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Devaluation in Modified Planned Economies: A Preliminary Model for Hungary

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Contents

Summary

This paper develops a stylized model of a "small" modified planned economy (MPE) such as Hungary, with a view to clarifying the channels through which a change in an MPE's exchange rate might affect its trade balance in convertible currency in the short- and medium-run. The model consists of five composite goods designed to reflect the present Hungarian price system. Although the specific features and number of composite goods used in this analysis are meant to apply to Hungary, the basic features of the model itself are sufficiently general so as to make it potentially applicable to other emergent MPEs as well.

Contrary to the impression of many observers, there exists the possibility of significant short- and medium-run relative price changes in Hungary in response to a devaluation. This is because at least one third of all prices are administratively fixed independent of the exchange rate, and the extent to which the prices of flexibly priced nontradables will rise following devaluation is critically determined by the state of initial aggregate demand and the extent to which the monetary authorities accommodate devaluation-induced price rises by increases in the nominal supply of money.

Nevertheless, several characteristics of the Hungarian economy suggest that the impact of a devaluation may be smaller than in a stylized small market economy. These include a relatively low sensitivity of enterprises to changes in relative prices, the possibility of initial excessive liquidity in the economy and excess demand pressures within the "competitive" sector, possible spillovers of devaluation-induced excess demand for fixed priced goods into "forced substitution" of other goods in domestic consumption, and the possibility that ruble area trade does not respond in the short and medium run to changes in domestic relative prices.

The paper also reviews the impact that recent and possible future reforms of the Hungarian economic mechanism might have on the role of the exchange rate as a stabilization instrument. Further liberalization of prices and successful reforms aimed at increasing the price sensitivity of enterprises and improving the mobility of factors of production should, under most conditions, enhance the impact of a devaluation on the trade balance. The expenditure-reducing impact of a devaluation would likely be raised by improvements in the credit mechanism and by policies that restrain liquidity.

I. Introduction

Changes in the official exchange rate are usually presumed to have little or no impact on the trade balance in classical centrally planned economies (CPEs). As foreign trade decisionmaking is decentralized, however, and links are established between domestic and foreign currency prices, the exchange rate may play a role in attaining both internal and external balance. Among the members of the Council for Mutual Economic Assistance (CMEA), modification of the foreign trade system and of the broader economic mechanism has been most far-reaching in Hungary. In the Hungarian context, the convertible currency exchange rate now plays a potentially much more important role in economic stabilization than does its counterpart in the classical CPE. 1/ Nevertheless, the impact of a currency devaluation in Hungary may still differ in some important respects from its effect in market economies of comparable size and income level.

One approach to evaluating the impact of a devaluation in Hungary would be to estimate econometrically the convertible currency trade balance response to various changes in the Hungarian exchange rate over the past decade. Unfortunately, however, such an approach would encounter a number of problems. First, the exchange rate system itself has been modified within the past several years, as the separate commercial and non-commercial rates were finally unified in 1981. Second, and probably more significantly, the Hungarian price system has recently undergone major changes and is subject to continuing modification. The price system of the 1970s based on "prime cost" was largely converted, insofar as tradables are concerned, into a "competitive system" in 1980. Since 1980, this system in turn has undergone further important modifications. Third, policies and systems regarding export subsidization, and trade and exchange controls have been modified over the past decade. Finally, the structure of trade restrictions faced by Hungary on convertible currency markets has changed in recent years, although the changes would be extremely difficult to quantify. Taken together, these institutional and policy changes would make it very difficult to estimate empirically the marginal impact of a devaluation on the trade balance. Even if this impact could be reliably estimated for the period, say, 1974-84, recent and prospective changes in and extension of the "competitive" price system would limit the relevance of such estimates for the period ahead.

This paper develops a preliminary model for analyzing the short- and medium-run effects of devaluation in a modified planned economy (MPE),

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1/ For a comparative study of exchange rate regimes in several planned economies, see Wolf (1985b). Various facets of the exchange rate system in the stylized CPE are explored in detail in Holzman (1974: Chapters 4, 10 and 15) and Wolf (1980, 1985b). Van Brabant (in press) presents a comprehensive classification of and information on various exchange rates in the CMEA countries.

using some of the main institutional features of the present Hungarian economic mechanism as the basis for the model. 1/ It is often argued that the Hungarian authorities have pursued an "active" exchange rate policy in the past mainly to help attain a certain target for the domestic rate of inflation, rather than to attempt to influence significantly the convertible currency trade balance. While this may be an accurate characterization of Hungarian exchange policy in the past, it does not preclude the possibility of the exchange rate being actively used to pursue other goals as well in the future. The emphasis of this paper, therefore, is on the trade balance impact of a devaluation, and not on its effect on the domestic price level, per se. The study attempts to clarify the main determinants of the effectiveness of the convertible currency exchange rate in improving the convertible currency balance of trade. It should be recognized that although the specific features and number of composite goods used in this analysis are meant to apply to Hungary, the basic features of the model itself are sufficiently general so as to make it potentially applicable to other emergent "modified" CPEs as well.

By no means is this paper considered to be a definitive or comprehensive analysis of the role of the exchange rate in economic stabilization in Hungary. Aside from making a number of simplifying assumptions regarding the Hungarian economy, the model developed and discussed in this paper also takes no explicit account of several factors that certainly must bear on the impact of exchange rate changes. For instance, to facilitate construction of the model, Hungary is assumed to be a price-taker on non-ruble markets, even with respect to its exports. For simplicity, just one convertible currency exchange rate is assumed; therefore the issue of the real effective exchange rate is ignored here. Other limitations include the omission of intermediate goods trade in the formal analysis, and the abstraction from differences between producer and consumer price structures and systems. Finally, an area that needs a great deal more research is the response by consumers in a modified planned economy to devaluation-induced excess demand pressures in fixed-priced markets. Moreover, it would be useful to attempt to incorporate the possibility of initial excess demand, at the macro and/or micro level, more explicitly into the formal model. Some of these limitations could be overcome in future analytical work, although in certain cases, such as the relationship between consumer and producer prices, more information would be needed first.

Section II of the paper briefly outlines the fundamental characteristics of the Hungarian price and exchange rate systems. In Section III a simple model is described and used to highlight the basic responses to devaluation that might be expected in a MPE such as Hungary. The model

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1/ For a discussion of the principal characteristics of the MPE, see Wolf (1985a).

is employed in Section IV to discuss the possible impact that certain characteristic features of the Hungarian economy may be expected to have on the effectiveness of exchange rate changes. The model is also used to analyze the impact that further economic reforms and policy changes might have on the effectiveness of the exchange rate in improving the trade balance. The formal model, some numerical calculations, and an analysis of the "ruble core" issue underlying the discussion in Sections III and IV are developed and interpreted in detail in Appendices I through III. Concluding remarks are presented in Section V.

II. The Hungarian Price and Exchange Rate Systems

The basic features of the Hungarian price and exchange rate systems relevant to our problem may be summarized using the terminology and notation of Wolf (1985b). In equation (1) the transaction price of the ith tradable (P_i) is defined as the product of (1) the convertible currency price of this good (P_i^*); (2) the convertible currency exchange rate (e), defined here as the forint price of convertible currency; and (3) a parameter (β_i) equal to 1.0 plus the explicit ad valorem trade tax (subsidy) rate on that commodity:

$$(1) \quad P_i'' = P_i^* e \beta_i$$

This transaction price may or may not be equal to the price at which this product is traded on domestic markets (P_i). Price reform over the past 15 years, however, has meant that an increasing number of Hungarian tradables have domestic prices that are directly or indirectly linked to changes in world market prices and in the exchange rate.

At the present time several methods for setting prices coexist in Hungary. About 80 percent of industry is now subject to the "competitive" system, by which domestic producer prices are linked directly or indirectly to transaction prices. In 1985, essentially all manufacturing output (about 35 percent of industry) will be sold on the basis of one or more of the three "rules" of the competitive system. 1/ Enterprises accounting for 35-40 percent of manufacturing are expected to qualify for the most liberal application of the competitive rules in 1985. Subject to a showing that they are successful exporters, and a demonstration of

1/ These rules are discussed in detail in Marer (1985). Also see Wolf (1985b).

"responsible" behavior with respect to utilization of domestic market power, these enterprises will only be constrained, in domestic price-setting, by the actual or hypothetical import transaction prices of the products marketed. In effect, this means that the domestic sales price for the ith product (P_i) must be no greater than the transaction price paid (received) for imports (exports) of that product or, if not traded, no greater than the hypothetical import transaction price.

Domestic producer prices of basic non-agricultural materials and energy, which account for about 45 percent of industry, are also keyed to transaction prices of these products determined for convertible currency trade. If these intermediates are imported from the convertible currency area, their effective domestic price will be the transaction price. If produced domestically or imported from other CMEA countries, the authorities charge the users a variable "producers differential turnover tax" equal to the difference between the convertible currency transaction price and the domestic cost or forint equivalent of the CMEA import price respectively. In order to be certain that changes in world market prices for such products are more than transitory, the authorities may wait 3-5 months after significant world market price changes have occurred before adjusting the producers' differential turnover tax.

In the remaining 20 percent of industry, most domestic trade is subject to producer prices that need bear little relationship to their transaction prices. Only about one-third of producer prices in agriculture are free. Procurement prices for the remaining agricultural products are set annually.

Producer price flexibility in most nontradable branches is considerably less than in tradables. Only about one-quarter of the value of output in construction and transportation-communication is subject to free pricing. Some of the producer prices on tradables and nontradables that are not "free," however, are still permitted to fluctuate within narrow limits or are subject to a price ceiling. For the economy as a whole, including foreign trade, about 70 percent of all producer prices are said to be "free" or administratively tied directly to convertible currency transaction prices.

Trade with the non-ruble area is carried out in convertible currencies, and enterprise export revenue and import expenditures in forints are calculated at transaction prices. Ruble area trade, however, is transacted at transferable ruble prices, which reflect only indirectly, and by no means consistently, world market prices in convertible currency. Because the structure of intra-CMEA prices tends to be inconsistent with the world market price structure, forint price discrepancies faced by enterprises trading with the CMEA cannot be eliminated simply by pegging the forint/transferable ruble exchange rate at some "correct" level. To

eliminate or at least reduce these discrepancies and the resulting impact they may have on enterprise profitability, the authorities follow a "price equalization" policy in ruble trade. For ruble area trade in basic intermediates this policy involves, as noted above, a system of variable producers' differential turnover taxes. There is price equalization for other products as well, but it is not necessarily carried out on a strict commodity-specific basis. The system of so-called "modernization grants" to enterprises has in effect involved a form of price equalization, but these grants appear to be related to the specific investment projects or to the overall profitability level of an enterprise engaged in ruble trade.

A number of questions remain regarding the forint pricing of ruble area trade. Changes in domestic prices for intermediates imported from the ruble area may lag changes in convertible currency transaction prices for these products. Is the lag, of possibly 3-5 months, long enough to induce enterprises, responding to changed relative prices, to shift sources of supply? Are there constraints in doing so, at least insofar as CMEA suppliers are concerned? Exactly how are domestic prices set for finished products imported from CMEA? What if many of these products have no close substitutes in the convertible currency area? Do changes in convertible currency transaction prices caused by changes in the convertible currency exchange rate affect ruble area transaction prices in the same way and at the same speed as changes induced by movements in world market prices? Exactly how does the tax-subsidy system work in ruble trade; does it effectively eliminate all enterprise incentive to reallocate trade in response to changes in relative prices?

Until now only producer price changes have been considered. At the retail level, approximately one-half of the trade in state and cooperative shops, two-thirds of services, and all of handicraft and other small-scale market types of goods and services had "free" prices (i.e., without officially set limits) in 1983. Between 90 and 95 percent of producer prices in light industry and the food industry are free. Without knowing, however, the precise extent to which products and services with free or partially flexible retail prices are produced with free or "competitive-system" priced inputs at the various stages of production, as well as the various price elasticities of supply and demand and the extent to which a devaluation could be expected to reduce aggregate real domestic expenditure, only a rough guess can be made concerning the probable "pass-through" of an exchange rate change to the consumer price index. Some Hungarian economists have estimated the elasticity of the domestic producers' price level with respect to an exchange rate change to be about 0.60-0.65. These estimates appear to be based, however, on the implicit assumptions that (1) the economy is a price-taker with respect to imports, (2) the relative price elasticity of export demand is infinite, and/or that the relative price elasticity of export supply is zero, and

(3) that the elasticity of real aggregate expenditure with respect to a change in the price level is also zero. 1/

Any stylized analysis of the balance of trade impact of a devaluation must proceed in terms of "composite" goods. The notion of a composite good is dependent on the assumption that relative price changes among the individual products making up the composite will not occur or at most will be negligible, at least in response to whatever disturbances are permitted in the stylized model. In the case of Hungary, the foregoing description of the price system suggests that it would be inadequate simply to divide the economy into the familiar dichotomy of a composite tradable, the price of which is fixed by the world market price and the exchange rate, and a flexibly priced composite nontradable.

The model developed in Appendix 1 and described in the next section represents an attempt to respond to the evident complexity of the Hungarian trade and price system, while at the same time to retain enough simplicity to make the model both mathematically tractable and describable in a literary exposition. Its forebearers are the classic one asset (money), tradable-nontradable market economy models of Dornbusch (1973) and Krueger (1974), and the relatively briefly sketched "modified" MCPE model of Wolf (1978), the latter containing simply a flexibly-priced tradable and a composite fixed-price tradeable-nontradable.

III. A Simple Framework for Devaluation Analysis

For purposes of this analysis we assume that Hungary is a price-taker in trade with the non-ruble area. 2/ Our stylized model of the Hungarian economy, elaborated in more detail in Appendix I, consists of five composite goods. One composite, the T good, includes those tradables that are either traded with the non-ruble area (excluding energy exports, which for simplicity are assumed to be entirely re-exports) or produced and sold domestically at prices which, at the initiative of either the enterprises or the authorities, move proportionately with convertible currency transaction

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1/ This combination of assumptions results in the prices of competitive non-ruble tradables as well as of ruble tradables rising in proportion with the exchange rate, and the prices of flexibly-priced nontradables also rising in proportion. *Using the estimated weights from Table 1*, this would yield an elasticity of the overall domestic producers' price level with respect to an exchange rate change of 0.68.

2/ This assumption possibly should be avoided in future refinements, at least with respect to non-ruble exports.

prices. 1/ In other words, the price of the T good is assumed to vary in direct proportion to the convertible currency exchange rate. 2/ Virtually all products making up the T good are included in the "competitive" price system, and the T good will sometimes be referred to as the "competitive" tradable. It is estimated, using 1983 data, that about 43 percent of the gross value of output would fall into this category at the producer level (See Appendix II for the methodology used in these calculations.)

A second composite, the I good, includes all those domestically produced tradables that are sold at home at fixed prices. These would be mainly agricultural commodities with fixed procurement prices and various industrial raw materials and semi-manufactures. About 16 percent of Hungarian gross output would fall into this category in 1983.

Exports to the ruble area, which accounted for about 7 percent of gross output (18 percent of GDP) 3/ in 1983, comprise the third composite, the R good. Despite the questions raised in the previous section about our understanding of how these goods are valued in forints, it will be assumed here for simplicity that their domestic prices are modified, with little or no delay, in line with changes in convertible currency transaction prices for similar goods. Consequently, an increase in the convertible currency exchange rate is assumed to have no effect on the price of the R good relative to that of the T good.

1/ Throughout this paper the distinction between non-ruble and convertible currency trade is ignored, for simplicity.

2/ Whether all domestic producer prices of goods within the competitive sector really move proportionately with their transaction prices is, of course, open to question. In a cross-section study of the Hungarian economy for the period 1981-83, Simon and Veress (1984) find no evidence of a systematic correlation between foreign trade and domestic prices. It is possible, of course, that the data available to the authors were simply too aggregative to pick up the correlations that did exist. As a greater number of enterprises become subject solely to the most liberal, or "third" price rule mentioned in the text, one might expect the correlation between domestic producer prices and transaction prices to increase for the competitive sector.

3/ Exports to the ruble area amounted to about 18 percent of GDP in 1983. For purposes of calculating the weight of the R good in our model, however, this higher percentage probably overstates the true weight of ruble exports in the economy. This is because while GDP measures only value added, exports are a gross concept. The same problem exists with respect to measuring the weight of non-ruble exports. If the ratio of value added to gross value of output were higher for ruble exports than other goods, the 7 percent figure used in the text would, however, underestimate the weight of these goods in the economy.

These two goods are nevertheless differentiated, not so much because the two groups may be mutually quite heterogenous (especially in respect of manufactures), but because there is assumed to be negligible or zero substitution between these goods in the short-run for institutional reasons. Hungary's ruble trade is still planned and carried out on the basis of bilateral trade agreements and cleared by what still amounts to a bilateral clearing mechanism. 1/ Therefore, even to the extent that forint relative price changes involving the R good do occur (e.g., vis-à-vis the I good; and against the N and F goods, which are yet to be considered), the pressures on enterprises to fulfill (but not significantly to over fulfill, on the export side) their ruble area trade plans may serve to minimize their supply response to these relative price changes. For this reason it will be assumed that short-run (say, within one-year) relative price supply and demand elasticities involving the R good are zero.

The fourth composite, the N good, includes all nontradables that have prices determined freely by the market. This category amounted to about 18 percent of gross output in 1983. The fifth composite, denoted the F good, includes all nontradables with fixed prices. This composite accounted for about 16 percent of gross output in 1983. Each of the composite goods, with the exception of the R good, are assumed to be gross substitutes for one another in both demand and supply. The estimated weights of each of these goods in gross output are shown in Table 1. Observe that no more than 50 percent of prices (the T and R goods) will in principle move proportionately with the exchange rate; another 18 percent have flexible prices, but, as explained below, these may not move in proportion to the exchange rate. About one-third of the prices are assumed to be fixed in the short-run.

Beginning from an assumed initial position of full stock-flow equilibrium (which includes full employment and balanced trade), the basic short-run impact of devaluation of the forint vis-à-vis the convertible currency can be summarized as follows. The increase in the convertible currency exchange rate will lead to an automatic proportionate increase in the transaction prices for all goods actually traded with the non-ruble area. Higher prices for these traded products will increase the relative profitability of non-ruble exports and diminish the demand for non-ruble imports. This will lead to domestic excess demand for all remaining competitive tradables and put upward pressure on their prices. Because by assumption these tradables can be traded with the ruble area

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1/ Clearing accounts are maintained in transferable rubles (TRs), but each CMEA country attempts to avoid accumulating TR claims on the others because they cannot be automatically converted into claims on goods.

at the new, higher transaction prices, there will be nothing to stop their prices from moving proportionately to the exchange rate. 1/

The effective transaction price for all goods traded with the ruble area will also be fairly rapidly increased by the authorities in proportion to the exchange rate change. In other words, the price of the composite T and R goods will rise essentially in proportion to the convertible currency exchange rate. The increase in nominal prices for these two composite goods will likewise raise proportionately the relative prices of these goods vis-à-vis the I, N and F composites. This change in relative prices will encourage producers to reallocate resources into production of the T good (recall that the R good is not considered a substitute in the short-run), away from the N good and the fixed-price I and F goods. At the same time, consumers of the T good, faced with its higher relative price, will begin to shift their purchases towards the N, I and F goods. While this is happening, the higher prices for the T and R goods will put upward pressure on the overall domestic price level. If the aggregate real demand elasticity with respect to a change in the price level is negative (because of the decline in real money balances, the real wage, or both), the higher price level will induce a general reduction in real expenditure.

Reallocation of output away from the N, I and F goods, and the shift in demand towards them, creates excess demand in these markets. Excess demand will cause the price of the free-priced N good to rise, but the prices of the I and F goods remain fixed by administrative fiat. The increase in the price of the N good has several effects. It contributes

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1/ The increase in the relative profitability of the competitive tradable would be diminished somewhat in a model that explicitly incorporates intermediate goods. If, for simplicity, profitability is defined as the ratio of product price (P) to product cost (C), the percentage change in relative profitability for the competitive tradable would be equal to $(\hat{P}_T - \hat{P}_N) - (\hat{C}_T - \hat{C}_N)$, where a "^" denotes a percentage change in a variable. Because the material input coefficient for the nontradable will in general be less than that for the T good, we would expect $\hat{C}_T > \hat{C}_{NT}$. This will make reallocation from the N into the T good less attractive to producers than in our simpler model. In effect, the supply side relative price elasticity (η_{NT}--see Appendix I) will be less than otherwise. As shown in equation (A18) of Appendix I, however, a lower substitution elasticity will also reduce the extent of price rise of the nontradable following devaluation from what it otherwise would be; therefore $(\hat{P}_T - \hat{P}_N)$ would be greater than in our model. The net supply side substitution effect with intermediates is likely to be less than in our model, but it is still likely to be positive.

Table 1. Estimated Weights for the Five Composite Goods in Hungarian Gross Output, 1983

(In percent)

1.	"Competitive" non-ruble tradable (T)	43
2.	Fixed-price non-ruble tradable (I)	16
3.	Ruble-area tradable (R)	7
	Total tradables	66
4.	Flexible-priced nontradable (N)	18
5.	Fixed-priced nontradable (F)	16
		100

Note: Tradables accounted for roughly 57 percent and nontradables 43 percent of Hungarian GDP in 1983.

Source: See Appendix II.

to the rise in the overall price level, and thus reinforces the general decline in real aggregate demand and therefore, given the assumption of initial equilibrium, the decline in real expenditure. A higher nominal and therefore higher relative price for the N good will now tend to diminish the excess demand for this product by reducing somewhat the incentive for producers to reallocate production towards the T good, and by diminishing the interest of consumers in shifting expenditure towards the N good. An increase in the N good's price will also cause the relative price of this good vis-à-vis the fixed-price I and F goods to rise. This will further diminish the excess demand for the N good and expand the excess demand for these other two composite products.

The situation in the T or the N markets is much different from that in the two fixed-price markets. In the latter, excess demand pressures are not being partially alleviated by price changes. Potential consumers of these goods will be accumulating excessive money balances, as they are frustrated from using them to purchase I and F goods. Because the I good is a tradable, consumers will attempt to buy additional quantities by importing. If the authorities hold to their policy of a fixed price for the I good, they will have to choose between permitting imports to occur in an amount that will satisfy consumers who now face a lower relative price and reduced domestic production of this good, or imposing trade and/or payments controls to stem all or part of the additional imports. To the extent that increased imports of the I good are allowed, the positive non-ruble trade balance effect of devaluation will of course be diminished. 1/

Those consumers of the I good who remain frustrated, and those who demand but cannot acquire the F good, face a choice which is complex and relatively difficult for formal economic analysis. They can simply accumulate the unwanted money balances, hoping that the fixed-price products will come available in the not-to-distant future. They can reduce their effort at work or attempt to work fewer hours--this will in general lead to a fall in output, including the production of I and F goods. They can attempt to acquire these goods on the black market, at higher prices than prevail in the state-controlled outlets. Also, entrepreneurs may be able to respond to these higher prices with additional output produced outside the socialized sector or by enterprise work associations using the capital stock of this sector. Finally, consumers can engage in "forced substitution" of T and N goods for these fixed priced goods. In this event they end up consuming more of the T and N goods than they prefer at prevailing

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1/ In a model with intermediate goods, various input prices would rise with devaluation, and producers of the I and F goods would also be faced with falling profits because of declining margins. To the extent that their output were not cut back, higher government subsidies to these enterprises would be necessitated.

relative prices, but on the margin they may well prefer greater consumption of these goods to increased holdings of money. 1/ To the extent that forced substitution, reduced labor effort and diversion of resources to "second economy" production of the I and F goods occurs, emergent excess supplies of the T good will of course be reduced, and the decline in excess demand for the N good (induced, as noted above, by the increased price of the N good), will also be diminished, causing a further increase in its price.

These are the general responses to a devaluation in this stylized five composite-good modified planned economy. In sum, the non-ruble trade balance will improve to the extent that the induced excess supply of the "competitive" tradable (T) exceeds additional imports of the fixed price tradable. Expressed differently, the improvement in the non-ruble trade balance will be equal to the reduction in aggregate demand caused by the increase in the price level, plus the amount of excess demand for the two fixed-price goods which is not accomodated (say, through imports or forced substitution). 2/

Whether the devaluation will indeed lead to an improvement in the trade balance, and by how much, is not evident from the above verbal discussion. These questions can only be answered with the aid of the analytical model developed in Appendix I. Equations (A19) - (A22) in that appendix are expressions (at different levels of generality) for the income-normalized improvement in the trade balance starting from balanced trade. Rather than replicate here those equations and their fairly technical interpretation, however, we will attempt a literary summary of those results.

The income-normalized improvement in the non-ruble trade balance (i.e., the change in the balance of trade divided by GDP, both expressed in forints) is shown in Appendix 1 to be a rather complex function of (1) the percentage change in the convertible currency exchange rate, (2) the elasticity of real aggregate demand with respect to the price level, (3) the different weight that each of the five composite goods has

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1/ A more detailed, but by no means comprehensive, discussion of the spillover effects of micro-disequilibrium on the consumption goods market in planned economies may be found in Wolf (1985a) and the references therein. One would expect that the rather primitive substitution coefficient relating any two goods (see Appendix 1) would be positively related to the underlying relative price elasticities of demand between these two goods.

2/ Alternatively, the improvement in the "competitive" trade balance will be equal to the sum of (1) the reduced expenditure on the T good due to the higher price level, and (2) the increased excess supply of the T good induced by the change in relative prices.

in national output (expenditure), (4) the elasticities of demand and supply of each good with respect to changes in each relative price (hereafter for simplicity, referred to as substitution elasticities), and (5) coefficients indicating the extent to which devaluation-induced excess demand for the two fixed-price goods is "accomodated" by imports and by "forced substitution". (The attempt explicitly to incorporate labor supply and black market responses to disequilibrium is left for future work).

The interaction of the above determinants can be classified into expenditure-reducing and switching effects, although the two effects are in fact interrelated. The necessary and sufficient conditions for the improvement of the "competitive" non-ruble trade balance are either (1) some degree of substitution between one or both of the fixed-price goods (I and F) and the competitive tradable (T), with the resulting excess demand for the former goods not being totally accomodated by forced substitution; or, lacking this, (2) both a negative elasticity of real aggregate demand with respect to the price level and some degree of substitution between the flexibly priced nontradable (N) and the T good. It is important to realize that in the event that the elasticity of real aggregate demand is negative, the price of the N good will rise in the short run by only a fraction of the percentage increase in the price of the T good. 1/ This, together with the existence of the two fixed-priced goods, ensures that all domestic prices will not rise proportionately, as is sometimes alleged in studies of the effectiveness of devaluation in Hungary. Indeed, under these conditions at most only about one-half of all prices would rise proportionately with the exchange rate. If one or both of the above conditions are met, the competitive trade balance will improve with devaluation in this model. If this improvement is greater

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1/ As a purely illustrative example, assume the output weights listed in Table 1, a velocity of broad money (V) = 2.3, an elasticity of money demand with respect to the price level (ϕ) of unity, an elasticity of the nominal supply of money with respect to a change in the price level (ε_P^M) of zero, a money stock adjustment coefficient (λ) of 0.50, absolute substitution (supply plus demand) elasticities of 0.4 within broad tradable or nontradable groups (e.g, between T and I goods) and 0.2 between these groups (e.g., between T and N), and forced substitution coefficients (β) of 0.50. Using equations (A13), (A17) and (A22) in Appendix I, the elasticity of real aggregate demand with respect to the price level (ε_p^a) would be -0.2, the elasticity of the price of the N good with respect to the price of the T good (ε_T^N) would be 0.19, and a 10 percent nominal devaluation would yield a short-run income-normalized improvement in the non-ruble trade balance (dB_t/Y) of .012. Doubling all substitution elasticities but holding all other parameters constant, including the forced substitution coefficients, would yield ε_T^N of 0.29 and dB_T/Y of .019.

than the value of permitted imports of the fixed-price tradable, the overall non-ruble trade balance will increase. The likelihood of these conditions being met in the case of Hungary will be explored in the next section.

Changes in virtually any of the aforementioned elasticities, sectoral weights and other parameters will affect both the expenditure-reducing and expenditure-switching facets of the response to devaluation. From a formal, technical standpoint, the net effect of changes in one or more parameters on the trade balance impact of devaluation may be ambiguous. Changes in individual parameters and their likely net effects are discussed in the next section.

IV. Determinants of the Size of the Trade Balance Impact of a Devaluation

Some of the specific determinants of the trade balance impact of a devaluation mentioned in the last section can be fairly easily quantified, or at least approximated. These include the sectoral weights of the various composite goods, and the velocity of money, the latter entering into the calculation of the elasticity of real aggregate demand with respect to the price level. Most of the other determinants, however, may not be subject to empirically-based quantification. Because we lack empirical estimates of various substitution elasticities between different "composite" goods, "forced substitution" coefficients, and so forth, the discussion that follows will be largely in qualitative rather than quantitative terms. It examines several characteristic features of the Hungarian economy and their possible impact on the effectiveness of the convertible currency exchange rate as a stabilization instrument. Some of these features are amenable to change through further extension of the economic reforms that have taken place in Hungary since 1968.

1. The price structure and price reform

One significant characteristic of the Hungarian economy, and indeed the organizing principle for the model contained in this paper, is the coexistence of several domestic price systems. Roughly one-third of the economy is still subject to more or less fixed prices, while an additional 7 percent of gross output, in the form of trade with the ruble area, is characterized by forint pricing which presumably has little or no impact on resource allocation; indeed, we have assumed for simplicity that the composite R good constitutes a kind of "ruble core" of transactions that is impervious, at least in the short run, to changes in relative prices.

The existence of the two fixed-price composite goods (I and F) makes the analysis of devaluation much more complicated than it would be in a stylized market economy with the familiar dichotomy of flexibly priced tradable and nontradable goods. The answer to whether devaluation has a greater or smaller impact in an economy with one-third of its products subject to fixed prices is "it depends."

Clearly, the potential scope for substitution effects is greater, ceteris paribus, for the two fixed-priced goods than the flexibly priced nontradable, as the proportionate decline in their prices relative to that of the T good will be equal to the full percentage increase in the exchange rate. We cannot be certain, however, whether their substitution elasticities vis-à-vis the T good will be equal to, larger or smaller than for the N good. There are, moreover, substitution effects between the N good and the two fixed price goods, and there is also the very real possibility of forced substitution of the T and N goods for these products. We should not therefore automatically assume that the existence of important groups of fixed-priced goods in the Hungarian economy will necessarily enhance the impact of devaluation. 1/ Indeed, the maintenance of fixed prices on a considerable range of output in Hungary is motivated by many of the same socio-economic goals (relative price stability, equitable income distribution, and enterprise stability) that influence various features of the economic mechanism and economic policies, which in turn may reduce the sensitivity of enterprises to changes in relative prices. Although we consider below the marginal effect of further "price reform" on the effectiveness of devaluation as a policy instrument, it should be remembered that any such extension of flexible pricing in the economy probably will also influence other parameters of the system, in the real world.

Consider, as an example of price reform, the extension of free pricing to additional non-tradables (i.e., an expansion of the N at the expense of the F sector). The net impact of such a reform on the competitive trade balance effect of a devaluation is formally ambiguous. It can be shown that the net expenditure-reducing impact of devaluation will be enhanced by the price reform, because now more prices will increase with devaluation. The substitution effect between the N and T goods will also be greater than before, because now the greater fall in real aggregate expenditure will lead to a smaller percentage increase in the price of the N good; the net increase of the price of the T good relative to that of the N good will be correspondingly greater and ceteris paribus this means greater substitution into production of the T good and away from expenditure on this product. These positive effects on the trade balance conceivably could be more than offset, however, by the diminished expenditure-switching which will now take place between F and T goods (due to the lower weight than before of the former), this substitution being induced in the first place by a change in relative price between the two goods that is fully as great as the percentage exchange rate increase. It can be shown, however, that the larger the expenditure-reducing effect of devaluation and the greater the substitution elasticities between N and T relative to those between F and T, the more likely

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1/ The simpler stylized MCPE model of Wolf (1978) did indeed leave this impression.

it is that an extension of flexible pricing would ceteris paribus enhance the trade balance impact of a devaluation.

2. Other obstacles to efficient resource allocation

Although it relies on price signals as a guide to resource allocation to a far greater extent than the classical CPE, the Hungarian economy is still subject to many of the rigidities inherited from the earlier stage of central planning. Specifically, despite the increased stress now being placed on enterprise profitability, enterprise managers still are probably not motivated, or in any event in most cases not permitted, to maximize profits as they might in a market economy. "Profile restrictions" still limit the ability of enterprises to shift or expand into new lines of activity. In addition, factor reallocation among enterprises and among industries is cumbersome and inefficient, particularly in respect of capital. Moreover, a policy of "soft budget constraints" for enterprises reinforces the other disincentives to rapid resource reallocation, at least on the part of enterprises faced with a decline in profits as a result of the relative price effects of the devaluation. Consequently, the expectation shared by a number of Hungarian economists is that the short-run substitution effect of a devaluation is likely to be quite small, if not negligible, on the supply side. The same would apply to the demand side as well, insofar as enterprise demand for capital equipment and intermediate products is concerned. 1/

Reforms aimed at raising the profit incentive of enterprise managers, easing profile restrictions and improving factor mobility, along with policies that encourage greater enterprise financial discipline, should enhance the short-run substitutability of the different composite goods on the supply side. Differentiation and manipulation of equations (A17) and (A21) in Appendix I indicate that policy changes and modifications of the economic mechanism that raise relative price elasticities have, strictly speaking, an ambiguous impact on the effectiveness of the exchange rate as a policy instrument. As a practical matter, however, the impact is likely to be positive, as intuition would suggest. 2/ This is particularly so if the initial substitution elasticities between the N and

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1/ The high degree of concentration of Hungarian industry, per se, should not cause the substitution effects to be negligible. For preliminary work, assuming a monopolistic market structure, see Wolf (1981). Also, the obstacles to rapid factor mobility among enterprises need not impede a reorganization of production within enterprises in response to changes in relative prices. For a summary of arguments for why elasticities may remain quite low in Hungary, see Wolf (1985b).

2/ The formal ambiguity could be explained along the lines of analysis used in the text to discuss the effect of price reform. Explicit discussion of this case, however, is omitted for reasons of space.

T goods are relatively low, which is likely to be the case and indeed provides one of the main impetuses for reform in the first place. 1/

3. Initial aggregate excess demand

Until now we have been assuming that there is no initial excess demand in the economy at either the aggregate level or in any of the individual composite good markets. This assumption facilitates the technical analysis in Appendix 1, and it also means that at the macro level we could necessarily expect a decline in aggregate real expenditure following devaluation, this decline being caused by the increase in the price level and the negative elasticity of real aggregate demand with respect to the price level.

If the economy initially is characterized by excess demand for goods as a whole, there must exist quantitative restrictions on trade. This excess demand will also be equal to the excess of economic agents' net flow supplies of money less their "notional" flow demand for money balances. In other words, their holdings of real balances are in excess of what they desire were they to be unconstrained in consumption, at the current level of income. If the currency is now devalued, the resultant increase in the price level will reduce the value of aggregate real balances, but unless the devaluation is large enough, it will not eliminate these surplus balances.

In a situation of initial excess demand, the elasticity of aggregate demand with respect to the price level must necessarily be smaller than in the event of initial macro-level equilibrium. 2/ More important, however, is what happens to real expenditure. If the authorities do not further restrict the availability of goods on the domestic market, through a tightening of trade controls, and if the increase in the price level following devaluation is not great enough to eliminate the excess demand, there is no reason to suppose that real expenditure will fall. Indeed, if the existing quantitative restrictions are lifted or at least eased, it may increase. In general, then, the expenditure-reducing effect of the devaluation will be diminished in the case of initial excess demand.

1/ It should be observed, however, that if the reforms also raise the substitution elasticities between the T good and the fixed-price tradable (I), and imports of the latter good are permitted, the overall non-ruble trade balance impact of a devaluation will be reduced. As noted earlier, the authorities could choose instead to impose or tighten existing quantitative controls on trade in the I good. This would lead, however, to the contradictory situation of devaluation being accompanied by increased trade controls.

2/ See equation (A13a) in Appendix I.

In this connection it may also be instructive to examine briefly the consequences for the impact of a devaluation of an absolute increase in the (negative) value of the elasticity of real aggregate demand with respect to the price level. This may come about because of a tightening of monetary policy, elimination of a currency overhang, an exogenous increase in the demand for money, or an increase in the speed at which money holders attempt to remove any disparity between the amount of money held and the amount demanded. Manipulation of the expressions in the Appendix would show that the impact of an increase in the absolute value of the aggregate demand elasticity on the magnitude of the trade balance effect of devaluation is also formally ambiguous. Of course the expenditure reducing impact of a given price level increase following devaluation will be enhanced, and this dampening effect on aggregate demand will cause the price of the N good to rise less than otherwise. This will promote a greater degree of substitution between the N and T goods, but the diminished increase in the price of the N good will cause the actual increase in the overall price level, and thus the fall in aggregate demand, to be smaller than before.

Whether an increase in the elasticity of aggregate demand with respect to the price level will lead to an enhanced trade balance effect of devaluation ultimately depends on the substitution elasticities. For example, if there were zero short-run substitution between the N and T composite goods, an increase in the aggregate demand elasticity would actually have no impact on the trade balance. In this case, the rise in the price of the T good following devaluation would not create excess demand for the N good. In the meantime, however, the devaluation causes the the price level to rise, and aggregate demand, including demand for the N good, would decline. The N good will now be in excess supply, and because its price is flexible, its price must fall. 1/ It will continue to decline until its fall has completely offset the price level effect of the increased price for the T good. Aggregate demand will ultimately return to its initial level, and the competitive trade balance will remain unchanged. It can be shown, however, that even quite small substitution elasticities between the N and T goods will be enough to ensure that a policy or other exogenous change causing an increase in the aggregate demand elasticity will enhance the effectiveness of the exchange rate in improving the balance of trade.

4. Initial excess demand for the "competitive" tradable

Another possibility is that while initial aggregate excess demand pressures may have been eliminated--through a combination of a tighter

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1/ If the price of the N good were downwardly sticky, and enterprises were not able to lay off workers, the decline in aggregate demand could lead to inventory accumulation.

credit policy, a shift in output proportions from investment to consumption goods, and increases in administered prices--initial disequilibrium may persist at the micro level. For example, we may imagine excess demand for the T good at the prevailing domestic (= transaction) price, this excess demand being exactly offset by excess supply in some other sector. 1/ Observe that unalleviated excess demand for the T good can only be enforced through direct controls on trade. (Also, note that the N good cannot be in excess supply, because its flexible price will ensure equilibrium in that market. Consequently, in terms of our model, either the ruble tradable (R) or one or both of the fixed price goods must initially be in excess supply.)

Frustrated consumer demand with respect to the T good will mean excessive money holding by consumers. This will just offset the above-plan enterprise inventories of the good or goods in excess supply. If consumers have not completely eliminated this excess liquidity through forced substitution and other responses, and excessive enterprise inventory accumulation has been effectively financed by the credit authorities or the government budget, money holders as a group will end up with excessive liquidity. The result, as discussed in the preceding section, will be a lower real aggregate demand elasticity and a reduced expenditure-reducing impact from devaluation.

Devaluation will, of course, cause the nominal and relative price of the T good to rise. In the sector characterized by excess supply (unless it is the R sector), this relative price change will lead to reduced output and increased demand for this product, thereby diminishing the excess supply. In the T sector, the higher relative price of this good will stimulate output and reduce demand. Because there was initially excess demand in this sector, however, the increase in output of the T good will also mean a rise in real expenditure on this product. Under these circumstances, therefore, the expenditure-switching effect of devaluation may also be minimal. Devaluation under these circumstances might permit, however, the reduction and possible elimination of the trade restrictions on the T good.

5. "Forced substitution" and devaluation

The impact of forced substitution of the T good for fixed-price goods in excess demand is straightforward. The greater the extent of such substitution, the less will be the excess supply of the T good available for net export.

An increased rate of forced substitution of the N good for fixed-price goods, however, has an ambiguous effect on the trade balance impact

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1/ Another possibility would be excess demand for certain competitive tradables just offset by excess supply of others.

of devaluation. An increased rate of forced substitution of N for F, for example, leads to a higher rate of price increase for the N good following devaluation because it raises the total effective demand for the N good. This in turn means that there will be a greater rise in the overall price level than before, and a larger expenditure-reducing effect from devaluation. At the same time, however, this greater increase in the price of the N good means a smaller rise in the relative price of the T good, and a lessened scope for substitution between these two products. If the former effect dominated, increased forced substitution of N for F could actually enhance the trade balance effect of devaluation. The greater the sum of the substitution elasticities between these two products relative to the real aggregate demand elasticity, however, the less likely it will be that increased forced substitution between the N and fixed-price goods will actually enhance the trade balance impact of devaluation.

6. The "ruble core"

As noted earlier, about 7 percent of the gross value of Hungarian output is exported to CMEA countries on the basis of ruble clearings. These exports account for 46 percent of total non-energy exports (the percentage is similar on the import side). There is, of course, some short-run substitution between these products and other goods, especially insofar as consumer good demand is concerned. And given the importance of energy, raw materials and intermediate products in Hungary's ruble imports, this sector is not really totally insulated from developments elsewhere in the Hungarian economy.

Hungarian economists emphasize, however, the lack of substitutability of ruble and non-ruble tradables in the short-run, and it was argued in section III that the institutional mechanism and policies under which this ruble trade is carried out suggest very low or negligible short-run substitutability. Furthermore, while consumers may view some ruble tradables as substitutes for other products, exports of these goods will in effect have no domestically quoted consumer prices (hence there is no basis for a substitution effect), and imports of consumer goods comprise only about 10 percent of total Hungarian imports from the ruble area. Moreover, to the extent that ruble area trade flows are indeed modified in the short-run to accommodate developments in other markets, these changes very likely occur primarily through various forms of administrative intervention and not in response to changes in domestic relative prices. For purposes of a stylized analysis, therefore, it seems reasonable to assume zero short-run substitutability of R goods for other products in response to changes in relative prices.

Intuition suggests that insulating 7 percent of total output (11 percent of combined tradable output) from relative price effects must have

some effect on the non-ruble trade balance impact of a devaluation. One senses that the effect should be negative, because the weight of the non-ruble tradable sector is presumably diminished by an increase in the weight of ruble trade. The smaller the weight of the non-ruble tradable sector, the less scope there will be for substitution effects involving non-ruble tradables. Furthermore, the smaller the weight of the "competitive" tradable sector (and indeed, most of the products traded with the ruble area would presumably fall within the "competitive" system if traded with the non-ruble area), the smaller will be the scope for the expenditure-reducing effect of the devaluation actually to improve the trade balance. This latter point may not be intuitively apparent and is discussed in Appendix III.

The impact of the "ruble core" on the scope for substitution effects, while intuitively more evident, is more difficult to prove. In Appendix III however, we seek to demonstrate that the initial diversion of part of tradable output and expenditure to ruble-area goods with zero short-run substitutability is likely to reduce the elasticities of substitution between the T good and nontradables. As noted earlier, a change in substitution elasticities involving the T good formally has an ambiguous impact on the net substitution effect per se. But the overall effect on the trade balance impact of devaluation of lower (higher) substitution elasticities is likely, as was pointed out, to be negative (positive), particularly if initial substitution elasticities are low. We may conclude, therefore, that the existence of a "ruble core" among tradables causes the non-ruble trade balance impact of a devaluation (vis-à-vis the convertible currency) to be less than it might otherwise be. 1/

1/ Although the R good is assumed to be non-substitutable in the short-run with other composite products, a devaluation vis-à-vis the convertible currency will still in general lead to excess supply domestically of this good. This is because if there is any reduction in real expenditure following devaluation, it may affect demand for the ruble tradable as well. Either enterprises will reduce imports of the R good, thereby running a trade surplus with CMEA partners, or they will accumulate unwanted inventories. (Forced substitution is assumed not to occur, given the zero substitutability assumption.) Whatever the precise response, this effect is implicitly taken into account in the equations in Appendix I. This induced excess supply effect in the ruble sector is similar to the analytical finding of Nivollet (1983), that a devaluation vis-à-vis the non-ruble area (which in effect would constitute a real appreciation of the forint against the transferable ruble) could cause a MCPE's ruble trade balance to improve, if the country's trade elasticities were low enough in trade with the CMEA (i.e., if the Marshall-Lerner condition were not satisfied).

V. Conclusions

This paper has developed an analytical model of a "small" modified planned economy, such as Hungary, with five "composite" goods: (1) a tradable priced according to the rules of the so-called "competitive" system, which accounts at the producer level for about 43 percent of the gross value of output; (2) a fixed-priced tradable (16 percent of output); (3) a good traded only with the ruble area (7 percent); (4) a flexibly-priced nontradable (18 percent); and (5) a fixed-priced nontradable (16 percent). Our analysis has yielded the following main conclusions with respect to the short- and medium-run trade balance effect of a devaluation in such an economy. First, contrary to the impression of many observers, not all domestic prices in Hungary will move proportionately with the exchange rate in the short-run following devaluation. Indeed, in the model used here, which admittedly does not take explicit account of the impact of increased prices for imported intermediates on the costs and thus possibly indirectly on the prices of various products outside the "competitive sector," at most about one-half of all domestic prices in Hungary would move more or less proportionately with the exchange rate. Explicit incorporation of intermediates into the model would undoubtedly raise this percentage, but probably not significantly for the short-run.

The model also demonstrates another basic fact of price formation in Hungary that is often overlooked in analyses of exchange rate policy in that country. Specifically, the extent to which the prices of flexibly priced products outside the "competitive" sector (i.e., nontradables) will rise following devaluation is critically determined by the state of initial aggregate demand and the extent to which the monetary authorities accommodate devaluation-induced price rises by increases in the nominal supply of money. The greater the initial excess aggregate demand, and the more "accommodating" the monetary policy, the smaller will be the expenditure-reducing impact of devaluation, the greater the short-run increase in nontradable prices, and the smaller the scope for substitution effects leading to expanded exports and reduced imports.

The model shows that if the economy is initially in equilibrium in all markets, the necessary and sufficient condition for improvement in the non-ruble trade balance following devaluation is some degree of substitution in supply and/or demand between one or both of the fixed-price goods and the competitive tradable (provided that forced substitution of the latter for the fixed-priced goods which now become in excess demand does not totally "accommodate" this excess demand.) Should there be zero or negligible substitution between these products, the necessary and sufficient condition for trade balance improvement then becomes the combination of a negative real aggregate demand elasticity (i.e., the expenditure-reducing effect) and some degree of substitution in supply and/or demand between the flexibly-priced composite nontradable and the competitive tradable.

Although satisfaction of the above conditions ensures a trade balance improvement following devaluation, there are several characteristics of the Hungarian economy that suggest that the magnitude of the trade balance impact of a devaluation may at the present time be smaller than in a stylized "small" market economy. For instance, many economists are of the opinion that short-run substitution elasticities in Hungary, particularly on the supply side, are relatively low. This judgment stems from the belief that, despite over 15 years of economic reform, the profit incentives of enterprises may still be weak, labor and particularly capital mobility between individual enterprises and between sectors is low in the short run, and the authorities have as yet not systematically subjected Hungarian enterprises to sufficient financial discipline. Active use of the "indirect tax rebate" policy on exports, however, suggests that the price responsiveness of exporting enterprises may not be as low as is sometimes alleged.

A second factor that would limit the effectiveness of devaluation, but one about which there is less consensus, is the possibility of continued excess liquidity in the economy as a whole. As noted earlier, if there were excessive liquidity in the economy, the expenditure-reducing impact of a devaluation would be lessened. Although there is disagreement about the presence of excess demand for goods at the macro level, continuing quantitative controls on a portion of competitive non-ruble tradables do suggest that excess demand pressures persist at least within this sector. To the extent that such excess demand does exist, devaluation will have a smaller expenditure-switching impact than the "initial equilibrium" result would suggest. Devaluation could at least be seen, however, as a means to reduce or even possibly to eliminate this excess demand, thereby permitting the further reduction or abolition of present trade controls.

Part of the potential balance of trade impact of a devaluation in Hungary comes from devaluation-induced excess demand pressures in the markets for fixed-priced goods. Because prices are assumed to be held constant in these markets in the short run, this excess demand persists and is offset, in theory, by excess supply of the competitive tradable which in turn constitutes part of the non-ruble trade surplus. It is unlikely, however, that persistent excess demand in these markets will not at least partially be accommodated by some combination of reduced labor supply, second economy activities, and "forced substitution" of other goods for those in excess demand. To the extent that this forced substitution involves, in particular, competitive tradables, the surplus of the latter for net export will be reduced.

A further complexity arises with respect to the fixed-price tradable. A devaluation, by lowering the domestic relative price of this product and raising the potential forint price received if exported, would make production of this good less attractive, unless it could be exported.

Domestic consumers, at the same time, will demand more of this product than before. Because it is a tradable, this good could in theory be imported. The authorities may therefore find it necessary to impose stricter trade controls on this good in order to preserve much of the positive trade balance effect of devaluation.

A final factor affecting the convertible currency exchange rate as a stabilization instrument is the share of gross output exported under ruble clearing arrangments. In our stylized model, this trade is characterized as a "ruble core" of products which is not substitutable with other composite products in the short run. The ruble composite thus constitutes a core of tradables that are largely unaffected by devaluation. The paper argues that this causes the substitution effects between the competitive tradable and other goods to be smaller than otherwise. It also tends to diminish the expenditure-reducing effect of devaluation on the non-ruble trade balance, as the possible decline in expenditure on the ruble composite leads to a trade surplus in ruble trade or excess inventory accumulation of this good rather than to increased net exports to the non-ruble area.

Having noted some of the factors that might diminish the effectiveness of a devaluation in Hungary, it will be instructive to review briefly the impact that recent and future reforms of the Hungarian economic mechanism might have on the role of the exchange rate as a stabilization instrument. As with each of the "reforms" discussed in the paper, an extension of "free" or "competitive" pricing to additional products would have, in terms of our formal model, an ambiguous effect on the trade balance impact of devaluation. As discussed in Section IV, however, a positive effect from further freeing of prices could be expected as long as the substitution elasticities (net of "forced substitution") between the fixed price good (which is subject to the greatest relative price effect, but which would now carry a lower weight) and the competitive tradable are not high relative to other parameters of the model.

Many of the ongoing reform efforts in Hungary are aimed at increasing the relative price sensitivity of enterprise managers and improving the mobility of factors of production. To the extent these reforms are successful, the relative price substitution elasticities between the different goods should increase, particularly on the supply side. As long as the initial substitution elasticities are relatively low, and this would appear to be the case in Hungary, an increase in these elasticities will unambiguously enhance the trade balance impact of a devaluation.

Improvements in the mechanism by which credit is extended, along with policies that eliminate excess liquidity, would in effect increase the (absolute) value of the elasticity of real aggregate demand with respect to the price level. While an increase in this elasticity formally has an

ambiguous effect on the trade balance effect of devaluation, for plausible values of the model's parameters it will indeed increase the effectiveness of exchange rate policy, as intuition suggests.

As discussed in Section I, the model developed in this paper still has a number of limitations insofar as its applicability to the actual Hungarian economy is concerned. We would submit, however, that it is still useful as a preliminary framework for examining the main channels by which an exchange rate change might affect economic activity in a MPE such as Hungary. Contrary to the impression held by many, the present price and exchange rate systems in Hungary would appear to offer potential for both the relative price and expenditure-reducing effects of a devaluation. At the same time, such as in the case of fixed price non-ruble tradables, devaluation could present the authorities with difficult policy choices. As discussed, several factors, characteristic although not unique to Hungary, probably diminish the effectiveness of the exchange rate at the present time. Successful implementation of the most recent as well as prospective modifications of the Hungarian economic mechanism, however, would probably enhance the role of the exchange rate as a policy instrument.

APPENDIX I

A Preliminary Model of Devaluation in a Modified Planned Economy

1. The Model

Consider a modified planned economy (MPE) with a price system similar to that of contemporary Hungary. A stylized version of this economy might have five composite goods: (1) a non-ruble area tradable subject to the most liberal form of the "competitive" pricing rules (the T good); (2) a non-ruble area tradable sold only domestically and at a fixed price (I); (3) a product traded with the ruble area (R), which is neither a substitute with nor a complement to the other composite goods in the short run, and the domestic price of which is administratively manipulated so as to vary directly with the price of the T good; (4) a nontradable with a price determined by market forces (N); and (5) a fixed-price nontradable (F). The T, I, N and F goods are gross substitutes in the short run. 1/

The domestic price of the "competitive" non-ruble tradable is free, except that enterprises are not permitted to set its domestic price (P_T) higher than the non-ruble area foreign currency price (P_T^*) converted at the official exchange rate (e) and multiplied by 1.0 plus the explicit ad valorem trade tax (t):

$$(A1) \quad P_T = P_T^* e\ (1 + t)$$

Expression (A1) is written as an equation rather than as an inequality because it is assumed that enterprises will export any excess supply and that this activity will eliminate any price differential. The MPE is assumed to be a "small country" in non-ruble trade; consequently P_T^* is fixed exogenously.

The MPE may not have quantitative controls on trade and/or payments, but maintenance of the "competitive" system suggests that such restrictions exist. Equation (A1) will apply to the MPE whether or not there are controls, but only if no controls exist, or prevailing restrictions are not binding, will satisfaction of (A1) necessarily indicate equilibrium in the T good market. In the event of excess demand for the "competitive" tradable at P_T, the authorities must choose between (1)

1/ A model of a MPE with a flexible priced tradable and fixed priced tradable-nontradable composite was first outlined in Wolf (1978). Aizenman (1981) examines the case of a market economy with a flexibly-priced nontradable, and two flexibly-priced tradables, one of which is subject to a quota.

permitting the competitive tradable balance of trade (B_T) to deteriorate, (2) raising the explicit trade tax or the exchange rate to eliminate the imbalance (through an increase in P_T), or (3) imposing controls to maintain both P_T and B_T at their initial levels.

Money income is defined by equation (A2), where S_i and P_i refer to the domestic output and price, respectively, of the ith composite good:

$$(A2) \quad Y = \sum_i P_i S_i.$$

Domestic aggregate demand (A) is defined by equation (A3), where D_i refers to the quantity demanded of the ith composite good:

$$(A3) \quad A = \sum_i P_i D_i.$$

In the event of excess demand for the ith good, D_i will exceed expenditure (E_i) on that product.

The trade balance for the "competitive" sector (B_T), denominated in domestic prices, is defined as the effective excess supply of the T good. By effective excess supply of the T good is meant the amount available for net export after adding to the notional domestic demand for the T good the additional expenditure on that product that may arise as a result of "forced substitution" of the T good for fixed priced goods (F and I), should the latter goods be in excess demand. 1/ The proportion of excess demand for the ith product "accomodated" by forced substitution of the T good for that product is indicated by the coefficient β_{Ti}.

In the case of the fixed priced tradable (I), there is also the possibility that some proportion (m_I) of the excess demand for that product may first be alleviated through net imports. By rearrangement of (A2) and (A3), B_T may be shown to be equal to excess aggregate supply (Y-A) plus the sum of the aggregate demand on the other four markets not accomodated by forced substitution of the T good or imports:

1/ See Kornai (1979) on the concept of "forced substitution." For a brief analysis of this phenomenon in the familiar two-commodity general equilibrium framework, see Wolf (1985a).

$$(A4) \quad B_T = P_T(S_T - E_T) = Y - A + \sum_{i \neq T} P_i(D_i - S_i)(1 - \beta_{Ti}(1 - m_i))$$

Here β_{Ti} can be greater than zero for only the fixed priced goods I and F, and m_i can be greater than zero only for the I good.

The <u>total</u> non-ruble trade balance (B_T') will be equal to B_T less net imports of the I good:

$$(A5) \quad B_T' = B_T - P_I(D_I - S_I)(1 - \beta_I + m_I(\beta_I - 1))$$

Totally differentiating (A4) with respect to the non-ruble (or convertible) currency exchange rate, e, yields a lengthy expression in terms of various partial derivatives. This expression may be simplified through manipulation and use of the following definitions.

Because real income is assumed fixed at the full employment level, the impact of an exchange rate change on nominal income, Y, occurs only through the effect on the price level. The price level relating to output is defined as:

$$(A6) \quad P = \prod_i P_i^{\alpha_i^S}$$

where α_i^S is the weight of the ith product in total output. The change in the overall price level occasioned by a devaluation is therefore a function of the induced change in the prices of the different tradables and nontradables and the weight of each composite good.

The impact of an exchange rate change on nominal aggregate demand, A, has both a price level component (where the price level is defined as before except that in this case the sectoral weight α_i^E refers to the proportion of total domestic expenditure represented by the ith good), and a real or <u>expenditure-reducing</u> (in the case of devaluation) component. Aggregate real domestic demand is assumed here to be a function of income and desired hoarding. Specifically, hoarding is considered to be a positive function of the excess stock demand for money balances:

$$(A7) \quad H^* = \lambda[M^* - M_{-1}]$$

where H* denotes nominal desired hoarding, and M* and M_{-1} refer to the desired money stock and last period's actual stock of money, respectively. The parameter λ denotes a stock adjustment coefficient.

The desired money stock is defined by equation (A8):

$$(A8) \quad M^* = y^{\gamma} P^{\phi}$$

where y is real income, P the price level, and γ and ϕ are constant elasticities, both greater than zero. Real desired hoarding is then:

$$(A9) \quad h^* = \lambda [y^{\gamma} P^{\phi-1} - M_{-1} P^{-1}]$$

Aggregate real demand for commodities (a), is defined as the difference between real income and desired hoarding:

$$(A10) \quad a = y - h^*$$

Differentiating (A10) with respect to the price level, recalling that real income is assumed constant, multiplying this total derivative by P/a, and simplifying, yields the following expression for the elasticity of real aggregate demand with respect to the price level (ε_P^a):

$$(A11) \quad \varepsilon_P^a = \frac{\lambda}{a} [MP^{-1}(\varepsilon_P^M - \phi)]$$

where ε_P^M is the elasticity of the nominal money supply with respect to the price level (essentially a policy variable).

If initial stock-flow equilibrium prevails, then a = y and, recalling the definition of the velocity of money (V),

$$(A12) \quad V = M^{-1}Py,$$

expression (A11) can be simplified to:

$$(A13) \quad \varepsilon_P^a = \frac{\lambda}{V}(\varepsilon_P^M - \phi)$$

It seems reasonable to suppose that $0 = \leq \varepsilon_p^M \leq \phi \leq 1.00$ and $0 < \frac{\lambda}{V} \leq 1.00$; 1/ this would ensure that $(-1.00) < \varepsilon_p^a \leq 0$.

If there is not initial stock-flow equilibrium, the elasticity of real aggregate demand with respect to the price level will be:

$$(A13a) \quad \varepsilon_p^a = \lambda \left[(\varepsilon_p^M - 1)MP^{-1} - (\phi - 1)\, M^*P^{-1}\right]\left[y - \lambda\,(M^*P^{-1} - MP^{-1})\right]^{-1}$$

The impact of an exchange rate change on the "competitive" non-ruble trade balance will depend, aside from the aggregate income and demand effects, on (1) whether particular composite goods' prices are fixed, (2) the extent to which the different relative prices change, (3) the elasticities of substitution in demand and supply among these goods with respect to changes in relative prices, (4) each product's relative importance in the initial levels of output and expenditure, and (5) the extent to which excess demand for fixed-priced goods will be reduced by "forced substitution" of other products for these goods in consumption. The changes in different relative prices are summarized in the following general elasticity, where P_i refers as before to the nominal price of the ith good and P_T denotes the price of the competitive nonruble tradable:

$$(A14) \quad \varepsilon_T^i = (\partial P_i/P_i)(\partial P_T/P_T)^{-1}$$

The short-run substitution elasticities, with respect to changes in the price of the ith good relative to the price of another ($j \neq i$) good, q_{ij}, are:

$$(A15) \quad \eta_{ij} = (\partial S_i/S_i)(\partial q_{ij}/q_{ij})^{-1}$$

$$(A16) \quad \varepsilon_{ij} = (\partial D_i/D_i)(\partial q_{ij}/q_{ij})^{-1}$$

2. Price adjustment for the flexibly priced nontradable

Of the five composite goods, two have administratively fixed prices (I and F) and two have prices which vary directly with the exchange

1/ The money stock adjustment coefficient (λ) will be greater than than zero and less than or equal to unity, and velocity (V) will typically be greater than unity.

rate, either because of enterprise or administrative price-setting (T and R). Only one good (N) has a price that is flexible but which also may not necessarily change proportionately with the exchange rate. Only one of the price elasticities of equation (A14) therefore requires a solution in terms of the parameters and exogenous variables of the model.

Because the N good has a flexible price, there is nothing to keep that market from moving to a new equilibrium after the responses to a devaluation have run their course. Consequently, the induced change in domestic supply of this nontradable must be equal to the induced change in domestic demand. The latter effect has two components: an expenditure and a substitution effect. Setting the quantity supplied of the N good equal to the quantity demanded, totally differentiating both sides of the equation with respect to the convertible currency exchange rate, assuming zero initial excess demand in all markets, multiplying both sides by q_{TN}, and simplifying, yields:

$$(A17)\quad \varepsilon_T^N = \varepsilon_p^a \left(\sum_{i \neq N} \alpha_i \, \varepsilon_T^i\right) + (\eta_{NT} - \varepsilon_{NT}) + \sum_{i \neq N,T} \left[\varepsilon_T^i \, (\eta_{Ni} - \varepsilon_{Ni})(1 - \beta_{Ni}(1-m_i))\right]$$

$$\frac{}{- \varepsilon_p^a \, \alpha_N + \sum_{i \neq N} \left[(\eta_{Ni} - \varepsilon_{Ni}) \, (1 - \beta_{Ni} \, (1-m_i))\right]}$$

Here β_{Ni} is defined similarly to β_{Ti} in equation (A4), except that this parameter now refers to forced substitution of the N for the ith good.

This elasticity (ε_T^N) of the price of the N good with respect to changes in the price of the T good (which in turn varies proportionately with the convertible currency exchange rate), as well as the various coefficients, elasticities and sectoral weights on the right hand side of (A17), enter directly into equation (A19), which in turn summarizes the competitive non-ruble trade balance impact of a devaluation. The competitive sector trade balance, therefore, is both a direct (A19) and indirect (A17) function of these coefficients, elasticities and weights. Although these are parameters in the short run, they may change in response to changes in the economic system or major policy changes. It can be shown that as long as

$\varepsilon_p^a < 0$, and $(\eta_{NT} - \varepsilon_{NT}) > 0$, then $0 < \varepsilon_T^N < 1.00$. 1/

1/ For the classic analyses of the two-good case with an explicit role for money, see Dornbusch (1973) and Krueger (1974).

The impact of changes in various parameters in (A17) on ϵ_T^N may be summarized as follows:

$$(A18)\quad \partial\epsilon_T^N/\partial\alpha_T < 0;\ \partial\epsilon_T^N/\partial\alpha_N < 0;\ \partial\epsilon_T^N/\partial\,(\eta_{NT} - \epsilon_{NT}) > 0$$

$$\partial\epsilon_T^N/\partial\epsilon_P^a > 0;\ \partial\epsilon_T^N/\ \partial(\eta_{Ni} - \epsilon_{Ni}) \gtrless 0$$

$$\partial\epsilon_T^N/\partial\beta_{Ni} > 0.$$

3. The trade balance impact of a devaluation

If the total derivative dB_T/de, now expressed in terms of the above coefficients, elasticities and weights, is multiplied by de/Y, it may be rewritten as equation (A19). The left-hand side, dB_T/Y, represents the "competitive" sector non-ruble trade balance improvement as a percent of GDP that results from a given percentage change in the exchange rate ($\hat{e}$):

$$\begin{aligned}(A19)\quad dB_T/Y = \hat{e}\ [&-\sum_i \alpha_i^s\ \epsilon_T^i\ \alpha_T - \sum_i \alpha_i^E\ \epsilon_T^i\ \alpha_T\ (\epsilon_p^a + 1)\\ &- \sum_{i\neq T} \alpha_i^s(\eta_{iT}\ (\epsilon_T^i - 1)(1 - \beta_{Ti}\ (1 - m_i))\\ &+ \sum_{j\neq T,\, i} (\eta_{ij}\ (\epsilon_T^i - \epsilon_T^j)(1 - \beta_{ij}\ (1 - m_j) + \epsilon_T^i)\\ &- \sum_{i\neq T} \alpha_i^E(\epsilon_{iT}(\epsilon_i{}^T - 1)(1 - \beta_{Ti}\ (1 - m_i)\\ &+ \sum_{j\neq T,\, i} (\epsilon_{ij}\ (\epsilon_T^i - \epsilon_T^j)(1 - \beta_{ij}\ (1 - m_j) + \epsilon_T^i)]\end{aligned}$$

In the event that initially all markets are in equilibrium and $B_T = 0$, $\alpha_i^s = \alpha_i^E$ (i=1,...,5), and (A19) reduces to:

$$(A20)\quad dB_T/Y = \hat{e}\,[-\Sigma_i \alpha_i \varepsilon_T^i \alpha_T \varepsilon_P^a - \Sigma_{i\neq T} \alpha_i [(\eta_{iT} - \varepsilon_{iT})(\varepsilon_T^i - 1)(1 - \beta_{Ti}\,(1 - m_i)] - \Sigma_{j\neq T,\, i} [(\eta_{ij} - \varepsilon_{ij})(\varepsilon_T^i - \varepsilon_T^j)(1 - \beta_{ij}\,(1 - m_j)]]$$

The third term in brackets on the right hand side of equation (A20) reflects the substitution effects among the I, N, F and R goods arising from changes in relative prices among them caused by an exchange rate change. For example, an increase in P_N arising from induced excess demand for the N good means that the relative price q_{NF} will also rise. This will stimulate substitution between the N and F sectors, but this substitution per se, although having an effect on ε_T^N (see equation (A17)), will not directly affect the T goods sector. Indeed, the third term for the pair ij will exactly offset this term for the pair ji, and (A20) may be written:

$$(A21)\quad dB_T/Y = -\hat{e}\,[\Sigma_i \alpha_i \varepsilon_T^i \alpha_T \varepsilon_P^a + \Sigma_{i\neq T}\, \alpha_i\, [(\eta_{iT} - \varepsilon_{iT})(\varepsilon_T^i - 1)\,(1 - \beta_{Ti}\,(1 - m_i))]$$

To facilitate interpretation of this result, recall that there is assumed to be zero substitutability between the R and other goods in the short run (thus $(\eta_{RT} - \varepsilon_{RT}) = 0$). Also, it will be assumed that all fixed-price goods are nontradeables, so $\alpha_I = 0$. With these assumptions, and recalling that $\varepsilon_T^T = \varepsilon_T^R = 1.00$ and $\varepsilon_T^F = 0$, (A21) simplifies to:

$$(A22)\quad dB_T/Y = -\hat{e}[(\alpha_T+\alpha_R+\alpha_N\varepsilon_T^N)\alpha_T\,\varepsilon_P^a + \alpha_N(\eta_{NT}-\varepsilon_{NT})(\varepsilon_T^N - 1) - \alpha_F(\eta_{FT} - \varepsilon_{FT})(1-\beta_{TF})]$$

In (A22) the first right-hand side term inside the brackets represents the expenditure-reducing effect on the T good of a devaluation, the second term denotes the impact of devaluation-induced substitution between the N and T goods, and the third term indicates the substitution

effect between F and T goods. Interpretation of (A22) is not quite as straightforward, however, as it might appear at first glance. Of course, if the usual assumptions are made regarding the various weights and elasticities (namely that all $\alpha_i > 0$; both substitution terms, the $(\eta_{iT} - \varepsilon_{iT})$, are positive; $\varepsilon_p^a < 0$), then $0 < \varepsilon_T^N < 1.00$ and a devaluation will unambiguously improve the competitive non-ruble trade balance.

A few other plausible cases, however, should be briefly considered. If the aggregate demand elasticity (ε_p^a) is zero, the trade balance will still improve as long as there is positive substitution between F and T goods ($(\eta_{FT}-\varepsilon_{FT}) > 0$) and the forced substitution coefficient β_{TF} is less than unity. Whether there is positive substitution between N and T goods in this case is irrelevant, because there is no mechanism by which an increase in the price level following devaluation can have an aggregate demand effect--consequently there will be nothing to keep the price of the N good from rising proportionately to the exchange rate change, thereby eliminating any substitution in supply or demand between N and T. Thus, if there is substitution with the T good only in the N sector, and $\varepsilon_p^a = 0$, the trade balance will not improve with a devaluation.

If the aggregate demand elasticity were negative, but both substitution terms were zero, the trade balance will not be responsive to devaluation. This is because the devaluation-induced increase in the relative price of the T good will cause no excess demand in either the F or the N sector. There will in the meantime be a price level and therefore an aggregate demand response to the increased price of the T good. Demand for the N good will decrease as will the demand for other products. This will create a situation of excess supply of the N good. Because the price of the nontradable is flexible and full employment is assumed, P_N will decline until the excess supply is eliminated. This means that P_N must fall by enough to completely offset the rise in the overall price level caused by the increase in P_T. On balance, therefore, aggregate demand remains unchanged and there is no expenditure-reducing effect as well as no substitution effect. (This result can be seen by setting the substitution terms in (A17) equal to zero. The resulting expression for ε_T^N, equal to $-(\alpha_T+ \alpha_R)/\alpha_N$, can then be substituted into (A22), yielding a zero expenditure-reducing effect.)

In sum, necessary and sufficient conditions for a devaluation to improve the competitive non-ruble trade balance in this trimmed-down version of a MPE are either (1) substitution between the fixed price

good (F) and the competitive tradable (T), with less than fully-accommodating forced substitution of the T for the F good or, lacking this, (2) both a negative aggregate demand elasticity and substitution between the N and T good.

The impact of various economic reforms on the trade balance impact of a devaluation, discussed in Section IV of the paper, may be derived by dividing both sides of (A22) by $\hat{e}$ and taking the total derivative of the resulting expression with respect to individual "variables" (such as the different expenditure weights, the real aggregate demand elasticity, the variuos relative price elasticities, etc.) on the righthand side of (A22). As indicated by (A18), this will in general involve changes in ε_N^T as well, which also enters into (A22). The resulting expressions are quite cumbersome and in most cases have formally ambiguous signs. (It should also be noted that some of the "other" elasticities may also be variables in this type of experiment because various reforms will change the institutional structure and, in the case of a price reform, the composition of different product groups will be modified.)

Calculation of Composite Good Shares for Hungary - 1983

In the accompanying table all sectors are divided into tradables and nontradables. For each sector or group of sectors is listed: in column (1) gross value of output, calculated from official Hungarian statistics; (2) f.o.b. value of exports, based on figures provided by the Hungarian authorities; (3) f.o.b. value of exports to the non-ruble area; (4) f.o.b. value of exports to the ruble area; (5) gross output available for domestic consumption (= (1) - (2)); (6) percentage of output subject to "free" prices; (7) value of output available for consumption subject to "free" prices at the producer level (= (5) x (6)), where for simplicity it is assumed that the percentages in column (6) are applicable to "output available from consumption" as well as to "output"; and (8) value of output available for consumption subject to fixed or limited flexibility prices at the producer level (= (5) - (7)). All recorded energy exports (see bottom of table) are assumed, for simplicity, to be re-exports.

Using the individual sectoral gross output values in column (1), the individual "free" price percentages for mining, metallurgy, construction materials, and chemicals are used to calculate a weighted free price percentage for these sectors as a group. This percentage (67 percent), is then implicitly applied to "miscellaneous industry" as well.

The individual composite good shares are calculated by dividing the following gross output totals for each good by the aggregate gross output of 2,273.2 billion forints (based on official Hungarian statistics). (1) T good: assumed composed of non-ruble exports (excluding energy) of 183.8 billion forints and free-priced tradables consumed domestically of 798.5 billion forints. (2) I good: equal to fixed-price tradables (366.2 billion forints). (3) R good: equal to ruble exports (excluding energy) of 158.9 billion forints. (4) N good: equal to free-priced nontradables (414.3 billion forints). (5) F good: equal to fixed-price nontradables (351.5 billion forints).

Appendix Table 2-1

(Output and exports in billions of forints)

Sector	(1) Gross Value of Output	(2) Total Exports (f.o.b.)	(3) Non-Ruble Exports	(4) Ruble Exports	(5) Output Available for Domestic Consumption ((1) - (2))	(6) Proportion of free Prices	(7) Output Available at Free Prices ((5) x (6))	(8) Output Not Available at Free Prices ((5) - (7))
Tradables								
Mining	66.9					0.20		
Metallurgy	105.0					0.99		
Construction materials	36.9	107.3	68.9	38.4	339.1	0.87	227.2	111.9
Chemicals	221.5					0.63		
Miscellaneous	16.1					0.67		
Engineering	278.0	96.4	27.0	69.4	181.6	1.00	181.6	--
Industrial consumer goods	156.9	53.0	26.2	26.8	103.9	0.94	97.7	6.2
Food processing	221.5	57.0	39.0	18.0	164.5	0.93	153.0	11.5
Agriculture and forestry	404.6	29.0	22.8	6.2	375.6	0.37	139.0	236.6
Subtotal	1,507.4		183.8	158.9			798.5	366.2
Nontradables								
Construction	162.1	--			162.1	0.25	40.5	121.6
Transp., comm.	124.8	--			124.8	0.23	28.7	96.1
Other material sectors	173.6	--			173.6	1.00	173.6	--
Electric energy	50.7	--			50.7	0.07	3.5	47.2
Non-material sectors	254.6	--			254.6	0.66	168.0	86.6
Subtotal	765.8						414.3	351.5
Total	2,273.2							
Energy exports			30.2	1.2				
Total exports			214.0	160.1				

APPENDIX III

Impact of the "Ruble Core" on the Trade Balance Effect of a Devaluation

Consider two economies, A and B. They are identical in all respects except that part of country A's output of and expenditure on tradables consists of goods traded with the ruble area. It is assumed that these products, which constitute a "ruble core," are not substitutable in the short run, in output and expenditure, with other composite goods in the economy. In effect, economy A (a very stylized version of the Hungarian economy) has three composite goods, a non-ruble tradable (T good), a non-tradable (N), and a product traded with the ruble area (R). Country B has only T and N goods. Whereas the relative price elasticities of demand and supply involving A's ruble area traded goods will be zero, all tradables in country B are assumed to be gross substitutes with the nontradable and between themselves. The question arises as to whether the income normalized non-ruble trade balance effect of a devaluation (dB_T/Y in Appendix 1) will be different in the two countries as a result of this difference in trade structure. For simplicity, fixed priced goods will be assumed away in this Appendix.

If the domestic price of the ruble area traded good is assumed to change pari passu with that of the non-ruble tradable in economy A (i.e., $\varepsilon_T^R = 1.00$), and the R good is not a substitute for the other two goods $(\eta_{RT} - \varepsilon_{RT}) = (\eta_{NR} = \varepsilon_{NR}) = 0$), equation (A21) in Appendix 1 becomes:

$$(B1) \quad dB_T/Y = -\hat{e}[(\alpha_T + \alpha_R + \alpha_N \varepsilon_T^N)\ \alpha_T \varepsilon_P^a + \alpha_N\ (\eta_{NT} - \varepsilon_{NT})\ (\varepsilon_T^N - 1)]$$

According to the Kravis-World Bank International Comparisons Project (ICP), the weight of nontradables in Hungarian expenditures at national prices in 1975 was close to the average weight of nontradables in other non-CMEA countries with comparable per capita income levels. 1/ For this comparison of a stylized version of Hungary (country A) with another "comparable" stylized economy (B), it therefore seems reasonable to assume

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1/ In terms of national prices, the 1975 nontradable expenditure weight for Hungary was 0.40, compared to an (unweighted) average weight of 0.43 for seven non-CMEA countries with roughly comparable per capita incomes. See ICP (1982), Table 6-10. The last year for which such comparisons are available is 1975. These weights, which relate to GNP, are not comparable to the weights in Table 1 based on the gross value of output.

equal expenditure shares for nontradables ($\alpha_N^A = \alpha_N^B$). (Hereafter, the superscripts refer to the two countries.) Equation (B1) would thus be of identical form for the two countries, but α_T^B would equal $(\alpha_T^A + \alpha_R^A)$, and α_R^B would equal zero. The issue posed here is whether these differences in weights, and the assumption that $(\eta_{RT} - \varepsilon_{RT})^A = (\eta_{NR} - \varepsilon_{NR})^A = 0$, will necessarily cause the relative price elasticities of supply and demand between the N and T goods $(\eta_{NT} - \varepsilon_{NT})$, and the elasticity of P_N with with respect to P_T (i.e., ε_T^N), to differ as between the two countries.

The first step will be to determine those conditions under which country B's relative price elasticities would be (absolutely) greater than those of country A. The second step will be to evaluate the liklihood of those conditions being met. For purposes of analytical tractability and simplicity of exposition, it will be assumed throughout that the markets for both the N and T goods will be in equilibrium.

1. The conditions for different elasticities in the two economies

The overall production possibilities of the two countries are assumed to be identical. What distinguishes A from B is that the former has devoted part of its output and expenditure to ruble area goods. A third (R good) dimension in effect may be imagined to each country's production possibilities, but only A operates in the ruble dimension. Because of the diversion towards the ruble area, country A's production possibilities frontier (ppf^A) in N, T space is a collapsed version of country B's frontier (ppf^B). (An important issue, addressed in section 2, is whether the inward shift in ppf^A is neutral with respect to its impact on production possibilities of N and T (i.e., ppf^A parallel to ppf^B), or whether the collapse is more at the expense of potential output of N or of T (non-parallel shifts--see $ppfs^A$ DD and EE in Figure 1). The slopes of the ppfs and indifference curves at the initial output-expenditure points of course partially determine the relative price elasticities of each country.

Focusing on the supply side, define the elasticity of supply of the N good with respect to the relative price q_{NT} $(= P_N/P_T)$ as η_{NT} (see equation (A15). Observe that if $\eta_{NT}^B/\eta_{NT}^A > \alpha_T^B/\alpha_T^A$, then η_{NT}^B/η_{NT}^A is certainly greater than unity, because by assumption $\alpha_T^B > \alpha_T^A$. Through considerable algebraic manipulation, including taking into account the relationship between "own" and "cross-price" elasticities, 1/ the above inequality $(\eta_{NT}^B/\eta_{NT}^A > \alpha_T^B/\alpha_T^A$ can be rewritten as:

1/ $\alpha_T^A \eta_{TN}^A = (\alpha_T^A - \alpha_N^A \eta_{NT}^A)$, and $\alpha_T^B \eta_{TN}^B = (\alpha_T^B - \alpha_N^B \eta_{NT}^B)$

$$(B2) \qquad \left(\frac{-dS_N^B}{dS_T^B}\right) < \left(\frac{-dS_N^A}{dS_T^A}\right)$$

In other words, $\eta_{NT}^B/\eta_{NT}^A > \alpha_T^B/\alpha_T^A$ if the (negative) slope of ppf^B at the pre-devaluation point (say, X^B in Figure 1) is flatter than the slope of ppf^A at country A's pre-devaluation point (say, Y^A in the figure). Defining the relative prices as $q^A = P_N^A/P_T^A$ and $q^B = P_N^B/P_T^B$, and assuming initial market equilibrium, (B2) becomes:

$$(B3) \quad q^A < q^B$$

In other words, a lower initial relative price of the nontradable in country A (q^A) than in country B (q^B) is a sufficient but not a necessary condition for $\eta_{NT}^B > \eta_{NT}^A$. It is not a necessary condition because up to some point q^A could be greater than q^B and η_{NT}^B/η_{NT}^A, while now smaller than α_T^B/α_T^A, would still be greater than unity. Similar reasoning would apply to the relationship, on the demand side, between ε_{NT}^B and ε_{NT}^A.

2. The likelihood of the conditions being met

It is noteworthy that the 1982 ICP study estimated that the relative price of nontradables in Hungary, as well as in the other CMEA countries included in the study, was lower in 1975 than in other countries with similar estimated income per capita levels. 1/ Given the methodological and data problems involved in comparing per capita incomes in a common currency as well as in calculating relative price levels, however, we should not base our conclusions solely on these findings.

It turns out that if approached from a purely analytical standpoint, the likelihood would indeed seem to be greater of $q^A < q^B$ (and hence $\eta_{NT} - \varepsilon_{NT})^A < (\eta_{NT} - \varepsilon_{NT})^B$), than of $q^A \geq q^B$. In Figure 1 is drawn the ppf for country B, and three possible "collapsed" ppfs for country A. Frontier CC represents a neutral or parallel shift in N, T production possibilities, DD suggests greater initial diversion from potential N than potential T output, while EE indicates proportionately greater initial diversion from potential T output. If it is assumed that preferences are homothetic and that the original diverison of output to

1/ In terms of national prices, the ratio of the nontradable to tradable prices in 1975 was 0.74 for Hungary and an (unweighted) average of 0.92 for seven non-CMEA countries with roughly comparable per capita incomes. See ICP (1982), Table 6-11.

ruble traded goods did not affect the preference map relating N and T goods, then parallel indifference curves W^A and W^B may also be drawn tangent to the parallel ppfs along ray OH at points X^A and X^B respectively.

As noted earlier, the nontradable takes essentially the same share of output and expenditure in the two countries; therefore $\alpha_N^A = \alpha_N^B$ and $P_N^A S_N^A = P_N^B S_N^B$. Because the two countries are assumed to be linked to the non-ruble world market to the same degree by international commodity arbitrage, $p_T^A = p_T^B$. These relationships suggest that:

(B4) $q^A S_N^A = q^B S_N^B$, and $S_T^A < S_T^B$.

Using (B4) and Figure 1, it can be shown that ppf^A cannot be parallel to ppf^B. If the two frontiers were parallel (i.e., CC and C'C'), the predevaluation general equilibrium points would be X^A and X^B. This would imply $q^A = q^B$. Yet if this is the case, by (B4) S_N^A would have to equal S_N^B. From the diagram it is clear that this is not possible.

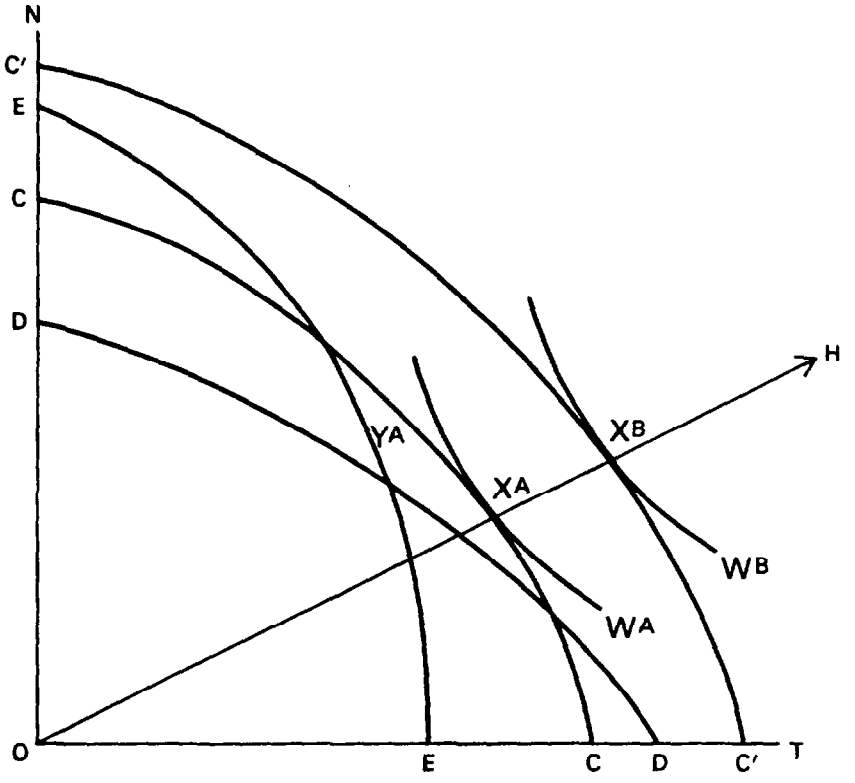
If ppf^A is steeper than ppf^B (see EE in the figure), at the intersection of ppf^A and OH the slope of ppf^A will exceed the slope of W through that point. An initial equilibrium in this case can only be achieved at some point above the ray, subject always to the constraint implied by (B4). By the same token, if ppf^A is flatter than ppf^B, the initial equlibrium must lie below OH. Recalling the relationship between the relative price q and the slope of the ppf, a steeper ppf^A than ppf^B implies $q^A < q^B$ (see inequalities (B2) and (B3)), whereas a flatter ppf^A implies $q^A > q^B$.

Given that goods traded with the ruble area are indeed tradable (although by assumption not substitutable with non-ruble tradables in the short run, for the economic and institutional reasons discussed in the text), it would seem reasonable to assume that their production leads to proportionately greater original diversion of resources from potential T than potential N output. This would suggest a ppf^A steeper than ppf^B, and therefore $\eta_{NT}^B > \eta_{NT}^A$.

In sum, even if enterprise incentives and the degree of factor mobility are similar in the two economies, country A, which devotes a large share of output and expenditure to trade with the ruble area in goods which are not substitutable with other goods in the short run, is likely to have lower elasticities of substitution between non-ruble tradables and nontradables.

APPENDIX III

Figure 1.



3. Implications for the trade balance impact of a devaluation

The implications of the existence of a ruble core for the effectiveness of a devaluation by country A vis-à-vis the non-ruble area can be explained using equations (A17) and (A21) of Appendix 1. For simplicity, we continue to assume only three composite goods (T, N and R).

The impact of an expansion of the ruble core at the expense of the non-ruble tradable will affect ε_T^N only through its effect on $(\eta_{NT} - \varepsilon_{NT})$. This is because $d\alpha_R = (-d\alpha_T)$, so the direct effect of devaluation on the overall price level will be unchanged. Because the existence and presumably the expansion of the ruble core will lower the substitution elasticities between N and T, and because it was already shown in Appendix 1 that $\partial\varepsilon_T^N/\partial(\eta_{NT} - \varepsilon_{NT}) > 0$, an expansion of the ruble area weight will reduce the elasticity of P_N with respect to a devaluation.

The lower value for ε_T^N, combined with a lower value for α_T, will by (A21) necessarily cause the expenditure-reducing effect of devaluation to be lower than otherwise. As discussed in the text, the impact of a change in $(\eta_{NT} - \varepsilon_{NT})$ on the substitution effects of a devaluation is analytically ambiguous, because while $(\eta_{NT} - \varepsilon_{NT})$ is lower, so is ε_T^N lower than before. By the same reasoning employed there, however, it is likely that the net effect of a decrease in $(\eta_{NT} - \varepsilon_{NT})$ will be a decline in dB_T/Y (unless the N, T substitution elasticities are initially very high). This, combined with the direct negative impact on dB_T/Y of a decline in α_T, will most likely ensure a diminishment of the trade balance impact of a devaluation.

References

Aizenman, Joshua "Devaluation and Liberalization in the Presence of Tariff and Quota Restrictions," Journal of International Economics, II (1981), pp. 197-206.

Dornbusch, Rudiger "Devaluation, Money and Nontraded Goods," American Economic Review, 63(5), (December 1973), pp. 871-80.

_____, Open Economy Macroeconomics, New York: Basic Books (1980).

Kornai, Janos "Resource-Constrained Versus Demand-Constrained Systems," Econometrica 47(4), (July 1979), pp. 801-19.

Kravis, Irving B., et. al. World Product and Income, (ICP) Baltimore: Johns Hopkins Univ. Press. (1982).

Krueger, Anne O., "The Role of Home Goods and Money in Exchange Rate Adjustment," in W. Sillekaerts, (ed.), International Trade and Finance, New York: International Arts and Sciences Press, (1974).

Marer, Paul, "Economic Reform in Hungary: From Central Planning to Regulated Market," in Joint Economic Committee, U.S. Congress, East European Economies: Slow Growth in the 1980s, Vol. 3, 1985 (in press).

Nivollet, B., "On Devaluation in Centrally Planned Economies," mimeo, (1983).

Simon, Andras and Maria Veress, "A kompetitiv árkepés es a tényárak 1981-83-ban," Kulgazdasag, (forthcoming).

Van Brabant, Jozef M., "Exchange Rates in Eastern Europe: Types, Derivation and Application," World Bank Staff Working Papers, in press.

Wolf, Thomas A., "Exchange-Rate Adjustments in Small Market and Centrally Planned Economies," Journal of Comparative Economics, 2(3), (September 1978), pp. 226-45.

_____, "On The Adjustment of Centrally Planned Economies to External Economic Disturbances," in P. Marer and J.M. Montias (eds.), East European Integration and East-West Trade, Bloomington: Indiana Univ. Press, (1980), pp. 86-111.

_____, "Foreign Trade Prices and Other Determinants of Hungarian Manufactures Exports to the West," unpublished manuscript, (1981).

Wolf, Thomas A., (1985a) "Economic Stabilization in Planned Economies: Toward an Analytical Framework," Staff Papers, International Monetary Fund, 32 (1), March, pp. 78-131.

_____, (1985b) "Exchange Rate Systems and Adjustment in Planned Economies," Staff Papers, International Monetary Fund, 32 (2), June, pp. 211-247.