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WP/91/31

INTERNATIONAL MONETARY FUND

Research Department

**A Note on Dual Foreign Exchange Markets with Official Rationing:
Predetermined Versus Floating Official Exchange Rate**

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March 1991

Abstract

This paper examines the relationship between the long run rate of inflation and the allocation of transactions between markets in economies that operate dual exchange market regimes and ration foreign exchange in the official market. It shows that wider access of importers to the official market, and wider access of exporters to the free market, are associated with higher rates of inflation and vice versa. The direction of causality among the various variables, and thus the effects of economic policies, depend on whether the official exchange rate is predetermined or floating.

JEL Classification Numbers:

431

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Summary

This paper examines the relationship between the long-run rate of inflation and the allocation of transactions between markets in economies that operate dual exchange market regimes and ration foreign exchange in the official market. It considers two alternative official exchange rate policies. Under one of them, the authorities determine the official exchange rate exogenously, and the allocation of transactions adjusts endogenously so as to produce equality between demand and supply in the official market. In contrast, under the alternative policy the authorities determine the allocation of transactions exogenously, and the official exchange rate adjusts endogenously so as to produce equality between demand and supply in the official market.

The paper shows that, for both types of official exchange rate policy, a wider access of importers to the official market and a wider access of exporters to the free market require a higher rate of inflation, and vice versa. This occurs because in these regimes the fiscal deficit is financed by a combination of the inflation tax and the benefit that the public sector receives by importing at the official exchange rate while the average market price of traded goods is higher, reflecting the higher free exchange rate. A wider access of importers to the official market, or a higher access of exporters to the official market, implies that the official exchange rate must increase with respect to the free rate, thereby reducing the benefit that the public sector obtains from the dual system. These lower benefits require a compensatory increase in the inflation tax revenue, and thus an increase in the inflation rate.

Although this relationship is valid irrespective of the way in which the official exchange rate is determined, the variables under the control of the authorities differ according to whether the official rate is pre-determined or floating. The paper shows that the direction of causality among the various variables, and thus the effects of economic policies, differs across regimes.

I. Introduction

A number of developing countries operate dual foreign exchange market regimes, with an official market for some selected transactions, and a free market for the remaining transactions. The specific way in which the official market clears, however, varies among countries. In some cases, the authorities use their holdings of international reserves to absorb any discrepancy between demand and supply of foreign exchange at the officially determined exchange rate. In other cases, however, the authorities lack an adequate level of international reserves to use as a buffer stock, and therefore implement some rationing scheme in the official market. Under these schemes, the Central Bank sells during a given period only the foreign exchange that it buys within the same period, thereby keeping international reserves constant.

Experiences with rationing can generally be classified into two categories according to the mechanism used for pricing foreign exchange in the official market. Under one of those mechanisms, the authorities set the official exchange rate exogenously. Any discrepancy between demand and supply of foreign exchange at the predetermined exchange rate results in changes in the restrictions regarding participation of importers and exporters in the official market. For example, if there is an excess demand for foreign exchange the authorities may order exporters to surrender a higher proportion of their exports proceeds in the official market, or, more likely, the authorities may reduce the range of imports that have access to the official market. In contrast, under the alternative mechanism, the authorities determine the allocation of transactions between the markets exogenously, and let the official exchange rate be the clearing variable. Thus, any potential excess demand or supply in the official market is eliminated by endogenous changes in the official exchange rate.

The purpose of this paper is to examine some simple relationships between these two alternative rationing schemes in the official market, one involving a predetermined exchange rate and the other one a floating exchange rate. 1/ Previous explicit discussions of rationing have centered mainly on the case of a predetermined exchange rate. 2/ Although rationing with a floating exchange rate is equivalent to a dual system in which both rates are floating, previous papers on this topic have not focused on the relationships discussed here. 3/ The comparison presented in this paper is based on a particular type of model that has been used fruitfully to examine the experience of some developing countries with a

1/ A comparison between a system in which the official market clears through changes in international reserves with a predetermined exchange rate, and one in which the official market is subject to rationing with a predetermined exchange rate is presented in Lizondo (1990).

2/ See for example Nowak (1984), and Pinto (1986).

3/ Models of dual floating exchange rates are presented in Flood and Marion (1982, 1983), Aizenman (1986), and Froot and Obstfeld (1990).

predetermined official exchange rate. 1/ The version of the model presented below is useful for examining both the case of predetermined official exchange rate and floating official exchange rate. 2/

The principal result derived from this model is the existence of a tradeoff between the long run rate of inflation and the degree of access of importers to the official market, or the degree of access of exporters to the free market. 3/ A wider access of importers to the official market, and a wider access of exporters to the free market, implies a higher rate of inflation, and vice versa. Although this relationship is valid irrespectively of the mechanism used for determining the official exchange rate, the variables under the control of the authorities differ across regimes. If the official exchange rate is predetermined, the authorities control the long run rate of inflation, but they have to adjust endogenously the allocation of transactions between markets. In contrast, if the official exchange rate is floating, the authorities control the allocation of transactions between markets, but have no control over the endogenously determined rate of inflation. Because of this difference, any given policy will have different effects depending on the regime under consideration.

The rest of the paper is organized as follows. Section II presents the model and derives the conditions for long run equilibrium. Section III examines the similarities and differences between both rationing schemes, and compares the effects of some economic policies across regimes. Section IV presents some concluding remarks.

II. The Model

1. Production, consumption, exchange rates, and prices

Consider an economy that operates a dual exchange market regime, with an official market managed by the Central Bank and a free market. Exporters are required to surrender in the official market the foreign exchange proceeds from a selected group of exports. Part of those proceeds are used to pay for public sector imports, and the rest is sold back to the private sector to pay for a selected group of its imports. Export proceeds not

1/ This type of model was developed and applied to Ghana in Pinto (1986), and was later applied to Bolivia in Kharas and Pinto (1989). See also Pinto (1990).

2/ The experience of some developing countries with floating official exchange rates is described in Quirk et al. (1987), and Kimaro (1988). For a description of the exchange regime of a particular country, see International Monetary Fund (1990).

3/ This is a variant of the tradeoff between the long run rate of inflation and the level of the spread, highlighted in Pinto (1986) and related papers. The relationship between Pinto's results and the results in this paper are explained below.

required to be surrendered in the official market can be sold in the free market. Similarly, foreign exchange for payments of imports not allowed in the official market can be bought in the free market. Purchases and sales of foreign exchange for portfolio reasons must also be effected in the free market.

The economy produces and consumes tradeable goods. 1/ Total output, denoted by y , is fixed and evenly distributed across a continuum of goods indexed between zero and unity. Private sector expenditure is also evenly distributed across a continuum of goods indexed between zero and unity. Total output is exported, and thus goods consumed by both the private sector and the public sector are imported. Proceeds from exports of goods indexed between $(1-v)$ and unity must be surrendered in the official market, while the rest can be sold in the free market. Similarly, foreign exchange for import payments for goods indexed between $(1-u)$ and unity can be bought in the official market, while the rest must be bought in the free market. 2/

The economy is assumed to be small in world markets, there is no foreign inflation, and units are defined so that the foreign currency price of all goods is unity. Therefore, the domestic currency price of goods imported through the official market is equal to the official exchange rate, denoted by e , while the price of the remaining private sector imports is equal to the free exchange rate, denoted by x . 3/ The domestic price level is thus defined by

$$(1) \quad P = e(1-u) x^u$$

2. Assets

There are two noninterest bearing assets, domestic money, denoted by M , and foreign money, denoted by f . The private sector holds domestic money in order to make transactions. Since the alternative is to hold foreign money, and the exchange of currencies for portfolio reasons must be effected in the free market, the demand for domestic money is assumed to depend on the expected rate of depreciation of the domestic currency in the free market.

$$(2) \quad m = \lambda(\dot{x}/x) = \lambda[(\dot{s}/s) + \pi] \quad \lambda'(\cdot) < 0$$

1/ Including nontradeable goods would not alter the main conclusions of the paper.

2/ It is assumed that the separation of the markets is strictly enforced, so that the actual allocation of transactions is equal to the legal allocation of transactions.

3/ The exchange rate is defined as the domestic currency price of foreign currency.

where $m=(M/P)$ is the real stock of domestic money, $s=(x/e)$ is one plus the spread between the free and the official exchange rate, $\pi=(\dot{e}/e)$ is the rate of depreciation of the official exchange rate, and a dot over a variable denotes its derivative with respect to time. ^{1/}

Assuming, for simplicity, that the banking system is composed only of a Central Bank, the nominal stock of domestic money evolves according to

$$(3) \quad \dot{M} = \dot{D} + e \dot{r}$$

where D is the nominal stock of domestic credit, and r is the stock of international reserves in terms of foreign currency. Domestic credit is used to finance the public sector deficit. Thus,

$$(4) \quad \dot{D} = e g - t P$$

where g denotes public sector expenditure (imports) in terms of traded goods, and t denotes tax revenue, assumed to be fixed in real terms.

Since the Central Bank implements a rationing scheme under which all export proceeds surrendered in the official market are used to pay for public sector and private sector imports, international reserves are constant. Thus, using (3), (4), and the definition of m ,

$$(5) \quad \dot{m} = (e/P) g - t - (\dot{P}/P) m$$

Equation (5) describes the evolution of the real stock of domestic money. Private sector's holdings of foreign money, on the other hand, evolve according to the trade balance in the free market. A trade surplus implies an increase in f , while a trade deficit implies a decline in f . Following the official rules for allocation of transactions between the markets, exports in the free market are equal to $(v y)$. Private sector expenditure on imports in the free market is a fraction u of total expenditure on imports. Assuming that the private sector spends a constant fraction a of its wealth, imports in the free market are equal to $[u a (M+xf)/x]$. Therefore,

$$(6) \quad \dot{f} = v y - u a (m s^{u-1} + f)$$

^{1/} Expected and actual rates of depreciation are taken to be equivalent because the discussion focuses on long run results.

There is an additional condition that must hold under rationing in the official market. Exports channeled through this market must be equal to public sector imports plus private sector imports channeled through this market. Exports in the official market are equal to $[(1-v) y]$, while private sector imports in the official market are equal to $[(1-u) a (M+xf)/e]$. Thus,

$$(7) \quad (1-v) y = g + (1-u) a (m s^u + f s)$$

Equation (7) ensures consistency in the rationing scheme for foreign exchange in the official market, and must hold irrespectively of the mechanism used for determining the official exchange rate. The way in which this consistency is brought about, however, does depend on the particular mechanism used for the official exchange rate. When this exchange rate is floating, the authorities determine exogenously the type of exports whose proceeds must be surrendered in the official market, and the type of imports that have access to foreign exchange in the official market. Equality between supply and demand, including demand for public sector imports, is brought about by endogenous changes in the official exchange rate. In contrast, when the official exchange rate is predetermined it cannot adjust to produce equality between supply and demand. Therefore, this equality is brought about by endogenous modifications in the allocation of transactions between markets, that is, by the authorities endogenously modifying the range of exports and/or imports channeled through the official market. ^{1/} This difference, regarding the way in which consistency is achieved under the two alternative official exchange rate regimes, accounts for the differences in the effects of economic policies under those regimes, as explained below in Section III.

3. Long run equilibrium

The discussion focuses on situations of long run equilibrium, where all real variables remain constant, and all nominal variables change at the same rate. Thus, in long run equilibrium $m = f = s = 0$, and both exchange rates,

^{1/} Notice that if the authorities do not modify the allocation of transactions formally, some modification will take place informally anyway. For example, assume there is an excess demand for foreign exchange in the official market and the authorities do not modify the range of imports that have access to this market, but allocate foreign exchange on a first-come first-served basis. As a result, some of the imports that formally have access to the official market will have to be channeled through the free market. The final effect is equivalent to the authorities having restricted formally the range of imports allowed in the official market.

and therefore the price level, increase at the rate π . 1/ Under these conditions, equations (2), (5), and (6), imply

$$(8) \quad m = \lambda(\pi)$$

$$(9) \quad \pi m + t = g / s^u$$

$$(10) \quad v y = u a (m s^{u-1} + f)$$

Equation (8) indicates equilibrium in the money market for a constant rate of depreciation (and inflation) equal to π . Equation (9) describes the financing of public sector expenditure g . There are three sources of financing, the inflation tax πm , tax revenue t , and implicit financing through the "spread factor" s^u [$=(P/e)$]. Since the public sector pays the official exchange rate e for its imports, and the average price of traded goods in the economy is P , there is an implicit financing obtained by the operation of the dual regime. 2/ The higher the spread factor s^u , the higher is the implicit financing. 3/ Equation (10) presents the condition for a balanced trade account in the free market.

Since equation (7), representing consistency of the rationing scheme in the official market, must also hold, (7) can be combined with (10) to obtain

$$(11) \quad s = u [(1-v) y - g] / (1-u) v y$$

1/ A long run equilibrium requires a long run constant rate of depreciation π . Under a floating official exchange rate, a long run constant π arises endogenously as a solution of the model. Under a predetermined official exchange rate, however, the value of π , both in the short run and in the long run, depends on the specific rule followed by the authorities to determine the official exchange rate. In what follows, it is assumed that the authorities choose a constant rate of depreciation π . Thus, by a predetermined exchange rate it is meant a crawling exchange rate. This clearly includes the case of a fixed exchange rate in the particular case that $\pi=0$.

2/ Throughout the paper it is assumed that the free exchange rate is depreciated with respect to the official exchange rate, so that $s > 1$, and thus $P > e$.

3/ The third source of financing may be identified more clearly if equation (9) is rewritten with the right hand side showing public sector expenditure valued at the average market price of traded goods. This results in (9') $\pi m + t + (1-s^{-u}) g = g$. Clearly, the higher the spread factor s^u , the higher the third source of financing.

Therefore, the spread factor is equal to

$$(12) \quad s^u = \{ u [(1-v) y - g] / (1-u) v y \}^u$$

Equations (8), (9), and (12), can be used to examine the relationships between a system with a predetermined official exchange rate, and a system with a floating official exchange rate. ^{1/}

III. Predetermined Versus Floating Official Exchange Rate

1. Common features in both regimes

The structure of the economy is basically the same under both mechanism for determining the official exchange rate. The central feature of both types of dual system is that the fraction of public sector expenditure not financed by tax revenue must be financed by some combination of inflation tax revenue and the spread factor (equation (9)). The inflation tax revenue is related to the rate of depreciation of the official exchange rate (equation (8)). The spread factor, on the other hand, is related to the allocation of transactions between the two foreign exchange markets (equation (12)).

These three basic relationships are represented by the solid curves in Figure 1, in both panels, (A) and (B). The NW quadrant describes the relationship between the rate of inflation, on the horizontal axis, and the inflation tax revenue, on the vertical axis (equation (8)). The higher is

^{1/} Equation (9) can be used to illustrate why Pinto (1986) derives a tradeoff between the rate of inflation and the spread, instead of a tradeoff between the rate of inflation and the allocation of transactions between markets. In Pinto's model, it is assumed that there is no separation between the markets. Those buying foreign exchange in the official market can sell it (illegally) in the free market, so that the domestic price of all traded goods reflect the free exchange rate. This is equivalent to assuming $u=1$ in (9), which would then indicate a relationship between the rate of inflation and the spread, instead of the rate of inflation and the spread factor. While in the model in this paper the allocation of transactions is connected to the spread factor (equation (12)), and thus to the rate of inflation (through equation (9)), in Pinto's model the legal allocation of transactions is irrelevant because there is no actual separation between the markets. Notice also, that making the assumption of no separation in the case of a floating official exchange rate would imply necessarily a zero spread because there would be perfect arbitrage between markets.

the rate of inflation, the higher is the resulting inflation tax revenue. ^{1/} The NE quadrant describes the relationship between the inflation tax revenue and the spread factor, for given levels of public sector expenditure and tax revenue (equation (9)). The higher is the inflation tax revenue, the lower is the spread factor needed to finance a given deficit, and vice versa. An increase in taxes shifts this curve towards the origin because it reduces the deficit to be financed. In contrast, an increase in public sector expenditure shifts this curve away from the origin because it increases the deficit to be financed.

The SE quadrant describes the relationship between the spread factor s^u and the fraction of private sector imports that must be channeled through the free market u , for a given level of public sector expenditure g and a given fraction of exports channeled through the free market v (equation (12)). A higher fraction of imports in the free market implies a higher spread factor for two reasons. First, from equation (11), a higher u implies a higher spread. This is because a transfer of imports (foreign exchange demand) from the official to the free market requires an increase in the relative price of foreign exchange in the free market with respect to the official market, that is, a higher spread. The second reason for the increase in the spread factor is the direct effect of u for a given spread. The higher is u , the higher is the weight that goods imported through the free market have on the price level, and therefore the higher is the benefit received by the public sector for being able to import its goods through the official market.

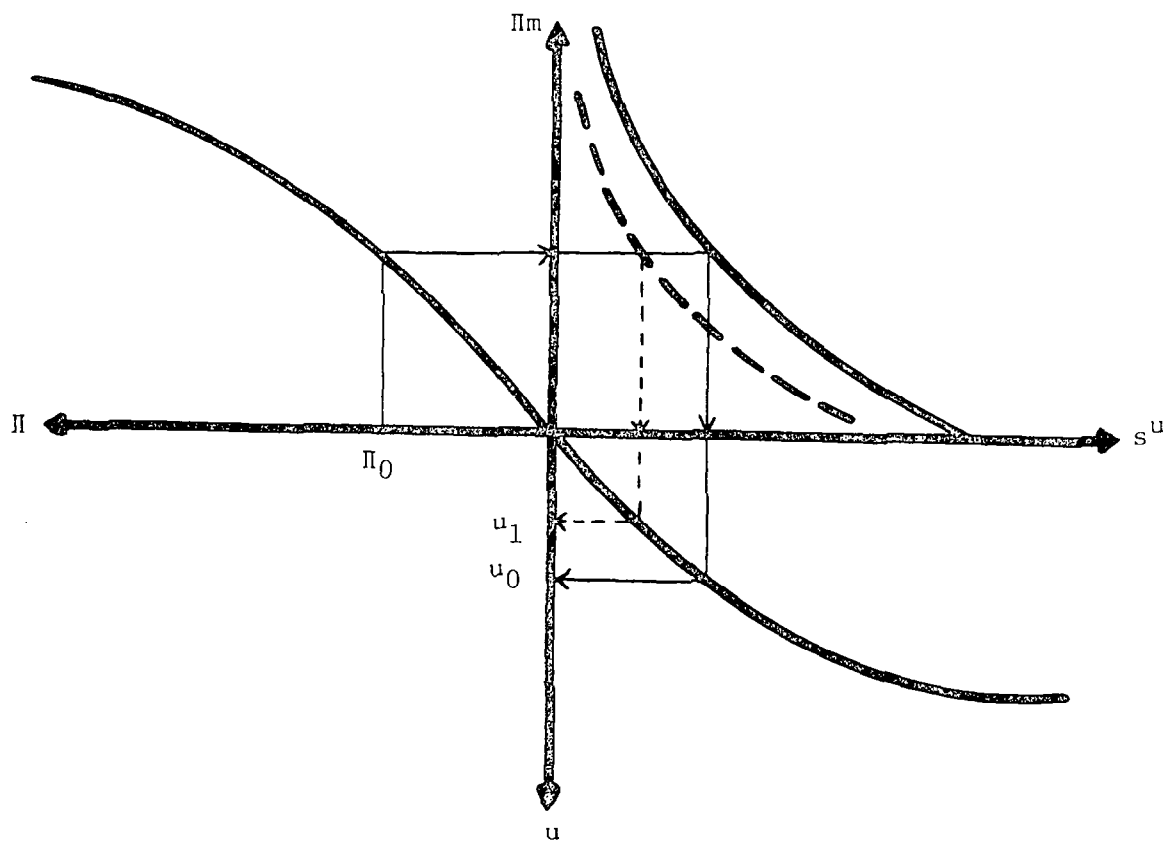
An increase in v shifts the curve in the SE quadrant downwards because with less export proceeds required to be surrendered in the official market, a lower fraction of private sector imports can be channeled through this market. Similarly, an increase in public sector imports also shifts this curve downwards. The additional foreign exchange that needs to be allocated in the official market for these higher public sector imports come at the expense of some private sector imports, which must be transferred to the free market.

The SE quadrant describes the relationship between the spread factor and u , for a given v , but a similar relationship exists between the spread factor and $(1-v)$, for a given u . In other words, a higher spread factor is consistent with both a higher fraction of imports in the free market u , and a higher fraction of exports in the official market $(1-v)$, (equation (12)). Therefore, all the conclusions below regarding the effect of policies on the fraction of imports channeled through the free market (for a given allocation of exports), can also be applied to the fraction of exports channeled through the official market (for a given allocation of imports).

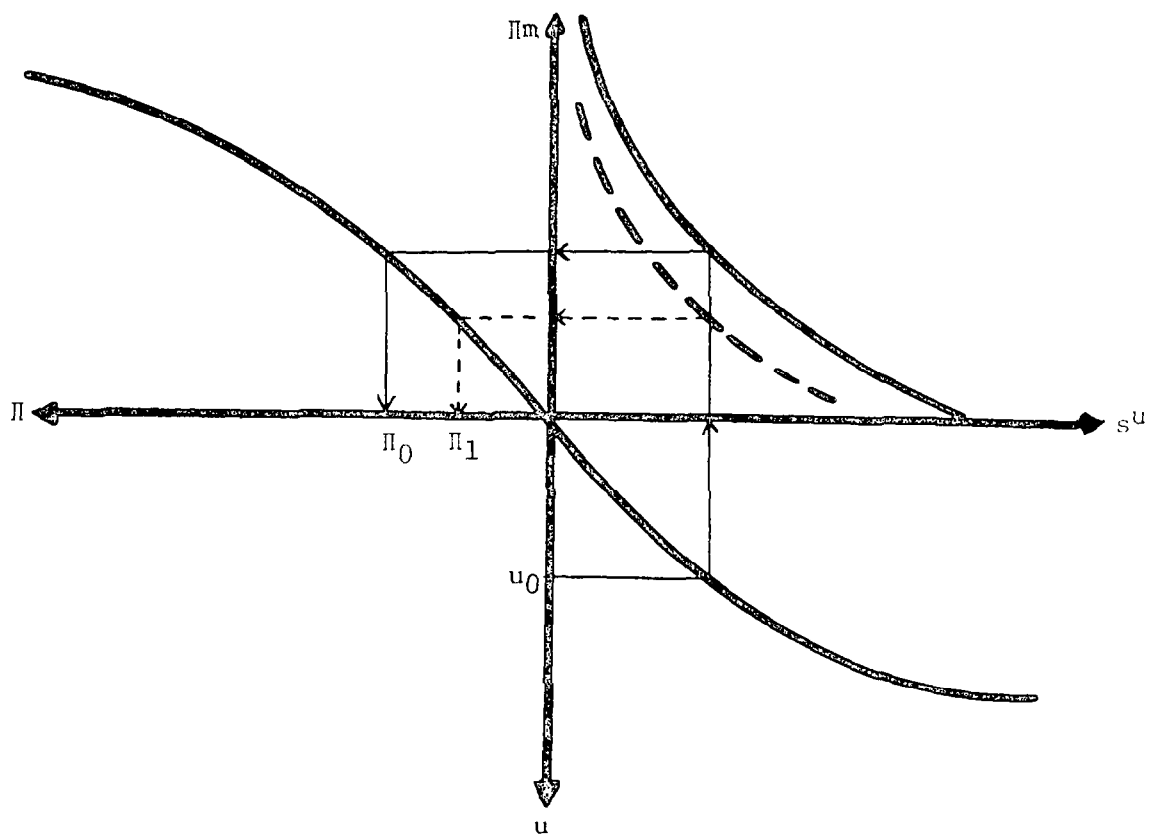
^{1/} This assumes that the elasticity of the demand for money is lower than unity for any rate of inflation. The results for the case of a demand for money with an elasticity higher than unity for a certain range of the rate of inflation can be readily derived from the discussion below.

Figure 1. Increase in Taxes

A)



B)



In fact, the authorities have two instruments regarding the allocation of transactions between markets, u and v . If they need to modify the allocation of transactions so as to make the rationing system consistent with other policies, they can use any of these two instruments, or a combination of both. For simplicity, the discussion below focuses on adjustments in u .

2. Differences between regimes

Although the relationships described above hold irrespectively of the mechanism used to determine the official exchange rate, there is a fundamental difference between a predetermined and a floating official exchange rate regarding the variables under the control of the authorities. In a predetermined official rate system, the authorities control the rate of depreciation of the official exchange rate, and therefore the long run rate of inflation. However, excess demand or supply of foreign exchange in the official market at the predetermined exchange rate must be eliminated by modifying endogenously the allocation of transactions between the markets. In contrast, in a floating official rate system the authorities control the allocation of transactions between the markets, and any potential excess demand or supply in the official market is eliminated by endogenous changes in the official exchange rate.

This difference between the two systems can be thought of as a difference in the sequencing of determination of the various variables. Panel (A) in Figure 1 describes the sequencing for the case of a predetermined official rate, while panel (B) describes the sequencing for a floating official rate.

With a crawling official rate the chain of causality moves clockwise starting from the NW quadrant. The authorities set the rate of crawl, and thus the long run rate of inflation, which determines the revenue from the inflation tax. The revenue from the inflation tax determines the spread factor needed to finance the given level of public sector expenditure, for a given level of revenue from other taxes. In turn, the spread factor determines the allocation of transactions between the exchange markets that makes the rationing scheme consistent with the rest of economic policies.

With a floating official rate the chain of causality moves counterclockwise starting from the SE quadrant. The authorities decide the allocation of transactions between the markets, which determines the spread consistent with this allocation, and thus the corresponding spread factor. This spread factor determines the inflation tax revenue needed to finance the given level of public sector expenditure, for a given level of revenue from other taxes. In turn, the required inflation tax revenue determines the corresponding inflation rate, and thus the rate of depreciation of the official exchange rate.

In both dual systems with official rationing there is a tradeoff between the degree of restriction in the access of importers to the official market (the level of u) and the rate of inflation, with lower restrictions associated with higher inflation and vice versa. ^{1/} This result (not shown) can be derived from Figure 1. In the crawling official rate system, a higher rate of crawl (and thus a higher rate of inflation) increases the revenue from the inflation tax. This results in a lower spread factor needed to finance public sector expenditure. This lower spread factor is consistent with lower restrictions in the access of importers to the official market, that is a lower u . ^{2/} In the floating official rate system the causality runs in the opposite direction. Lower restrictions in the access of importers to the official market implies an increase in the demand for foreign exchange in the official market with respect to the free market, which reduces the spread. The lower spread, together with a lower u , imply a lower spread factor. This requires a higher revenue from the inflation tax to finance public sector expenditure, thereby resulting in a higher rate of inflation.

3. Effects of policies

The difference in sequencing examined previously imply that, despite their identical basic structure, both systems will respond differently to changes in some policy variables. The common tradeoff explained above determines the relationship between the response of the degree of access to the official market in one system, and the response of the rate of inflation in the other. This is illustrated for an increase in taxes, an increase of public sector expenditure, and a transfer of exports from the official to the free market, in Figures 1, 2, and 3, respectively. In all these figures, the broken lines indicate the shift of the various curves for each of the policy changes.

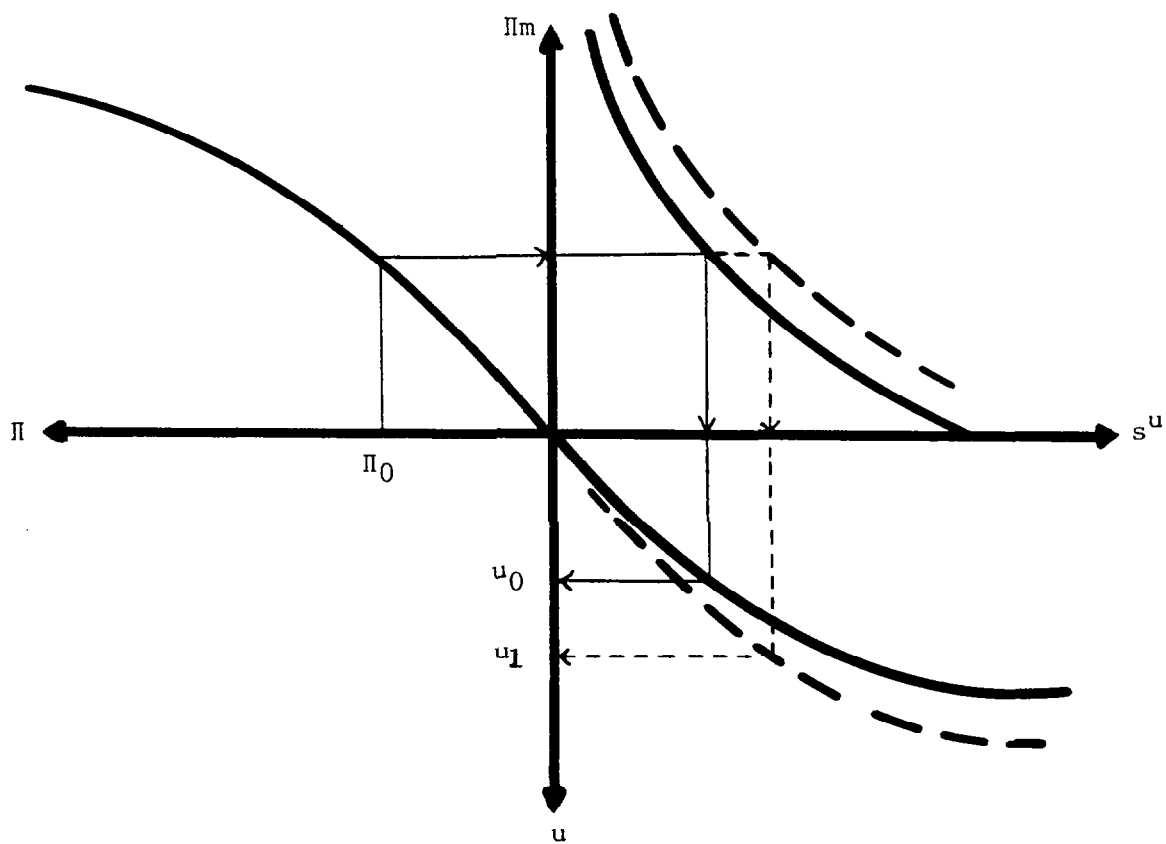
An increase in taxes reduces the deficit that must be financed by a combination of inflation tax revenue and spread factor. With a crawling official rate, the inflation tax revenue stays constant, so the spread factor declines. This decline in the spread factor allows for additional imports being channeled through the official market. With a floating official rate, the spread factor stays constant, so the reduction in the public sector deficit requires lower inflation tax revenue, thereby resulting in a lower rate of inflation. Notice that the effect on the

^{1/} As mentioned previously, a similar tradeoff exists between the degree of restriction in the access of exporters to the free market (the level of $(1-v)$) and the rate of inflation.

^{2/} Since the increase in the rate of inflation reduces u , it implies not only a lower spread factor, but also a lower spread (see equations (11) and (12)). This lower spread is consistent with a lower u because by transferring imports (demand for foreign exchange) from the free to the official market the relative price of foreign exchange in the free market with respect to the official market must decline.

Figure 2. Increase in Public Sector Expenditure

A)



B)

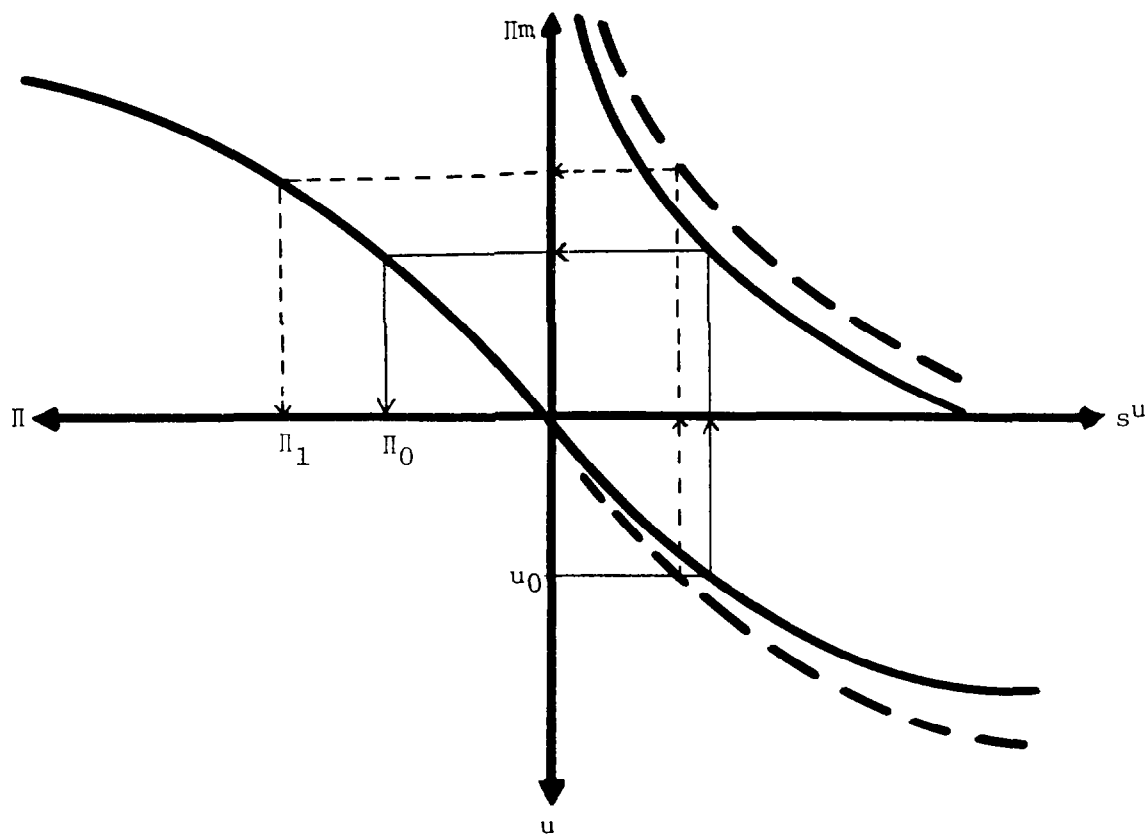
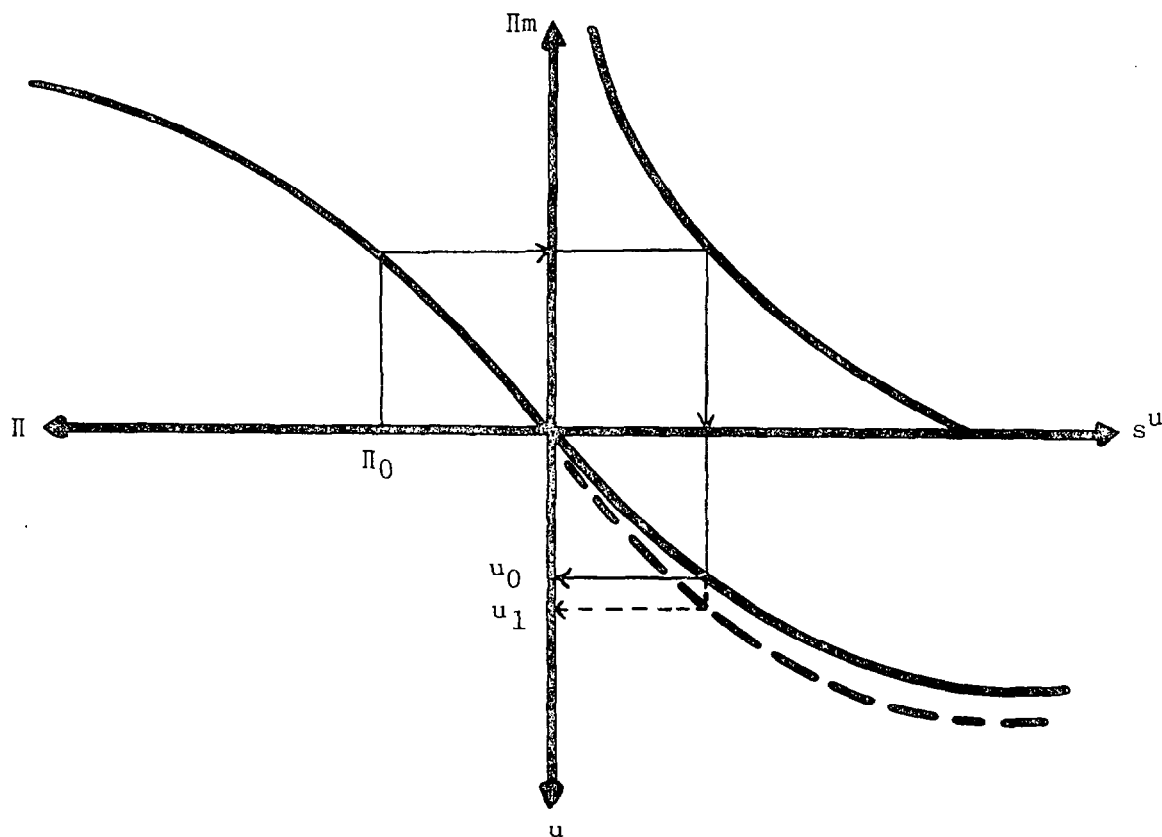
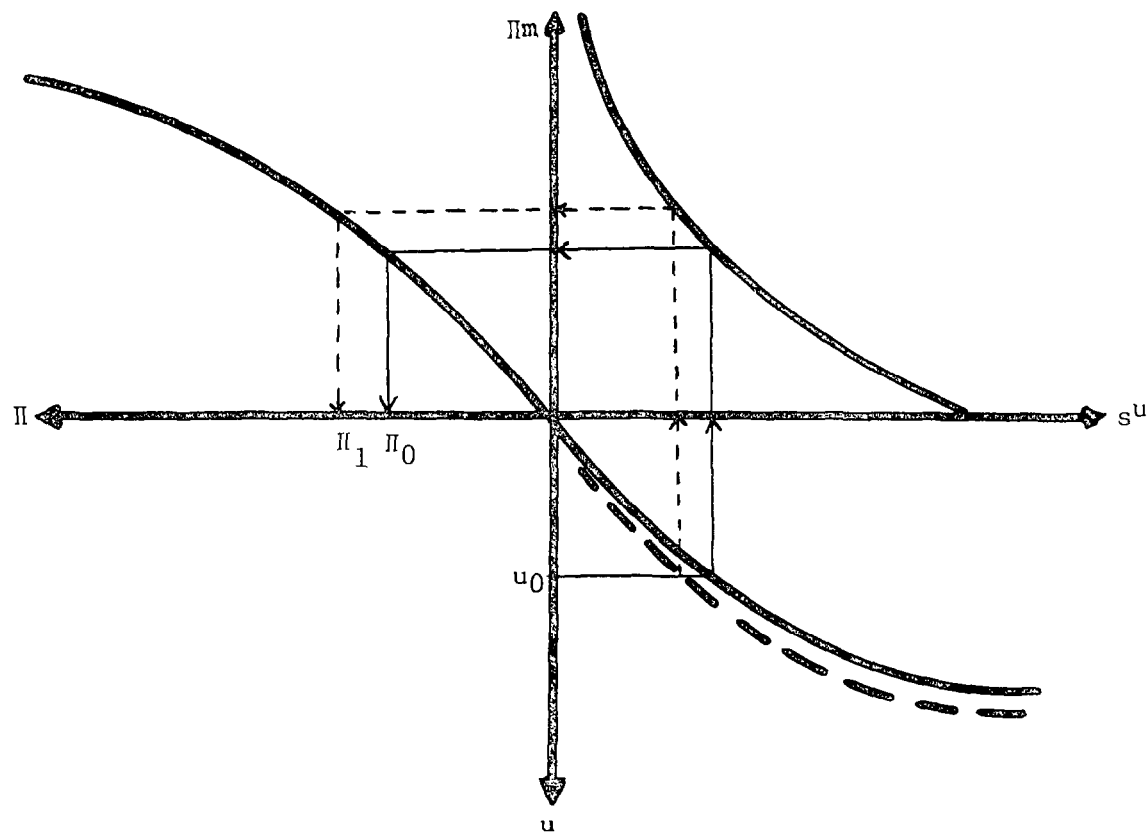


Figure 3. Transfer of Exports from the Office to the Free Market

A)



B)



spread differs between regimes. Under a crawling official rate the spread declines, while under a floating official rate the spread stays constant.

An increase in public sector expenditure increases the deficit that must be financed by a combination of inflation tax revenue and spread factor. In addition, it increases directly the pressures in the official exchange market by requiring more foreign exchange to pay for the higher public sector imports. With a crawling official rate, both factors lead to a more restricted access of private sector importers to the official market, a higher u . With a floating official rate, both factors lead to a higher inflation tax revenue, and thus to a higher rate of inflation. The effect on the spread also differs between regimes in this case. The spread declines with an official floating rate because the additional demand in the official market must increase the relative price of foreign exchange in the official market with respect to the free market. With a crawling official rate the effect on the spread is ambiguous. On the one hand there is an additional demand in the official market due to the increase in public sector imports, which tends to reduce the spread. On the other hand, there is a transfer of demand from the official to the free market due to the endogenous increase in u , which tends to increase the spread. Depending on which of those forces is stronger, the spread declines or increases.

A transfer of exports from the official to the free market, an increase in v , does not affect the deficit to be financed, but reduces the availability of foreign exchange in the official market. With a crawling official rate, this change is compensated by a transfer of imports from the official to the free market, that is, by an increase in u . Since the spread factor is not affected, the increase in u must be accompanied by a fall in the spread. With a floating official rate, the transfer of exports from the official to the free market also reduces the spread due to the reduction in the supply of foreign exchange in the official market with respect to the free market. The lower spread implies a lower spread factor. This requires a higher inflation tax revenue, and thus a higher rate of inflation.

IV. Concluding Remarks

In economies with dual foreign exchange markets and rationing in the official market, there is a relationship between the long run rate of inflation and the allocation of transactions between the markets that insures consistency in the rationing scheme. A wider access of importers to the official market, or a wider access of exporters to the free market, requires a higher rate of inflation, and vice versa. The reason is that in these regimes the fiscal deficit is financed by a combination of the inflation tax, and the benefit that the public sector receives by importing at the official exchange rate while the average market price of traded goods is higher in reflection of the free exchange rate. A wider access of importers to the official market, and a wider access of exporters to the official market, imply that the official exchange rate must increase with

respect to the free rate, thereby reducing the benefit that the public sector obtains from the dual system. These lower benefits require a compensatory increase in the inflation tax revenue, and thus an increase in the inflation rate.

Although this relationship is valid irrespectively of the way in which the official exchange rate is determined, the variables under the control of the authorities differ according to whether the official rate is crawling or floating. This implies that the direction of causality among the various variables, and thus the effects of economic policies, differ across regimes.

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