the authorities permit the nominal money supply to rise pari passu with the domestic price level, in effect permitting domestic economic agents to retain their initial level of real

money balances without having to cut back on real spending. (It should be pointed out that although the MPE may still be lacking many of the institutions or instruments usually associated with "monetary policy" in market economies, governmental actions designed to cushion enterprises from adverse disturbances, in the form of subsidies or credits, have identical effects, in terms of the magnitude of domestic credit extended by the banking system, as in market economies (see Wolf (1985a)).

A second possibility might be that, while monetary policy may not be fully accommodative, enterprises might be completely unresponsive to the change in relative value added per unit induced by the devaluation ($\varepsilon^s_{xn} = 0$), and consumers might likewise be completely unresponsive to the changed relative price ($\varepsilon^d_{xn} = 0$). Such a situation is difficult to imagine, and would involve a downward spiral in the price of the nontradable. 1/ It should be pointed out, however, that if substitution effects were totally lacking only on the supply side, the domestic price of the exportable would increase less than proportionately to the exchange rate change. This is because in this case expenditure-switching and -reducing effects of the devaluation would still free some of the exportable for sale abroad, and as long as the economy faced a downward sloping export demand curve the attempt to expand exports would put downward pressure on the domestic as well as the foreign price of the exportable. 2/ Analysts of devaluation in MPEs frequently assume this type of nonresponse, although the underlying reasons are not always fully elaborated. Among the factors limiting the output response of enterprises might be limitations on factor mobility, and the ease with which enterprises or divisions specializing in nontradables are able to persuade the authorities to subsidize their losses (i.e., weak financial discipline).

A third case of a proportionate increase of the domestic price of the exportable following devaluation would be when enterprises face a perfectly elastic rest-of-world demand curve for their exportable ($\varepsilon^d_x = -\infty$). Later in this section it will be shown that it is only in the first case, namely, when monetary policy is fully accommodative, that the positive effect of devaluation on the trade balance is necessarily eliminated. Unless one of the three cases holds, and the second case would seem to be implausible, the domestic price of the exportable will rise by less than in proportion to the exchange rate.

1/ In this case, equilibrium in both markets could only be maintained by a fall in the price of the nontradable that was sufficient to cause no net change in the overall price level and no change in either the terms or the balance of trade.

2/ A similar argument would show that a less than proportionate increase in the price of the exportable would also occur if substitution effects characterized only production (i.e., if $\varepsilon^d_{xn} = 0$, but $\varepsilon^s_{xn} > 0$).

2. The terms of trade effect

The elasticity of the terms of trade with respect to a change in the exchange rate may be summarized by:

$$(1) \quad \varepsilon_e^{tot} = (\varepsilon_e^x - 1),$$

where ε_e^{tot} and ε_e^x are the elasticities of the terms of trade and of the domestic price of the exportable, with respect to devaluation. In this model, in which the foreign currency price of the imported intermediate is fixed by the world market, the terms of trade response depends solely on what happens to the domestic price of the exportable. The greater the increase in the latter, the smaller will be the deterioration in the terms of trade. Under any of the three conditions mentioned in the previous subsection, $\varepsilon_e^x = 1.00$ and the terms of trade remain unchanged.

3. The price level effect

The elasticity of the domestic price level with respect to devaluation will be the expenditure-weighted sum of the aforementioned elasticity of the domestic price of the exportable and the elasticity of the price of the nontradable:

$$(2) \quad \varepsilon_e^p = \alpha_x^e \varepsilon_e^x + \alpha_n^e \varepsilon_e^n,$$

where ε_e^p is the elasticity of the price level, ε_e^n is the elasticity of the price of the nontradable, and α_x^e and α_n^e are the respective expenditure weights ($\alpha_x^e + \alpha_n^e = 1.00$). As the price of the exportable increases with devaluation, its higher relative price domestically will induce, in general, a shift in output from the nontradable to the exportable and a shift in expenditure toward the nontradable. Aside from resulting in additional supplies of the exportable for sale abroad, these shifts will create excess demand for the nontradable. As a result its price will rise, but whether it increases proportionately to the price of the exportable depends on whether monetary policy accommodates the overall price level effect of the devaluation. If not, consumers and producers will attempt to rebuild their real money balances, eroded by the higher price level, by cutting back on real expenditure. In effect, aggregate real expenditure falls, and this will keep the price of the nontradable from rising proportionately to the price of the exportable. In all cases other than a fully accommodating monetary policy, therefore, the relative domestic price of exportable will rise in flow equilibrium and $\varepsilon_e^n < \varepsilon_e^x$. This means that the domestic price level must rise by less than the rate of depreciation of the currency ($\varepsilon_e^p < 1.00$). Only in

the event that monetary policy fully accommodates the price effects of devaluation will the maximum potential price level impact be witnessed ($\varepsilon_e^p = 1.00$).

4. The real income effect

The impact of devaluation on real income in this model may be summarized by:

$$(3) \quad \varepsilon_e^y = \alpha_x^e \beta_x^{-1}(\varepsilon_e^x - 1),$$

where ε_e^y is the elasticity of real income (= real value added), α_x^e is the expenditure weight for the exportable, and β_x denotes the initial ratio of domestic expenditure on the exportable to exports (= imports). If monetary policy is fully accommodative, causing both prices to increase proportionately to that of the imported intermediate, or foreign demand for the exportable is perfectly elastic, there will be no real income effect from the devaluation ($\varepsilon_e^y = 0$). Under the simplifying assumptions of this model any decline in real income will of course be larger, the greater is the deterioration in the terms of trade (i.e., the smaller is ε_e^x).

5. The trade balance effect

The impact of devaluation on the trade balance, assuming for simplicity that trade is initially balanced, is summarized by:

$$(4) \quad \varepsilon_e^B = (\varepsilon_e^x - 1) + \sigma\varepsilon_{xn}^s\varepsilon_e^v - \beta_x[\varepsilon_{xn}^d(\varepsilon_e^x - \varepsilon_e^n) + \varepsilon_a^x\varepsilon_e^a].$$

In this equation ε_e^B denotes the export-normalized change in the trade balance (denominated in foreign currency) divided by the percentage change in the exchange rate, σ is a parameter defined in equation (A28), $\varepsilon_{xn}^s (> 0)$ is the elasticity of domestic supply of the exportable with respect to a change in relative value added per unit of output, $\varepsilon_e^v (> 0)$ is the elasticity of relative value added with respect to a change in the exchange rate, β_x is the initial ratio of domestic expenditure on the exportable to exports, ε_{xn}^d (< 0) is the elasticity of domestic demand for the exportable with respect to a change in its relative price, $\varepsilon_a^x (> 0)$ is the elasticity of domestic demand for the exportable with respect to a change in real aggregate expenditure, and ε_e^a (< 0) is the change in real aggregate expenditure with respect to a change in the exchange rate.

The first term on the right-hand side of equation (4) is the elasticity of the terms of trade with respect to devaluation (see equation (1)). As noted earlier, this will either be zero, in the event that the economy is indeed a "small country," or negative. The second term reflects the impact of substitution in production on the trade balance, after taking into account the impact that the shift in production will have on imports of the intermediate product. 1/ Except in the cases in which there is no quantity response on the part of enterprises to devaluation ($\varepsilon^{s}_{xn} = 0$) or relative value added does not change because a fully accommodative monetary policy has nullified any potential change in relative price ($\varepsilon^{v}_{e} = 0$), this term will be positive. The third term summarizes the expenditure switching effect on the demand side. It will carry a net positive sign except in the event that there are no substitution effects in consumption ($\varepsilon^{d}_{xn} = 0$), or monetary policy is fully accommodative and there is no change in the domestic relative price ($\varepsilon^{x}_{e} = \varepsilon^{n}_{e}$). The fourth term reflects the expenditure reducing effect of devaluation. Its net effect on the trade balance will also be positive unless either the elasticity of expenditure on the exportable with respect to a change in real aggregate spending is zero ($\varepsilon^{x}_{a} = 0$, which is unlikely), or real aggregate expenditure remains unchanged ($\varepsilon^{a}_{e} = 0$), the latter occurring only in the event that monetary policy is fully accommodative, or the size of the devaluation is inadequate to eliminate an initial stock of excess liquidity. 2/

Whether the trade balance will improve with a devaluation therefore depends in this model on whether the combined positive substitution effects in production and consumption and the expenditure reducing effect are sufficient to more than offset the negative terms of trade effect. From equation (4) and the foregoing discussion it is clear that if monetary policy fully accommodates the devaluation, all four terms on the righthandside of the equation will be equal to zero and the trade balance impact will be nil. It is also clear, however, that a positive output response on the part of enterprises is not a necessary condition for an improvement of the trade balance. As seen earlier, the domestic price of the exportable will increase sharply in this case, but not proportionately

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1/ The value for positive σ will be smaller, the higher the import intensity of the exportable relative to that of the nontradable. When the import intensity of the two products is equal, as is assumed in this paper, $\sigma = \delta_{x}$.

2/ Of course, if the economy is characterized by an initial excess stock of money, the effects of devaluation will be more complex. But observe that if this situation initially prevails, domestic prices are not market-clearing and, unless all prices are suddenly liberalized coincident with the devaluation, there is no reason to expect that the full inflationary effect of devaluation will be experienced in this case either. Clearly the existence of initial excess demand for goods in the MPE will reduce and possibly totally eliminate the positive trade balance effect of a devaluation (see Wolf (forthcoming)).

with the exchange rate. Expenditure effects will be such as to leave demand for the nontradable unchanged, 1/ but domestic demand for the exportable will decline, freeing additional supplies for export. It is the increased exports which, in the absence of a flat export demand curve, will keep the domestic price of the exportable from rising proportionately with the exchange rate.

Equation (4) contains four endogenous variables: ε_e^x, ε_e^n, ε_e^v and ε_e^a. When the system is solved in terms of only the exogenous elasticities, the various weights, and exogenous variables, we have:

$$(5) \quad \varepsilon_e^B = [\lambda V(\varepsilon_p^m - \phi)(\varepsilon_x^d + 1)C][BD]^{-1},$$

where B, C and D are lengthy expressions defined in equations (A24), (A30) and (A31), respectively. Evaluation of those equations and equation (5) indicates that the necessary and sufficient condition for the trade balance impact of devaluation to be positive is the combination of (1) the existence of substitution effects in either domestic production and/or consumption ($\varepsilon_{xn}^d < 0$ and/or $\varepsilon_{xn}^s > 0$); (2) a less than fully accommodating monetary policy ($\varepsilon_p^m < \phi$); and (3) an elastic export demand curve ($\varepsilon_x^d < (-1.00)$).

Because the price elasticity of demand for the imported input is here assumed to be zero (i.e., the assumption of a fixed import intensity of domestic output), the requirement that the elasticity of foreign demand for the exportable be greater than unity becomes a kind of Marshall-Lerner condition. Observe, however, that this condition alone is a necessary but not a sufficient condition for a devaluation to improve the trade balance. It should also be noted that by equation (5) the trade balance cannot deteriorate in response to devaluation unless the export demand curve is inelastic. 2/

IV. Implications for Exchange Rate Policy in Modified Planned Economies

The foregoing discussion has concentrated on the mutual determination of the price level, terms of trade, real income and trade balance effects of devaluation. It has shown that conclusions regarding the direction and magnitude of these effects should only be drawn after taking into account

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1/ The substitution effect will be positive but the expenditure-reducing impact will be negative.

2/ Technically speaking, ε_e^B could also be negative in the event that the export demand curve were elastic, domestic substitution elasticities had the expected signs, but the monetary authorities more than compensated for the initial price effects of devaluation ($\varepsilon_p^m > \phi$).

all the pertinent elasticities, other parameters, and exogenous policy variables. Even in the relatively simple three-good model discussed in this paper, the interactions among the different variables are fairly complex. Clearly for a more complicated model that reflected more closely the reality of a real-world MPE, the interactions would be even more complex.

In the model, which is composed of two composite final products and an imported intermediate good used in fixed (and, for simplicity, identical) proportion in relation to output, a devaluation will improve the trade balance only if each of the following three conditions is met: (1) enterprises and/or consumers are responsive to a change in relative price in their output or expenditure decisions; (2) the monetary authorities do not fully accommodate the price level effects of the devaluation; and (3) the economy is operating in the elastic range of its export demand curve. 1/

In the model, in which all prices are market-determined, the overall domestic price level rises by the theoretically maximum rate following devaluation in only one extreme case--when the monetary authorities fully accommodate the initial price effects arising from the devaluation. In this event there will be no deterioration in the terms of trade nor in real income, but neither will there be any improvement in the trade balance. Yet with some notable exceptions, 2/ the economic literature in the MPEs and the work of western analysts of these economies frequently does not make clear that the full price level effects of devaluation really depend upon monetary policy being fully accomodating. As noted in the introduction, some analysts have stressed that in MPEs domestic enterprises are often permitted to pass along to consumers the increase in costs arising from higher prices for imported intermediates. On the basis of this institutional feature and the observed high import intensity of much of domestic production, it is frequently concluded that devaluation will have an almost exclusively inflationary impact, with very limited scope for a change in dometic relative prices and an improved trade balance. While such price rules may well govern much of enterprise behavior in MPEs, this model demonstrates that as long as monetary policy is not fully accommodative, proportionate increases of domestic prices for final products would lead to a fall in real money balances, and economic agents could be expected to cut back real expenditure. At prevailing output levels this would lead to excess supplies, which could only be eliminated by cutting prices on the nontradable and some combination of price cutting and increased sales abroad of the exportable. The ultra-inflationary argument based on the existence of imported intermediates thus ultimately depends either

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1/ In the long-run, once full stock equilibrium is re-attained in the money market, the trade balance will have reverted to its initial position. This is of course the typical finding of the so-called monetary approach" to devaluation.

2/ See Botos and Riecke (1985).

on the assumption that monetary policy is fully accommodative, or that institutional factors prevent any downward flexibility in domestic prices. 1/

It should be emphasized that a zero elasticity of output of the exportable with respect to a change in its relative price is not sufficient, in and of itself, to cause the price level to rise by its theoretical maximum following devaluation, or to keep a devaluation from improving the trade balance. Therefore the argument, frequently encountered in the MPEs, that the alleged low price elasticity of output will cause devaluation to be wholly or mainly inflationary in its impact, is not, strictly speaking, correct. Indeed, it was shown in the previous section that responsiveness of enterprises to changes in the relative price is not a necessary condition for the trade balance to improve with devaluation. As long as any initial excess demand in the economy is more than eliminated by the price effects of devaluation (combined with tight financial policies), and consumers are responsive to changes in relative prices, devaluation will lead to expanded exports. Of course, the potential for export expansion will be greater, the larger is the responsiveness of enterprises to changes in the relative price. 2/

Another implication of the analysis in Section III is that it is inconsistent to argue, as some have done, that devaluation in the MPE will tend to have only an inflationary impact and that at the same time it will result in a deterioration of the terms of trade. The maximum domestic price level effect depends on the domestic price of the exportable rising proportionately with the exchange rate. Yet if this happens, clearly the terms of trade cannot also deteriorate. By holding out the picture of a simultaneous maximum increase in domestic prices combined with the real income loss associated with a deterioration in the terms of trade, the opponents of devaluation as an instrument of stabilization in MPEs would appear to present too pessimistic a picture.

If the MPE faces less than perfectly elastic rest-of-world demand for its exports, and monetary policy is not fully accomodative of the price level increase triggered by devaluation, then devaluation will indeed lead to a deterioration in the terms of trade. The decline in the

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1/ In this latter case, enterprises with a hard budget constraint presumably would be forced to reduce output. In any event, the capability of the producers of the nontradable to pass along to consumers the increase in costs arising from a higher domestic price of the imported input would not in general lead to a proportionate increase in the price of the nontradable, because the cost of the former good accounts for only a fraction of the price of the latter.

2/ Of course, under certain circumstances high elasticities could still lead to a "perverse" trade balance response to devaluation. See Wolf (1978).

terms of trade will lead to some fall in real income, but it implies a deterioration in the trade balance only if the economy is in the inelastic range of its export demand curve. It is therefore of critical importance whether the export demand curve is inelastic in the relevant range.

Although the suggestion by many economists in MPEs that the overall export demand curve is downward-sloping is plausible, there is reason to suppose that it may not be as steep as commonly supposed. Those Hungarian estimates of the elasticity of export demand (ε^d_x) that are known to this writer, for example, are based on single equation estimates of an export demand function. 1/ Because these Hungarian empirical investigators presume that this country does not face an infinitely elastic export demand curve, and because the assumption of an infinitely elastic export supply curve would clearly not be tenable, they should really be using a simultaneous system of export demand and supply equations to estimate these elasticities. Orcutt (1950) long ago demonstrated that such single equation estimates are likely to be downwardly biased if prices are actually determined simultaneously. 2/

Because the available export supply elasticity estimates are also based on single equation regressions, 3/ Hungarian empirical researchers may also have been led to overly pessimistic conclusions regarding domestic expenditure switching possibilities. It should also be noted, on the basis of the discussion of Section III, that an empirical finding that the elasticity of export supply with respect to relative price is statistically insignificantly different from zero implies that domestic substitution effects are absent on both the output and expenditure sides (i.e., $\varepsilon^s_{xn} = \varepsilon^d_{xn} = 0$). Such a finding would seem to be implausible from a conceptual standpoint, and raises further questions about the reliability of such estimates of export supply elasticities.

The issue of simultaneous equations bias aside, it is also quite possible that the failure (and perhaps the impossibility) of such empirical work to take explicitly into account the frequent changes in the price and regulatory systems in recent years, changes in the degree of stringency of monetary policy, and the related enterprise-specific interventions which characterize the MPE, has tended to bias empirical work

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1/ See, for example, Botos and Riecke (1985) and Tarafas and Szabo (1985).

2/ The Hungarian estimates are also based on total "nonsocialist" trade. Because reported nonsocialist exports are known to include large re-exports of petroleum, which may be assumed to be determined by other factors in addition to their foreign currency re-export price, the Hungarian estimates of the export demand elasticity are probably downwardly biased for this reason as well.

3/ See Tarafas and Szabo (1985).

toward export supply elasticity estimates that are low or are statistically insignificantly different from zero. 1/ A further possibility is that very low estimates of the price elasticity of export supply for the past reflect, in part, excess demand conditions domestically which, strictly speaking, have nothing to do with the price elasticities. Estimations of the elasticity of export supply with respect to a devaluation should, as indicated by equation (4), distinguish between expenditure-switching and expenditure-reducing effects.

Alternatively, it might be argued that the elasticity of export supply is indeed low precisely because the budget constraints faced by enterprises in MPEs are soft and factor mobility, even in the case of hard budget constraints, is restricted. Most likely the export supply elasticity in MPEs is lower than in otherwise comparable market economies for these reasons, but it is also probably not as low as present empirical estimates might suggest, because of the lack of recognition in existing empirical work of the aforementioned simultaneity and ceteris paribus problems.

V. Concluding Remarks

The failure of many empirical researchers in MPEs to take account of the full extent of simultaneity implicit in the determination of MPE exports is consistent with, and may well even partially reflect, a more general neglect by analysts of these economies of the quite complex interaction of the effects of a devaluation. The foregoing discussion, admittedly based on the analysis of a relatively simple three-good model, but for that reason even more compelling given the emphasis of the paper on the simultaneity of interactions, suggests the following major conclusions.

First, economists and officials in the MPEs may well exaggerate the inflationary consequences of a devaluation, and in any event frequently neglect to point out that these consequences are very importantly determined by the degree of stringency of the credit and monetary policies of the authorities. Specifically, the inflationary impact of a devaluation will be less than the theoretical maximum permitted by the domestic price system as long as the authorities do not fully accommodate the price level increase through expansionary monetary policy. It is important for the authorities to realize that the inflationary impact of devaluation is determined by the stance of the monetary authorities and the relevant price elasticities, and not by input-output coefficients per se.

1/ It should also be noted that if a devaluation were accompanied by the phasing out of various commodity-or enterprise-specific export incentives, the devaluation might result in extensive relative price and quantity changes within the tradable sector as well as between tradables and nontradables.

Second, close observers of MPEs may be overly pessimistic regarding the terms of trade deterioration that may accompany devaluation. Although a devaluation-induced decline in the terms of trade is plausible for otherwise "small" MPEs, it should also be recognized that to the extent it does occur, the inflationary impact of devaluation is correspondingly weakened. Although a deterioration in the terms of trade does involve a loss in real income, it also implies a worsening of the trade balance only in the event that the economy is actually operating in the inelastic range of its export demand curve. In any event, existing empirical studies of trade elasticities in these countries may have overstated the terms of trade implications of devaluation.

Third, these same analysts may tend to underestimate the trade balance improvement that might come with devaluation. In part this may reflect the misconceptions that exist regarding the necessary and sufficient conditions for devaluation to improve the trade balance. The pessimism has undoubtedly also been reinforced by empirical studies that conclude that trade elasticities may be negligible. While there may be good reasons to suppose, in an economy with soft budget constraints for enterprises, limited factor mobility, and widespread intervention by the authorities, that the elasticity of export supply may be low relative to that of market economies, there is also some cause for suspecting that existing empirical estimates of both export demand and supply elasticities for MPEs are biased downwards. These biases are partially the result of using econometric specifications that ignore the simultaneity among certain key variables in the MPE that is stressed in this paper.

Finally, it should be pointed out that existing price elasticities, as well as the responsiveness of domestic expenditure to devaluation, are in reality not parameters beyond the control of the authorities. Indeed, the "elasticity" of real aggregate expenditure with respect to devaluation, a rough measure of the expenditure reducing effect, is in theory very much under the influence of the financial authorities in a MPE. Regardless of the particular institutional structure of the financial system, it is the authorities that ultimately can control the extension of credit to the population and the degree of financial discipline exerted on enterprises. The various "price elasticities" are also subject to influence by the authorities, to some extent even in the short run, through policies that enforce strict financial discipline on enterprises. 1/ Over the medium term and longer term these elasticities can be raised through measures aimed at expanding factor mobility and reducing pervasive intervention by the authorities in the microeconomic affairs of enterprises.

1/ The institutional and policy environment that constrains this enforcement is discussed in Marer (1986), Wolf (1985a) and the references therein.

APPENDIX

A Three-Good Model of Devaluation

Consider a fully-employed economy with three composite goods: an exportable final product (X), a nontradable final product (N), and an imported intermediate (M) that is used in fixed proportions (i_x, i_n) in production of the two final products. Domestic output of the exportable (nontradable) is a positive (negative) function of relative value added per unit of output (v):

$$(A1) \quad S_x = S_x(v),$$

$$(A2) \quad S_n = S_n(v),$$

$$(A3) \quad v = (P_x - i_x P_m)(P_n - i_n P_m)^{-1}$$

Here S_x and S_n refer to output of the exportable and nontradable respectively, and P_x, P_n and P_m are the respective domestic currency prices of the exportable, nontradable and imported intermediate. If the import intensity of the exportable is higher than or equal to that of the nontradable, an increase in the relative price of the exportable will always imply an increase in the relative value added per unit of that product.

The volume of imports of this input (Q_m) is the sum of imports used in production of the two final products:

$$(A4) \quad Q_m = i_x S_x + i_n S_n.$$

The domestic currency prices of the two traded products are linked respectively to their foreign currency prices by the usual international commodity arbitrage equation::

$$(A5) \quad P_x = P_x^* e,$$

$$(A6) \quad P_m = P_m^* e,$$

where P_x^* and P_m^* are the two foreign currency prices and e is the exchange rate, defined as the domestic currency price of foreign exchange. Domestic demand for the exportable (nontradable) is negatively (positively) related to the relative domestic currency price ($q = P_x/P_n$) of the two

products. The demand for both goods is also a positive function of the level of real aggregate expenditure (a):

$$(A7) \quad E_x = E_x(q, a),$$

$$(A8) \quad E_n = E_n(q, a).$$

Foreign demand for the exportable (Q_x^d) is assumed to be a negative function of its foreign currency price relative to the price for similar goods in the rest-of-the-world. Both the price level and real income abroad are assumed, for simplicity, to be fixed. The home country is assumed to be a price taker for its imports (hence P_m^* is exogenously fixed), but not necessarily for its exports. The supply of exports (Q_x^s) equals the excess domestic supply of the exportable, such that the market for the exportable clears:

$$(A9) \quad Q_x^s = S_x - E_x,$$

$$(A10) \quad Q_x^d = Q_x^d(P_x^*),$$

$$(A11) \quad Q_x^s = Q_x^d.$$

The market for the nontradable is also assumed to clear:

$$(A12) \quad S_n = E_n.$$

The balance of trade, denominated in foreign currency prices:

$$(A13) \quad B_t^* = P_x^* Q_x - P_m^* Q_m$$

is assumed to be initially equal to zero.

Real aggregate expenditure is equal to the difference between real income, or value added (y), and real hoarding (h):

$$(A14) \quad a = y - h.$$

Real hoarding equals real desired hoarding (h^*):

$$(A15) \quad h = h^*,$$

Here the latter is a positive function of the difference between the desired level of real money balances (M^*P^{-1}) and the stock of real money balances held at the beginning of the period (MP^{-1}):

$$(A16) \quad h^* = \lambda[y^{\gamma}P^{\phi-1} - MP^{-1}].$$

where P is the price level, γ and ϕ are the elasticities of money demand with respect to real income and the price level respectively ($M^*P^{-1} = y^{\gamma}P^{\phi-1}$), and λ is a coefficient indicating the speed of adjustment of real desired hoarding to any imbalance between the desired and actual real money stocks.

Real income is defined as the ratio of nominal value added to the overall price index for final products.

$$(A17) \quad y = (P_x S_x + P_n S_n - P_m Q_m)P^{-1}.$$

The price index is constructed in terms of expenditure weights:

$$(A18) \quad P = P_x^{\alpha_x^e} \cdot P_n^{\alpha_n^e}$$

where α_x^e and α_n^e are the weights for the exportable and nontradable respectively ($\alpha_x^e + \alpha_n^e = 1.00$).

Equations (A1) through (A18) contain 18 endogenous variables. The production possibilities of the economy and the foreign currency price of the exportable are considered to be fixed. Policy instruments are the exchange rate and the nominal money supply, although the latter will also be jointly determined by economic agents according to the hoarding equations (A15)-(A16). Having made the simplifying assumption that the import intensity of production of the two final products is the same ($i_x = i_n$), which considerably facilitates the solution of this simultaneous system, the trade balance, price level, real income and terms of trade effects of a devaluation were derived. The interrelationships between these different effects can best be shown by expressing them in terms of the response of the two endogenous prices, P_x and P_n, to a change in the exchange rate.

In this model the terms of trade response to a devaluation depends in effect solely on the impact of devaluation on the price of the exportable, because the foreign currency price of the import is assumed to be fixed. The elasticity of the terms of trade with respect to a change in the exchange rate is:

$$(A19) \quad \varepsilon_e^{tot} = (\varepsilon_e^x - 1),$$

where ε_e^x is the elasticity of the domestic price of the exportable (P_x) with respect to a change in the exchange rate. The greater the increase in the domestic price of the exportable, the smaller will be the deterioration in the terms of trade.

The impact of devaluation on real income may be summarized by the elasticity of real income with respect to a change in the exchange rate:

$$(A20) \quad \varepsilon_e^y = \alpha_x^s(i_n - i_x)\varepsilon_{xn}^s\varepsilon_e^v + \alpha_x^e\beta_x^{-1}(\varepsilon_e^x - 1),$$

where α_x^s and α_x^e are the initial output and expenditure weights for the exportable, ε_{xn}^s is the price elasticity of domestic supply of the exportable, ε_e^v is the elasticity of relative value added per unit of output with respect to a change in the exchange rate, and β_x denotes the initial ratio of domestic expenditure on the exportable to actual exports. Recalling that $i_n = i_x$, it is clear that if monetary policy fully accommodates the devaluation so that both domestic prices increase proportionately to the exchange rate ($\varepsilon_e^x = \varepsilon_e^n = 1.00$), and/or foreign demand is perfectly elastic, there will be no change in real income (equation (A20) will be equal to zero). The elasticity of the domestic price level with respect to devaluation is:

$$(A21) \quad \varepsilon_e^p = \alpha_x^e\varepsilon_e^x + \alpha_n^e\varepsilon_e^n .$$

Both prices are determined endogenously in the model, but their derivation is painstaking and the resulting expressions are very cumbersome. The elasticity ε_e^x, for example, is equal to:

$$(A22) \quad \varepsilon_e^x = AB^{-1}, \text{ where}$$

$$(A23)\quad A = \varepsilon_x^d[-\varepsilon_{xn}^d\alpha_x^e + \frac{\varepsilon_{xn}^s\alpha_x^s}{1-i} - \varepsilon_a^n\varepsilon_p^a\alpha_n^e]$$
$$+ \varepsilon_{xn}^d[\varepsilon_a^x\mu(\alpha_x^e)^2 + \alpha_x^e\beta_x\varepsilon_a^x\varepsilon_p^a\alpha_n^e - \varepsilon_a^n\mu\alpha_x^e + \varepsilon_{xn}^d\alpha_x^e\beta_x]$$
$$+ \varepsilon_{xn}^d\varepsilon_{xn}^s[\frac{\alpha_x^e\delta_x}{1-i}]$$
$$+ \frac{\varepsilon_{xn}^s}{\beta_x(1-i)}[\varepsilon_a^x\mu\alpha_x^e\beta_x\alpha_x^s + \varepsilon_a^n\mu\alpha_x^e\delta_x], \quad \text{and}$$

$$(A24)\quad B = \varepsilon_x^d[\varepsilon_{xn}^d\alpha_x^e + \frac{\varepsilon_{xn}^s\alpha_x^s}{1-i} - \varepsilon_a^n\varepsilon_p^a\alpha_n^e]$$
$$+ \varepsilon_{xn}^d[(\alpha_x^e)^2\varepsilon_a^x\mu + \beta_x\varepsilon_p^a)$$
$$- \varepsilon_a^n(\mu\alpha_x^e + \varepsilon_p^a\beta_x) + \varepsilon_{xn}^d\alpha_x^e\beta_x]$$
$$+ \varepsilon_{xn}^d\varepsilon_{xn}^s[\frac{\alpha_x^e\delta_x}{1-i}]$$
$$+ \frac{\varepsilon_{xn}^s}{\beta_x(1-i)}[\alpha_x^s\varepsilon_a^x\alpha_x^e\mu\beta_x$$
$$+ \varepsilon_a^n\mu\alpha_x^e\delta_x + \alpha_x^s(\beta_x)^2\varepsilon_a^x\varepsilon_p^a$$
$$+ \varepsilon_a^n\varepsilon_p^a\delta_x\beta_x].$$

In the foregoing equations ε_x^d (< 0) and ε_{xn}^d (< 0) are the (relative) price elasticities of foreign demand for the exportable and domestic demand for the exportable, respectively. ε_{xn}^s is the elasticity of output of the exportable with respect to a change in relative value added per unit, which when $i_x = i_n$ is equal to $(1-i_x)$ times the elasticity of supply of the exportable with respect to its relative price; ε_a^n and ε_a^x the elasticities of demand for the nontradable and exportable, respectively, with respect to a change in real aggregate expenditure. The values μ and ε_p^a are defined as follows:

$$(A25)\quad \mu = (1-\lambda V^{-1}\gamma),$$

$$(A26)\quad \varepsilon_p^a = \lambda V^{-1}(\varepsilon_p^m - \phi),$$

where ε_p^m is the assumed policy exogenous elasticity of the nominal money supply with respect to the price level and the parameters are as defined in equation (A16). ε_p^a is in effect an elasticity of real aggregate expenditure with respect to the price level. Although the signs of A and B are not formally unambiguous, it can be shown that they will both be negative provided the foregoing price elasticities have the expected signs.

If monetary policy fully accommodates the price level effect of a devaluation, preventing any decline in real money balances, $\varepsilon_p^m = \phi$, and $\varepsilon_p^a = 0$. In that event, it can be seen that A = B, and the domestic price of the exportable will rise by the full amount of the devaluation ($\varepsilon_e^x = 1.00$), as will the price of the nontradable. When $\varepsilon_p^a < 0$, $\varepsilon_e^x > \varepsilon_e^n$, and the increase in the relative price of the exportable will induce the shift of resources into exports, which is necessary for an improvement in the trade balance.

The elasticity of the trade balance with respect to devaluation is

$$(A27) \quad \varepsilon_e^B = (\varepsilon_e^x - 1) + \sigma\varepsilon_{xn}^s\varepsilon_e^v - \beta_x[\varepsilon_{xn}^d(\varepsilon_e^x - \varepsilon_e^n) + \varepsilon_a^x\varepsilon_e^a)],$$

where ε_e^v is the elasticity of relative valued added per unit with respect to a change in the exchange rate, ε_e^a is the elasticity of aggregate real expenditure with respect to devaluation (where expenditure is the difference between real income and hoarding--recall equation (A14)) and:

$$(A28) \quad \sigma = \delta_x - \alpha_x^s(i_x - i_n)(i_x\alpha_x^s + i_n\alpha_n^s)^{-1}.$$

The first term on the righthandside of (A27) is the elasticity of the terms of trade with respect to devaluation. If the export demand curve is downward sloping, this elasticity will be negative. The second term is the substitution effect on the output side, after taking into account the impact that the shift in production will have on imports of the intermediate product, and which in general would be expected to be positive. The third term reflects the combined (and generally positive) impact of domestic expenditure switching ($[-\beta_x\varepsilon_{xn}^d(\varepsilon_e^x - \varepsilon_e^n)] > 0$), and of the expenditure-reducing effect of devaluation ($[-\beta_x\varepsilon_a^x\varepsilon_e^a] > 0$).

Whether the trade balance will improve with devaluation depends on whether the combined positive substitution and expenditure effects

will be greater than the (in general) negative terms of trade effect. In the case of $i_x = i_n$:

$$(A29) \quad \varepsilon_e^B = [\lambda V^{-1}(\varepsilon_p^m - \phi)[\varepsilon_x^d + 1]C][BD]^{-1}, \quad \text{where}$$

$$(A30) \quad C = [-\varepsilon_{xn}^d[\varepsilon_a^n \varepsilon_p^a \alpha_n^e \beta_x(\alpha_x^e \varepsilon_a^x[1 + \alpha_n^e] + \varepsilon_a^n)]$$

$$- (\varepsilon_{xn}^d)^2[\beta_x \alpha_x^e(\alpha_x^e[\varepsilon_a^x \alpha_n^e + \alpha_x^e] + \varepsilon_a^n)]$$

$$+ \frac{\varepsilon_{xn}^d \varepsilon_{xn}^s}{1-i}(\alpha_x^s \beta_x(2\alpha_x^e \varepsilon_a^x + \varepsilon_a^n)]$$

$$+ \frac{\varepsilon_{xn}^s}{1-i}[\alpha_x^s \beta_x \varepsilon_a^x \alpha_n^e \varepsilon_a^n \varepsilon_p^a]$$

$$- \frac{(\varepsilon_x^s n)^2}{(1-i)^2}[\beta_x \varepsilon_a^x (\alpha_x^s)^2]], \quad \text{and}$$

$$(A31) \quad D = (-\alpha_x^e \varepsilon_{dn}^d + \frac{\alpha_x^s \varepsilon_{xn}^s}{1-i} - \varepsilon_a^n \varepsilon_p^a \alpha_n^e).$$

The expression C in equation (A30) will be non-zero only if at least one of the domestic elasticities of substitution is non-zero and carries the expected sign; in that event C will be negative. D will be non-zero if either or both of the domestic (relative) price elasticities are negative, and/or monetary policy is not fully accommodating ($\varepsilon_p^a < 0$); in this case, D will be positive and the denominator in (A29), $(BD)^{-1}$, will be negative. The numerator will also be negative if, in addition to C being negative, monetary policy is not fully accommodating ($\varepsilon_p^m < \phi$) and foreign demand for the exportable is elastic. The necessary and sufficient conditions for the trade balance to improve with devaluation ($\varepsilon_e^B > 0$) are therefore: (1)$\varepsilon_{xn}^d < 0$ and/or $\varepsilon_{xn}^s > 0$ (i.e., there exist substitution effects domestically); $\varepsilon_p^m < \phi$ --monetary policy is not fully accommodating; and $\varepsilon_x^d < (-1.00)$--the economy is in the elastic range of its export demand curve. Observe, however, that there need not be substitution effects on the output side (i.e., $\varepsilon_{xn}^s > 0$) for devaluation to improve the trade balance.

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