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ADJUSTMENT WITH A FIXED EXCHANGE RATE:  
CAMEROON, COTE d'IVOIRE AND SENEGAL

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## Abstract

As members of the CFA Franc Zone, Cameroon, Côte d'Ivoire and Senegal cannot use the nominal exchange rate as a tool of macroeconomic adjustment. We consider these countries' responses to the commodity and oil price shocks of the 1970s in light of this and other institutional constraints. Using a two-sector model we show there exist instruments that, in principle, permit the real exchange rate depreciation necessary for adjusting to macroeconomic imbalances. We interpret the very different adjustment experiences of the three countries (despite a common economic structure and institutional setting) in terms of different uses of these instruments. Alternative assumptions about the labor market leave the qualitative nature of the results unaltered. Statistical analysis of data from the three countries confirms the model's linking of the current account and real exchange rate with the instruments of adjustment.

ADJUSTMENT WITH A FIXED EXCHANGE RATE  
CAMEROON, COTE d'IVOIRE AND SENEGAL

I. Introduction

Like most developing countries, Cameroon, Côte d'Ivoire and Senegal were subjected to the external shocks of commodity booms and oil price hikes of the 1970s. As members of the CFA Zone (a monetary union with France) however, these countries could not devalue their nominal exchange rate to adjust to the macroeconomic imbalances that followed. The purpose of this paper is to interpret the adjustment experiences of these three countries in light of this and other institutional constraints.

The cases of Cameroon, Côte d'Ivoire, and Senegal are particularly interesting for another reason. In addition to sharing a common institutional framework for adjustment, they have a similar economic structure: all three are largely primary producers, with a small industrial base and service sector fueled by public expenditures. Yet the outcome of their adjustment experiences were quite different. By the early 1980s, Cameroon was enjoying low foreign debt and steady, 4 percent growth in GDP, while Côte d'Ivoire and Senegal were experiencing high debt-service payments and declining GDP.

Our major conclusion is that membership in the CFA Zone does not, in principle, impede adjustment to macroeconomic imbalances. There exist enough instruments to achieve, for example, the real exchange rate depreciation that is necessary to redress a current account deficit. However, in practice, these instruments are not always used, or used in the wrong direction, and this is why the outcomes were different in the three countries.

To make these points, we first describe in the remainder of this Introduction the rules of CFA Zone membership. Next, we look closely at the

adjustment to shocks by Cameroon, Côte d'Ivoire and Senegal, using a set of common "adjustment indicators" for 1973-84 (Section II). These serve as the backdrop to a model of adjustment-with-a-fixed-exchange-rate presented in Section III. The model captures the distinctive features of CFA Zone economies as well as the instruments of adjustment to which they have access. While these countries cannot effect a nominal devaluation, the model shows how a real devaluation can be achieved by a reduction in government expenditure or a change in commercial policy. The roles of wage rigidity and unemployment are highlighted in the analysis. In Section IV, the model is tested using data from Cameroon, Côte d'Ivoire and Senegal. Conclusions follow in Section V.

The CFA Zone consists of two monetary unions, the Union Monétaire Ouest-Africaine (UMOA) and the members of the Banque des Etats de l'Afrique Centrale (BEAC). Participation in the Zone sets its members apart from most other developing countries in at least three ways. <sup>1/</sup>

Monetary Integration: Member countries pool 65 percent of their foreign exchange reserves with the French treasury. Each union's central bank sets monetary policy based on its overall asset position, and all bank members face the same interest rate. <sup>2/</sup> The central bank influences an individual country's monetary position by imposing country-specific credit constraints and limiting each country's central government's borrowing to 20 percent of its previous year's fiscal receipts. <sup>3/</sup> By pooling reserves, the countries avoid some of the seignorage costs of holding reserves.

Currency convertibility: The CFA Franc is convertible since it is guaranteed by the French Franc (FF), itself a convertible currency. Each country has an operations account with the French treasury which it can overdraw at a graduated interest rate that rises to the Bank of France's rediscount rate. There are no foreign exchange implications for transactions among Zone members. Convertibility does, however, have implications for asset choice by residents and, in the longer run, for foreign direct investment.

Fixed exchange rate: The CFA Franc is pegged to the French Franc at an exchange rate (50 CFAF = 1 FF) that has remained

unchanged since 1948. Parity adjustment requires unanimous agreement among Zone members. Effectively, CFA countries cannot use nominal devaluation of the exchange rate as an instrument of macroeconomic adjustment.

Although a type of CFA Franc had been in use during the colonial era, the two Central Banks were created when the majority of the members received their independence from France. In its early stages, the CFA Zone was designed as a means of providing balance of payments credit to these emerging nations. In addition, it was felt that a common and stable exchange rate would attract foreign investment into these countries. Over the long run, membership in the Zone has induced a sense of monetary and fiscal discipline, damping the "stop-go" cycles observed in many developing countries. Nevertheless, despite the general consensus that the monetary union has been working fairly well and that its members have probably fared better than they would have in its absence, concern has recently been raised that adjustments to macroeconomic imbalances have not been as prompt and complete as desirable, as sustained periods of real exchange rate appreciation have been observed among many Zone members.

Indeed, as a result of the turbulent 1970s, many CFA countries were experiencing macroeconomic "crises" in the early 1980s. Senegal and Côte d'Ivoire -- the two largest UMOA members -- had huge current account and public sector deficits that could in turn lead to debilitating debt-service payments in the future. Cameroon had become an oil exporter and was running sizeable current account surpluses. Some observers began questioning whether the particular nature of the CFA Zone prevented its members from adjusting their economies to these dramatic changes. To assess this question, we turn now to a detailed analysis of the adjustment process in Cameroon, Côte d'Ivoire and Senegal.

## II. Case Studies of Adjustment: Cameroon, Côte d'Ivoire and Senegal <sup>4/</sup>

All three countries experienced windfall gains from the commodity price increases of the mid-seventies. <sup>5/</sup> Cameroon and especially the Côte d'Ivoire benefitted from the coffee and cocoa boom of 1975-77; <sup>6/</sup> Senegal enjoyed a phosphates boom in 1973. <sup>7/</sup> In addition, Cameroon became a net oil exporter in 1980. Nevertheless, the adjustment experience of the three countries differed substantially. External borrowing patterns varied as did the relative contributions of the private and public sectors to the trade deficits or surpluses. As suggested by the model to be presented in Section III, the compositional differences in expenditures in turn differentially affected the external sector's competitiveness in each country.

To study the adjustment experience of each country, we use a matched set of adjustment indicators suggestive of the model to be presented below. These indicators measure the magnitude of the external shocks and help show how adjustment took place.

A first set of indicators is constructed from price indices. The commodity terms-of-trade index is supplemented by an index measuring the ratio of the domestic producer price to the world price for the two most important export commodities (coffee and cocoa for Cameroon and Côte d'Ivoire; phosphates and groundnuts for Senegal). The impact of the shock on the structure of production is measured by two real exchange rate indices. An index corresponding to the concept of the real exchange rate developed in the model of Section III is constructed from national accounts data (tradables include agriculture and industry and non-tradables account for the rest). A rise in the index signals an increase in the relative price of tradables. Second, a purchasing power parity index (PPPRER) is used to measure the

external competitiveness of manufacturing. This index is the ratio of an import-trade-weighted manufacturing wholesale price index (WPI) of trading partners to the domestic manufacturing WPI, so that a fall in the value of the index indicates a loss of manufacturing competitiveness. <sup>8/</sup>

The second set of adjustment indicators measures the sources of current account deficits and the composition of government expenditure. Observing that the current account, CA (expressed as a percentage of GDP) is equal to net domestic savings, we decompose it into its private and public sector components, i.e.

$$(2.1) \quad CA = S_p - I_p + S_g - I_g,$$

where  $S_p$ ,  $S_g$  are private and public savings, and  $I_p$ ,  $I_g$  are private and public investment. <sup>9/</sup> The usefulness of this decomposition derives not only from the fact that public sector deficits are, at least in principle, instruments of adjustment, but also from the observation that public sector spending is usually more intensive in non-tradables than private sector spending, an observation that will play a crucial role in the model of Section III. Finally public sector expenditure and investment patterns are tracked to see whether foreign borrowing is guided towards investment which, if it has a higher rate of return than the borrowing costs, would justify the increase in external debt.

## 2.1. Cameroon

Cameroon was subject to two major positive shocks in the late 1970s. First, the coffee and cocoa boom of 1975-76 led to windfall gains for the commodity stabilization fund (ONCPB), as producer prices were kept down during the boom. Second, the discovery of offshore oil, which went into production

in 1978, created a one-time opportunity for the government to accelerate its development program.

How did Cameroonian policymakers respond to these favorable shocks? Figure 1 summarizes the story. At the time of the 1976-77 coffee boom, production was at its lowest point since the 1960s. The "spending effect" of the boom was therefore not substantial. The real exchange rate did not appreciate (although its rate of depreciation slowed). Nevertheless, manufacturing competitiveness continued its downward slide, reflecting the country's inward-looking industrial policy, rather than the effects of the shock. After the boom, the government raised producer prices of both cash crops while simultaneously restraining government spending (between 1976 and 1980, both government expenditure and investment declined).

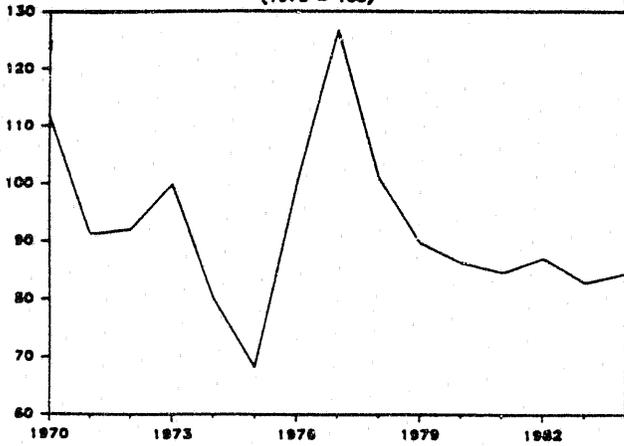
The post-1978 oil boom was of much greater significance, but elicited a similar response. While estimates vary, there is reason to believe that up to three-fourths of the oil revenues were saved abroad. <sup>10/</sup> This is confirmed by the sizeable current account surpluses recorded since 1978. In fact, the government has used the oil revenues to retire a small part of its foreign debt. Consequently, and in contrast to other oil exporters' experiences, Cameroon's real exchange rate continued to depreciate (even mining is excluded from tradables) in the first few years of the oil era (Figure 1). To the extent that this windfall was spent domestically, it was channeled into investment rather than consumption; while the share of public expenditure in GDP fell slightly between 1978 and 1982, that of public investment almost doubled.

It is often observed that a period of real exchange rate appreciation is followed by a consumption boom because the private sector perceives a

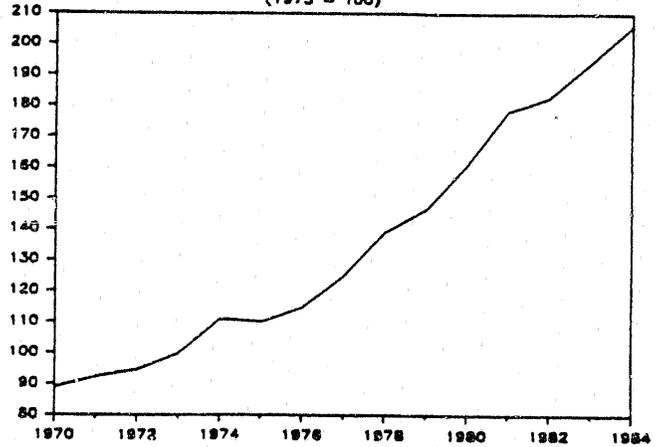
Figure 1

# Cameroon -- Adjustment Indicators

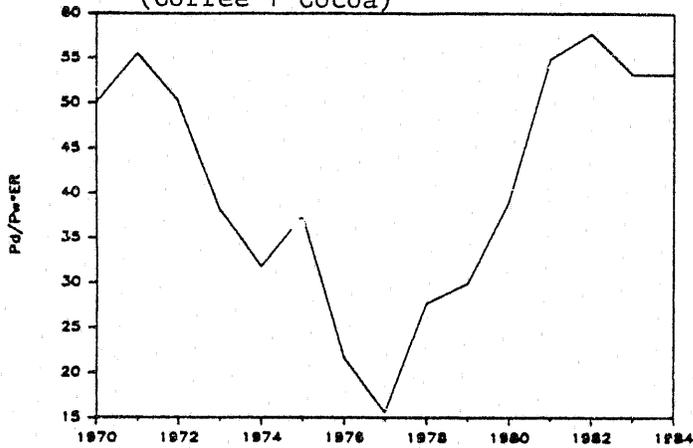
Terms of Trade  
(1973 = 100)



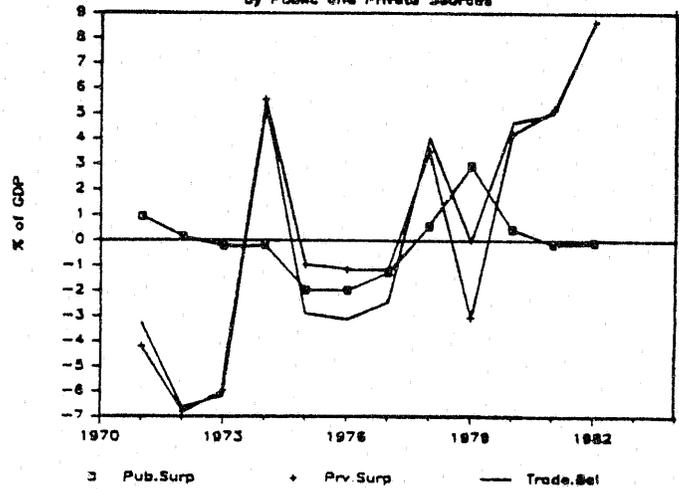
Real Gross Domestic Product  
(1973 = 100)



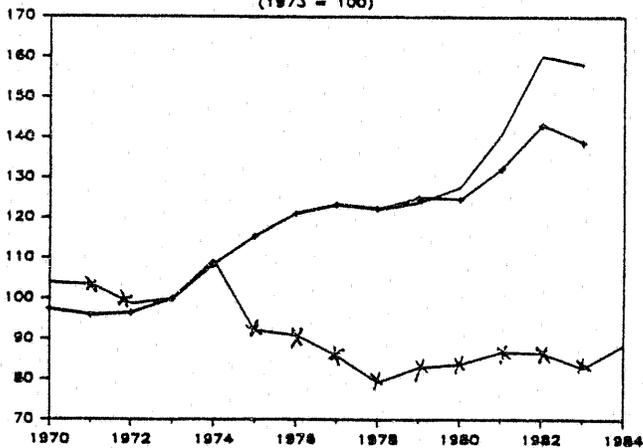
Ratio of Producer to World Price (%)  
(Coffee + Cocoa)



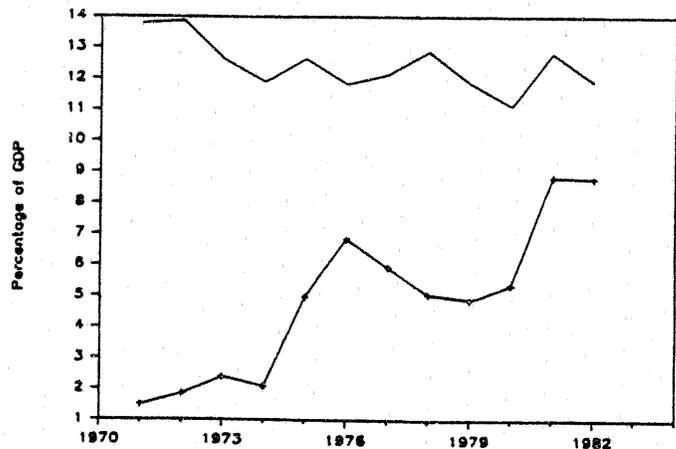
Decomposition of Net Domestic Savings  
by Public and Private Sources



Real Exchange Rates  
(1973 = 100)



Public Expenditure and Investment



— Pt/Pnt    + (Pt/Pnt)\_ex.mining    — Manufacturing Competitiveness Index (PPPRER)

— Exp/GDP    + Inv/GDP

permanent increase in wealth. This was avoided in Cameroon. That it was the private rather than the public net savings which rose simply reflects the system of budget accounting in Cameroon. The bulk of oil revenues and expenditures financed by them are entered in the compte hors budget, which is outside the official public financial accounts. The government has used its liquid position to raise the producer prices of cash crops, keeping the real exchange rate from appreciating and preventing the traditional export sector from contracting the "Dutch disease". The bias of the public expenditure mix towards investment rather than consumption has also been beneficial for future growth. Because money and real wages have risen, however, (the inevitable consequence of incomplete sterilization), manufacturing's international competitiveness has fallen, as shown by the PPPRER index.

## 2.2. Côte d'Ivoire

With coffee and cocoa accounting for 50 percent of Côte d'Ivoire's export earnings, the 1975-77 boom in these commodities led to a sharp, but short-lived, improvement in the overall terms of trade, which then deteriorated by a cumulative 37 percent between 1977 and 1980 (partly reflecting the 1979 oil price shock). As in Cameroon, the stabilization fund was the main recipient of the windfall gains between 1976 and 1978. The fund's income reached 16 percent of GDP at the peak of the coffee and cocoa boom in 1977.

Faced with these rapid changes in its external environment, Côte d'Ivoire chose a different adjustment path from Cameroon. The government accelerated the investment program it had started around 1974 (see Figure 2). The increase in public investment was mainly allocated to large projects with high unit costs, long gestation lags, and low foreign exchange earning

potential. Furthermore, and unlike the other two countries, the government increased the share of public expenditure in GDP immediately following the coffee boom. As suggested by the model in Section III, this expenditure pattern is consistent with the observed loss of manufacturing sector competitiveness.

When the commodity boom came to an end, the government continued its investment program, increasing the share of public investment in GDP. Public expenditure also continued to rise rapidly; its share in GDP rose from 15 percent in 1977 to a peak of 26 percent in 1982. <sup>11/</sup> By contrast, the private sector adjusted rapidly on both sides of the boom, as shown in the decomposition of the net domestic savings. Private expenditure surged immediately following the boom, but fell just as quickly when the terms of trade deteriorated.

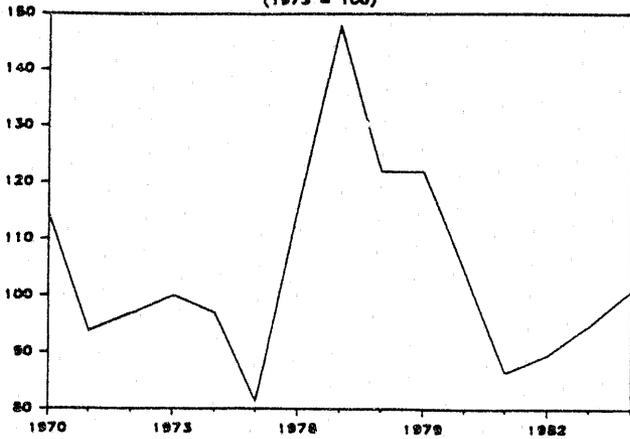
Part of the increase in public sector borrowing was financed internally (the money supply grew by 33 percent a year between 1975 and 1980), but much of it was external; the debt-service ratio (debt-service payments as a percentage of merchandise exports), which had averaged 8 percent during the 1965-75 period, quadrupled during 1980-85. When the time came to adjust in 1980, it was the private sector that generated the large surplus to service the increased external debt. Expenditure switching could have been achieved by reductions in the relative size of nontradable-intensive public expenditure; but little of this occurred. Instead the post-1980 adjustment was mostly achieved by private expenditure reduction and a consequent fall in GDP. This slow adjustment by the public sector contrasts sharply with Cameroon's experience.

Figure 2

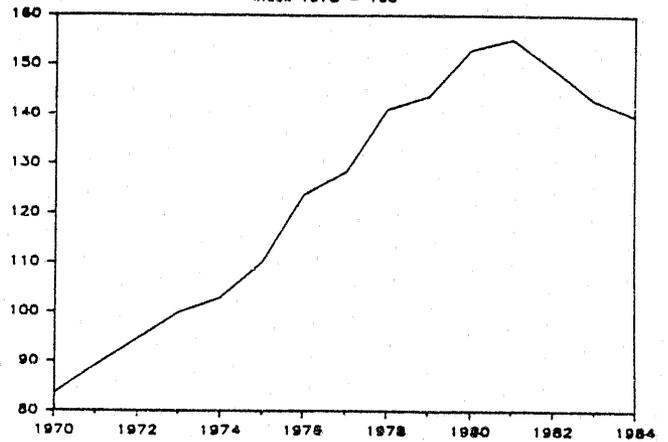
COTE d'IVOIRE

# -- Adjustment Indicators

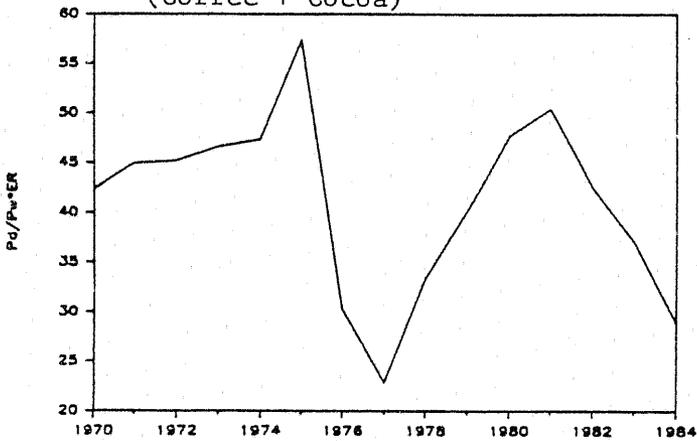
Terms of Trade  
(1973 = 100)



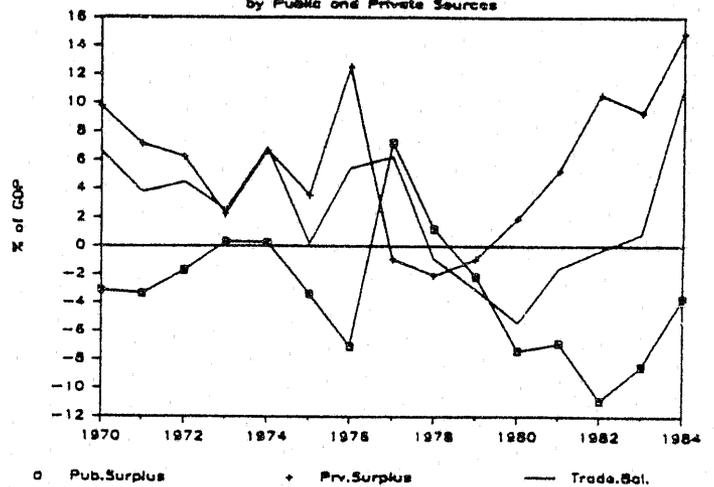
Real Gross Domestic Product  
Index 1973 = 100



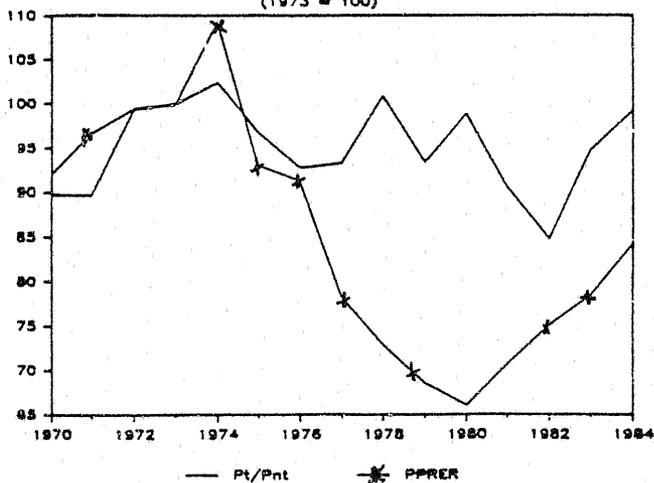
Ratio of Producer to World Price (%):  
(Coffee + Cocoa)



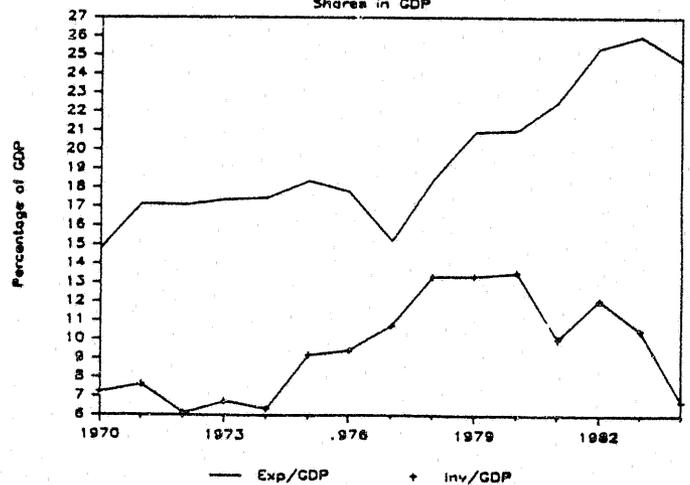
Decomposition of Net Domestic Savings  
by Public and Private Sources



Real Exchange Rates  
(1973 = 100)



Public Expenditure and Investment  
Shares in GDP



The implications of Côte d'Ivoire's public sector "boom" for the real exchange rate closely follows the predictions of the model of Section III: an initial real exchange rate appreciation between 1975 and 1977, accompanied by a sharper and sustained loss of competitiveness for the manufacturing sector (see Figure 2). The developments following the commodity boom did not seriously reduce the prices of tradables relative to nontradables, which would have helped achieve expenditure switching towards nontradables and hence restore external balance. Two factors contributed. First, when the boom ended, taxation of coffee and cocoa was reduced, raising the relative price of a component of the tradable sector. Second, public investment had a sizeable import component. Nevertheless, manufacturing lost competitiveness rapidly as the public sector deficit was financed by money creation. With a fixed exchange rate, expenditure switching would have been better achieved had the public sector curtailed its import-intensive expenditures. Unfortunately, this path was not followed.

### 2.3. Senegal

The 1970s were a particularly volatile period for the Senegalese economy. A phosphates boom in 1973-75 <sup>12/</sup> was followed by two droughts, in 1977-78 and 1979-80. Most observers agree, however, that the policies following these shocks, as much as the disturbances themselves, brought on the economic crisis that gripped the country in the 1980s.

The indicators in Figure 3 lend credence to this view. Soon after the phosphates boom, the real exchange rate appreciated because there was little taxation of windfall gains as in Cameroon and Côte d'Ivoire. Windfall revenues were spent domestically on consumption rather than investment, as the two lower charts on the right show. Net dissaving was dominated by the

private sector's contribution, and public investment's share in GDP stayed practically constant.

Moreover, when the terms of trade deteriorated after 1977, Senegal continued an expansionary policy of maintaining private consumption and expanding public consumption. The latter grew in real terms at an average rate of 6.7 percent a year during 1975-80, although per capita output fell by 0.6 percent a year during the period. This contributed to the continued real exchange rate appreciation. The government responded to the shocks of 1977/78 and 1979/80 by increasing consumer subsidies, public sector employment, and transfers to the parapublic sector. Meanwhile, incentives to produce exports showed little increase since the domestic prices of the main cash crops remained well below their world levels. The successive droughts and declining terms of trade called for an alternative adjustment path, namely for a real exchange rate depreciation. As the model below shows, this could have been achieved by cutting government expenditure, even if there had been relative price rigidities.

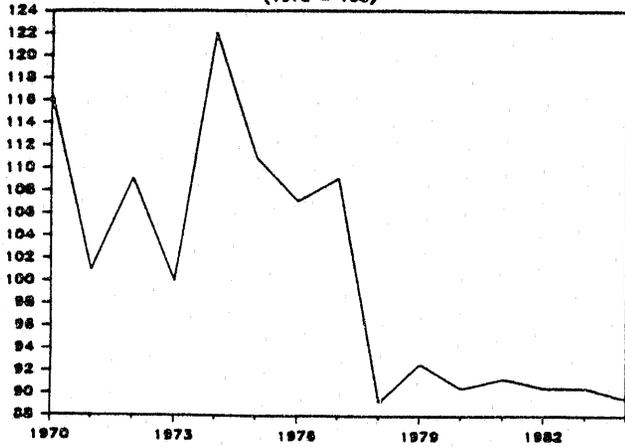
The outcome of all this is shown in the stubbornly negative trade balance and oscillating GDP figures of the last fifteen years. In addition, Senegal faces a debt crisis, or more appropriately, a "creditworthiness crisis" in the mid-1980s. The government had to undertake draconian structural adjustment measures in 1984. The results of this program have yet to be seen. There is little doubt, however, that a different set of responses to the favorable and unfavorable shocks of the 1970s would have led to less drastic cutbacks in the 1980s.

In sum, despite similar characteristics and institutional frameworks, the three countries adjusted quite differently to a common sequence of terms-

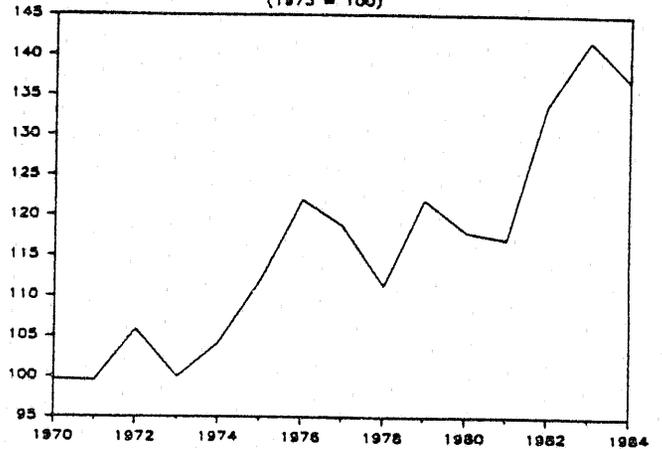
# Senegal -- Adjustment Indicators

Figure 3

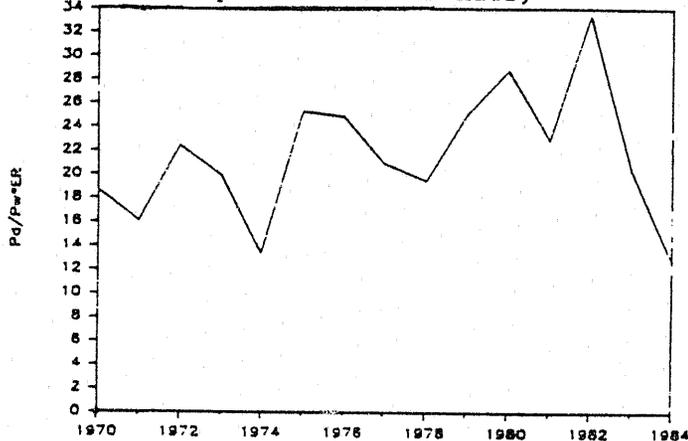
Terms of Trade  
(1973 = 100)



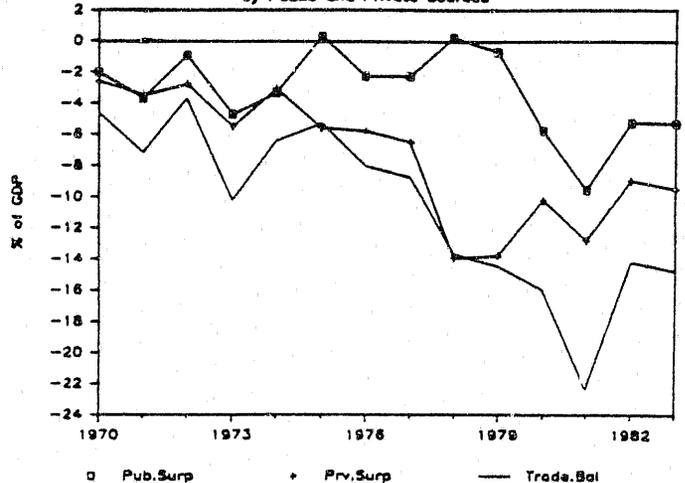
Real Gross Domestic Product  
(1973 = 100)



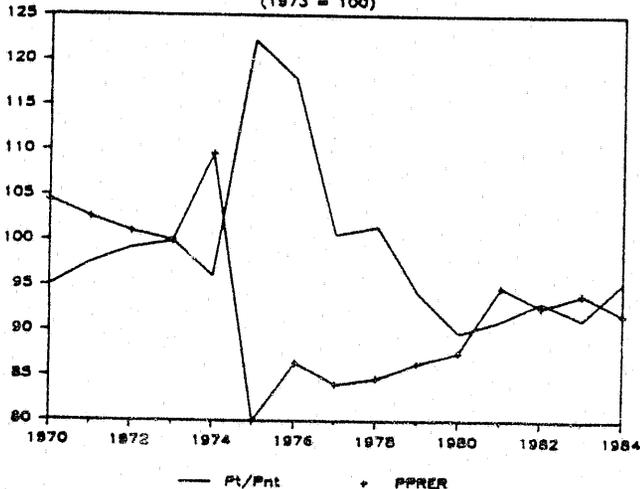
Ratio of Producer to World Price (%):  
(Phosphates + Groundnuts)



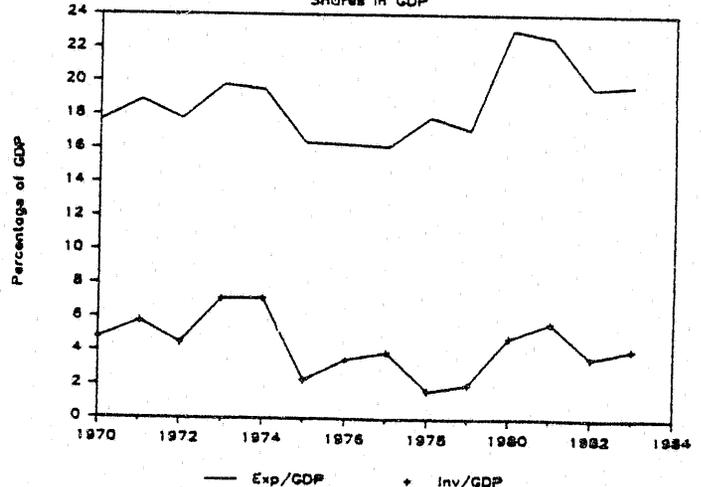
Decomposition of Net Domestic Savings  
by Public and Private Sources



Real Exchange Rates  
(1973 = 100)



Public Expenditure and Investment  
Shares in GDP



of-trade shocks. None avoided loss of external competitiveness in manufacturing, and only Cameroon avoided real exchange rate appreciation. <sup>13/</sup> Côte d'Ivoire's manufacturing sector experienced a sustained loss of external competitiveness, and Senegal's real exchange rate appreciated. Given the magnitude of these swings, one must ask whether they could have been dampened so as to avoid costly resource shifts into, and then later out of, nontradables.

In our discussion above, we attributed these different patterns of real exchange rate behavior and loss of external competitiveness to different patterns of external borrowing, public expenditure levels and taxation of windfall gains. Below we show that this interpretation is consistent with predictions from a two sector model. The model is also useful to determine the relative impact of alternative instruments to maintain real exchange rate stability and reduce external deficits.

### III. A Model of Medium Term Adjustment

The popular model to analyze medium-term macroeconomic equilibrium (when nominal aggregate demand pressures are zero and the focus is on real variables) is the "dependent economy" model due to Salter (1959) and Swan (1960). In that model, the equilibrium real exchange rate or relative price between tradables and nontradables depends on fundamentals (tastes and technology in the relevant sectors) the level of capital inflows and the extent of price rigidity in the labor market or the nontradable sector. <sup>14/</sup> When a current account deficit, (i.e. absorption of goods and services exceeding current income <sup>15/</sup>) must be eliminated a policy that allows the real exchange rate to depreciate is required. Defining the real exchange rate as

$RER = (PT/PN)e$ , where  $e$  is the nominal exchange rate and  $PT$  and  $PN$  are indexes of tradable and nontradable sectors, in the case of the CFA Zone where  $e$  is fixed what is required is a policy that lowers  $PN$  or the wage rate (in terms of foreign prices) unless fiscal policy is used to raise the relative price of tradables,  $PT$ . Thus a policy which switches expenditures towards nontradables is required in addition to an initial reduction in the level of expenditures so as to achieve external balance without experiencing a rise in unemployment.

The above analysis leaves out the role of monetary policy in dealing with external imbalance. We now consider this. A current account deficit means the net financial asset position for the nation as a whole is deteriorating (for example, private capital inflow may be so great that Central Bank reserves are increasing). As indicated by equation 2.1, the deficit may reflect a public or private sector deficit. With the exchange rate fixed, if there is a budget deficit that exceeds net private saving and autonomous capital inflow, foreign exchange reserves will be run down and, unless there is sterilization, the domestic assets of the banking system will decline. The automatic monetary mechanism will then tend to eliminate the deficit as the price of nontradables falls relative to tradables. In practice of course, there is at least partial sterilization of these monetary effects so that the flow equilibrium deficit is partly maintained.

The implication of monetary union membership for CFA Zone countries is that there is a limit to the extent to which any individual country can sterilize the monetary implications of its external deficit. <sup>16/</sup> Effective monetary policy will thus speed up the monetary adjustments that are called for by a current account deficit if there is some relative price rigidity in

the economy. But the implications for the real economy of a current account deficit remain, regardless of the effectiveness of monetary policy. It is with these adjustments in the real economy that we are concerned with in the remainder of the paper.

We return therefore to the standard analysis of expenditure policy mixes to restore external balance that are analyzed in the Salter-Swan "dependent economy" model. <sup>17/</sup> Here we propose to highlight more precisely what adjustment in real variables are required to correct an external deficit by extending the standard dependent-economy model to consider features typical of CFA Zone countries. <sup>18/</sup> First, a current account deficit is a national deficit. As such it is the sum of the private and public sector financial deficits, the private deficit being the excess of private investment over private savings and the public deficit being the budget deficit. The model recognizes this distinction and assumes -- to approximate the case studies under review -- that the private sector deficit is always zero (i.e. the private sector does not borrow or lend to the government or from or to foreigners). Therefore the current account deficit is the budget deficit. Second, access to the French treasury implies that external borrowing is a possibility open to these countries whenever it is necessary to adjust to macroeconomic disequilibrium. Third, because the exchange rate cannot be used for expenditure switching, trade taxes/subsidies are an important means of adjustment to a current account imbalance. Hence they are included in our analysis. Fourth we consider structural characteristics by our selection of functional forms, thus departing from the standard dependent economy analysis: the export sector is the traditional, price-taking sector but the rest of the economy produces a good which is imperfectly substitutable with

the imported commodity. We refer to this sector as the "semi-tradable" sector and the elasticity of substitution in use between this sector's output and imports reflects the extent of "dependence" of the economy.

### 3.1 The Model

A typical CFA Zone member's economy is characterized by a primary sector producing a cash crop (coffee, cocoa or groundnuts) that is almost entirely sold in world markets at an exogenously given dollar price, together with a small industrial sector and a sizeable nontradable sector. The industrial sector produces goods and services that are imperfect substitutes for goods sold in international markets; by contrast the cash crop is a homogenous, undifferentiated product. Hence the distinction between the two sectors. Without much loss of generality, we can aggregate the industrial and nontradable sectors into a "semi-tradable" sector. Since it includes manufacturing, the semi-tradable sector competes for demand with foreign goods, albeit partially. For simplicity, we assume further that output in each sector is produced by a Cobb-Douglas production function. To reflect the medium term focus of the analysis we assume sector-specific capital. This gives us the following production functions, with the terms for capital suppressed:

$$(3.1) \quad E = \bar{A}L_1^\alpha$$

where

$E$  = output (equal to exports) of the primary sector

$L_1$  = labor employed in the primary sector.

and

$$(3.2) \quad Q = \bar{B}L_2^\beta$$

where

Q = output of semitradables

L<sub>2</sub> = labor employed in the semitradables sector.

A bar over a variable indicates that the variable is exogenous. The output of the semitradables sector is an imperfect substitute in private consumption with imports. Assume that preferences are described by a CES utility function. Then the demand for semitradables, C, and imports, M, is determined by:

$$(3.3) \quad \frac{C}{M} = \bar{K} \left[ \frac{P^* (1+t)e}{P} \right]^\sigma$$

where P\* = the exogenous world price of imports (chosen as numeraire)

P = domestic price of semitradables

e = the exchange rate (fixed by assumption and set equal to unity by choice of units)

t = ad valorem tariff rate

σ = elasticity of substitution (equal to minus the own price-elasticity of demand for imports).

$\bar{K}$  = a constant.

C = private demand for semitradables.

M = private demand for imports.

Labor is the only mobile factor. If it is available in fixed supply ( $\bar{L}$ ) then we have the constraint:

$$(3.4) \quad L_1 + L_2 = \bar{L}$$

Alternatively, we consider the implications of a wage that is rigid in terms of consumption goods. We consider two variants suggested by the two consumption goods in the model. In the first one, we assume nominal wage rigidity in terms of the (tariff inclusive) import price and in the second,

rigidity in terms of the semitradable sector price. In the first variant, unless the tariff rate changes, supply response will be from the semitradable sector; in variant two, supply response will be from the cash crop sector exclusively. In both instances, we relax the full employment assumption thereby incorporating Keynesian multiplier effects. In the first alternative, (3.4) is replaced by:

$$(3.4') \quad W/(P^*(1+t)e) = \bar{W}$$

and in the second by:

$$(3.4'') \quad W/P = \bar{W}.$$

Finally, profit maximization and perfect competition require equality of the value of marginal product across the two domestic sectors:

$$(3.5) \quad \alpha\pi(1-s)e\bar{A}L_1^{\alpha-1} = \beta P\bar{E}L_2^{\beta-1}$$

where  $\pi$  is the world price of the export sector and  $s$  is the ad-valorem export tax rate.

We assume that the government exogenously purchases only semi-tradables, amounting to  $\bar{G}$ . This assumption is subjected to sensitivity analysis and Appendix 1 formulates the model for the case where an exogenous fraction,  $m$ , of  $\bar{G}$  is spent on imports. Material balance for semi-tradables requires that:

$$(3.6) \quad Q = C + \bar{G}$$

The government's budget constraint is:

$$(3.7) \quad e(F + tP^*M + s\pi E) = P\bar{G}$$

where  $F$  is foreign borrowing (e.g., borrowing from the operations account) by the government and  $e$  the nominal exchange rate, set equal to unity. Net private domestic savings are assumed zero.

By Walras' Law (the equality between income, including foreign borrowing by the government, and expenditure), the difference between the value of imports and exports equals the current account deficit,  $F$ , i.e.:

$$(3.8) \quad P^* M = \pi E + F.$$

Since we have assumed for simplicity that the fiscal deficit is the current account deficit, this abstracts from any real effects arising out of the government's borrowing from the central bank, and from the fact that some foreign borrowing may be done by the private sector. This roughly fits the countries studied in which private borrowing was transitory whereas public borrowing was often sustained.

Note further that (excluding the effects of taxes and subsidies) there are two relative prices in our model:  $\pi$  and  $P$ . A rise in  $\pi$  is an improvement in terms-of-trade. A rise in  $P$  is a rise in the price of semi-tradables relative to imports. A rise in  $\pi/P$  represents a change in the relative price of exportables to semi-tradables. Excluding again the effects of taxes and subsidies,  $\pi/P$  is the real exchange rate facing producers. In the remainder of the paper, when we speak of the real exchange rate we shall mean the value of  $\pi/P$  (inclusive of export taxes) since its value signals the relative profitability of engaging in exportables vs. domestic production (see Figure 4).

The model represented by equations (3.1) - (3.8) is sufficiently simple for qualitative analysis. Its solution in log-differential form is given in the appendix and comparative static solutions for typical parameter values are given below. The model can also be illustrated graphically. We do so and show the effects of the shocks experienced by Cameroon, Côte d'Ivoire and Senegal, as well as of the policy responses (import tariffs, export taxes

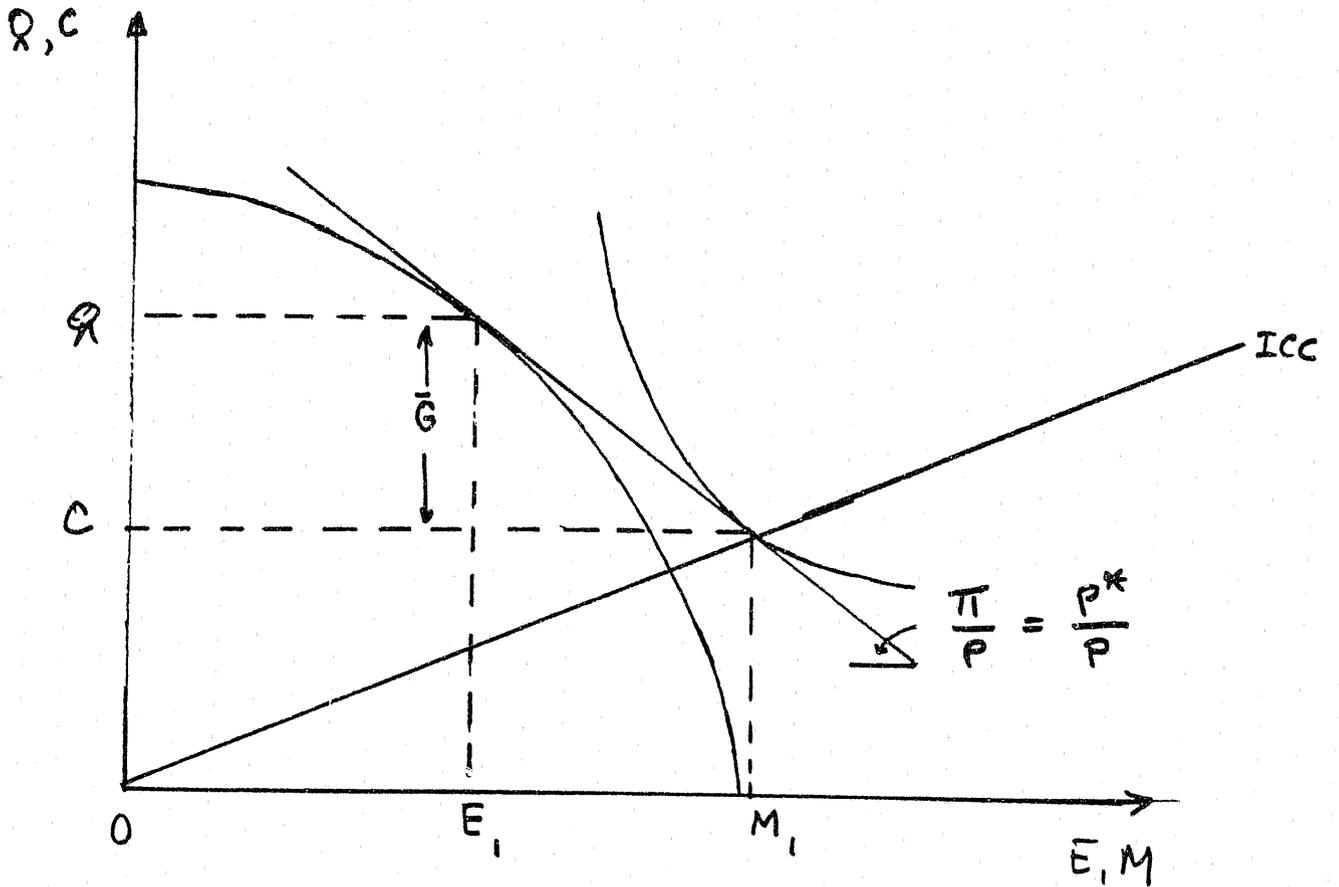
and changes in government expenditure). We restrict ourselves in the graphical analysis to the full-employment case, leaving the implications of wage rigidity for the multiplier analysis reported in Section 3.3.

### 3.2 Graphical Analysis

Figure 4 portrays an equilibrium in the model for the full employment case. Assume that export taxes and import tariffs are zero. Assume further that there are constant terms of trade, defined to equal 1 so that  $P^* = \pi$ . The production functions together with the full-employment condition imply that there is a well-behaved transformation frontier between E and Q, as shown. For a given price ratio  $\pi/P$ , production is determined by the point at which the slope of the tangent equals  $\pi/P$ . The private consumer's budget line is given by the line from the production point with slope  $P^*/P$ , which by assumption equals  $\pi/P$ , since  $s=t=0$ . Private consumption is determined by the point where the indifference curve is tangent to this budget line. Equilibrium is defined as the price level  $P$  where the production of the semitradable  $Q$  is exactly  $\bar{G}$  units above private consumption of the semitradable,  $C$ . The government budget deficit, which is here assumed to equal its consumption of semitradables  $\bar{G}$ , is equal in value to the current account deficit  $OM_1 - OE_1$ .

Now suppose  $t > 0$ . Holding  $P$  fixed, the consumer's budget line rotates clockwise (not drawn in Figure 4) and is no longer equal to the producer budget line as  $P^*(1+t)/P > \pi/P$ . If the substitution effect dominates the income effect of the tariff, the demand for  $C$  will rise and the relative price of the semitradable will have to rise to eliminate excess demand for  $Q$ . In

Figure 4  
Equilibrium in the Dependent Economy Model

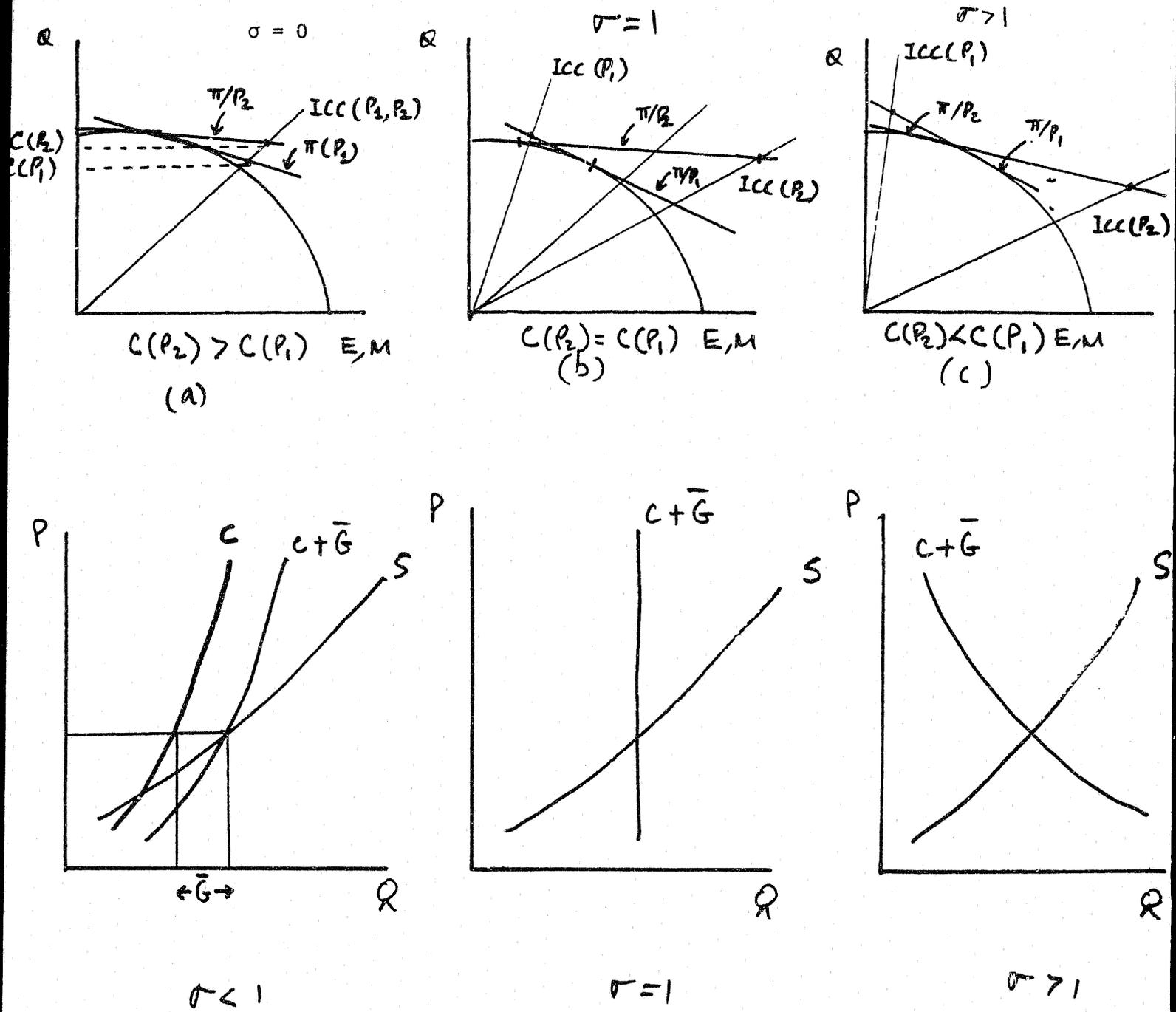


the new equilibrium, the income consumption curve (ICC) will rotate counter-clockwise but by less than if  $P$  were to remain unchanged.

In order to perform comparative statics exercises with this apparatus, it is useful first to describe the supply and demand curves for semitradables. This is done in Figure 5 where the top part of Figure 5 is used to motivate the shape of the private demand curve,  $C$ , in the bottom part of Figure 5. For deriving total demand we consider only cases of a budget deficit ( $\bar{G} > 0$ ) so that the equilibrium production point on the transformation frontier is above the intersection point of the relevant income consumption curve (ICC) with the budget line. As  $P$  rises, the slope of  $\pi/P$  flattens out and  $Q$  rises. Hence, the supply curve of  $Q$  is upward-sloping. The slope of the demand curve depends on  $\sigma$ , the elasticity of substitution between imports and semitradables. Notice that for higher levels of  $P$ , not only does the slope of the consumer's budget line shift, but so does the point on the transformation frontier whence it is drawn. The latter represents the general equilibrium income effect while the slope rotation reflects the substitution effect. In equilibrium, the income effect for this nontraded good is not zero because the government buys a fixed amount,  $\bar{G}$ , of it.

Now consider extreme values of  $\sigma$  in the top half of Figure 5. For  $\sigma = 0$ , the income-consumption paths for all prices are a unique ray through the origin. In this case, as  $P$  falls (the slope of the tangent gets steeper), private demand for  $C$  declines. That is, the private demand curve for  $C$  in the bottom half of Figure 5a is upward-sloping. <sup>19/</sup> With  $\sigma = 0$ , there is no substitution effect; hence the general equilibrium income effect dominates. The intersection of  $C$  and  $S$  in the bottom half of Figure 5a is not an

Figure 5  
 Comparative Statics in the Dependent Economy Model  
 ( $P_2 > P_1$ )



equilibrium, since exogenous government demand,  $\bar{G}$ , is not taken into account. Equilibrium is at the intersection of the demand curve for semitradables,  $C+\bar{G}$ , with the corresponding supply curve. By contrast, for very high values of  $\sigma$  small changes in prices bring about substantial changes in the income-consumption paths (recall that our indifference curves, being based on CES utility functions, are homothetic, so all income-consumption paths are rays through the origin). In this case, the substitution effect dominates, so that demand for C rises as P declines and the demand curve is downward sloping (Figure 5c). When  $\sigma = 1$ , the income and substitution effects cancel each other and the demand curve is vertical (Figure 5b). 20/ Hence the demand curve is upward- or downward-sloping depending on which side of unity  $\sigma$  lies.

With this apparatus, we are able to anticipate much of the comparative statics multiplier results reported below. First, an increase in G always leads to an increase in P (and hence a real exchange rate appreciation). Whether or not the demand curve is downward-sloping, a rightwards shift will raise P.

Second, the impact of a tariff increase is asymmetric depending on which side of unity  $\sigma$  lies. The effect of an increase in  $t$  is to make the slope of the consumer's budget line steeper in Figure 4. As explained earlier, if the income effect dominates, this leads to less demand for C and M i.e. when  $\sigma < 1$ . In turn, this implies that the demand curve in Figure 5(a) shifts to the left so that P falls. In the extreme case where  $\sigma = 0$ , imports are noncompetitive so that a tariff is equivalent to a consumption tax. By contrast, if  $\sigma > 1$ , the tariff lowers demand for M but raises it for C causing the demand curve in Figure 5(c) to shift to the right, raising P.

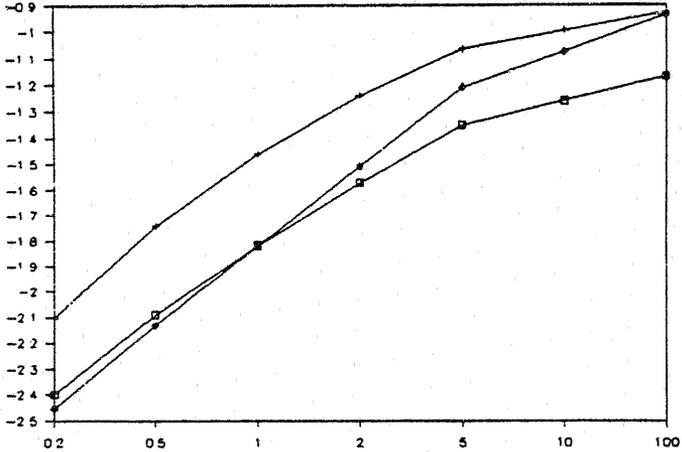
Whether or not  $P$  declines, an increase in the tariff rate lowers the current account deficit. This is because we assumed no private borrowing. If the private sector always balances its budget, the increased tariff revenues contribute one-for-one towards reversing the government's deficit, and therefore the trade deficit.

Third, the same mechanism is at work for a favorable terms-of-trade shock (an increase in  $\pi$ ). It will improve or worsen the current account deficit depending on the value of  $\sigma$ . This can be explained by observing that the effect of an increase in  $\pi$  is to shift the supply curves for  $Q$  to the left. In addition, the demand curve shifts to the right (the income effect). For low  $\sigma$ , this can lead to an increase in  $P$  and  $Q$ . If  $Q$  rises,  $E$  must fall, given the transformation frontier. Moreover, as  $P$  is higher demand for  $M$  is greater. The higher  $M$  and lower  $E$  leads to an unambiguous increase in the current account deficit. For high  $\sigma$ , the substitution effect dominates, consumers demand less  $Q$ , thus releasing resources to the exportable sector and yielding an improvement in the current account deficit.

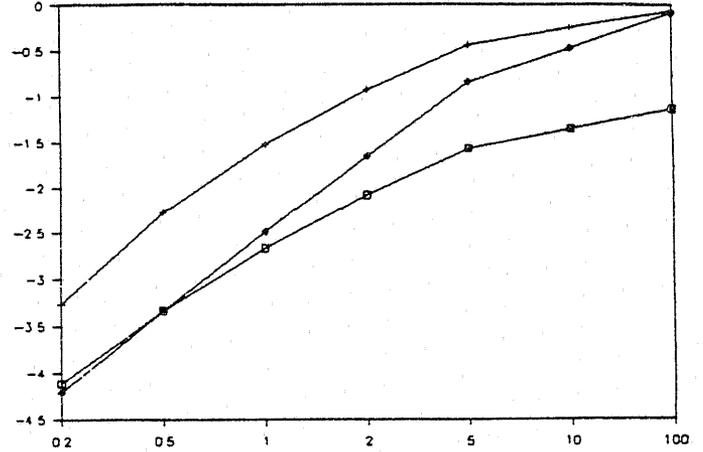
Finally, the effect of an increase in the export tax is to shift the supply curves in Figure 5 to the right. Since exporting is less profitable, resources shift to semitradables. This always implies a decline in  $P$ . For a low  $\sigma$ , this shift also causes  $Q$  to decline, implying an increase in  $E$ . When  $\sigma > 1$ , the impact on  $E$  is in the opposite direction. In both cases  $P$  declines. Moreover, the current account deficit improves because of the increased public revenues from the tax increase.

Figure 6  
Current Account Multipliers \*/

IMPORT TARIFF



EXPORT TAX RATE



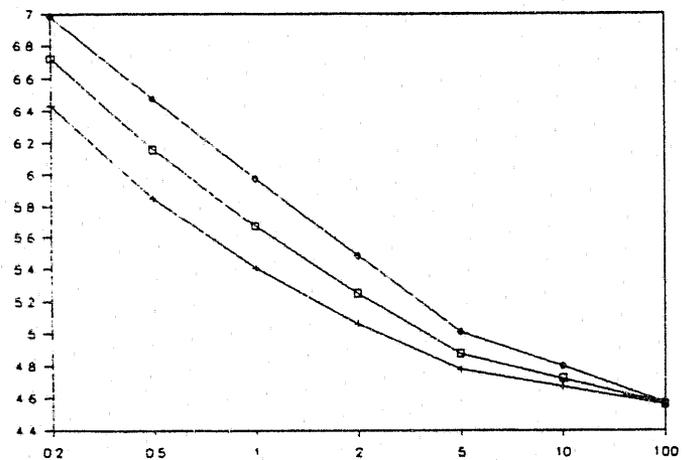
Substitution Elasticity ( $\sigma$ )

□ FLEXIBLE WAGE

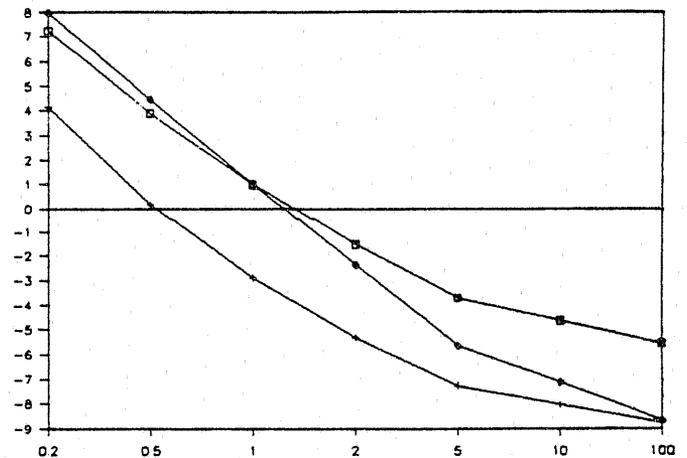
+ FIX WAGE  $P^*(1+t)$

◇ FIX WAGE (P)

GOVERNMENT EXPENDITURE



TERMS OF TRADE



\*/ Multipliers are defined as the percentage change in  $F = P^*M - \pi E$  for a one percent change in the corresponding exogenous variable (e.g. the import tariff).

### 3.3 Adjustment with Rigidity: Parametric Analysis

We now supplement the graphical analysis with multiplier calculations derived from solving the model under different demand and supply elasticities and three different assumptions about labor market behavior. Since the elasticity of substitution in demand between imports and the semitradable is an important parameter, we start with a systematic variation of  $\sigma$  under the three model variants. This allows us to examine simultaneously the influence of relative price rigidity and inflexibility in demand and supply.

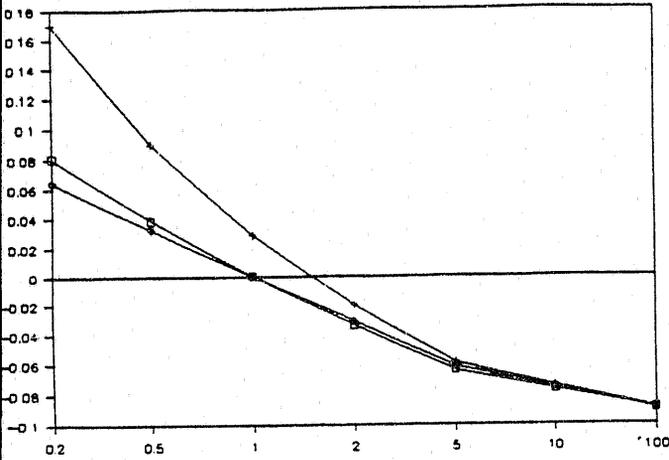
For all calculations, we take as a starting point a small government sector in total expenditures (i.e. a small budget deficit) and a small external deficit. Government expenditures are 5% of total expenditures, foreign exchange revenues are 95% of foreign exchange expenditures, and initial tariff and export taxes are 25% and 10% respectively. These parameter values are roughly representative of the initial situation in the three countries.

Figures 6 and 7 display the multipliers for the current account,  $F$ , and the real exchange rate,  $RER$ , where the plotted values are percentage changes in  $F$  and  $RER$  for a one percent change in the selected instrument (e.g. the import tariff) or exogenous variable (e.g. the terms of trade) under different values for  $\sigma$ . <sup>21/</sup>

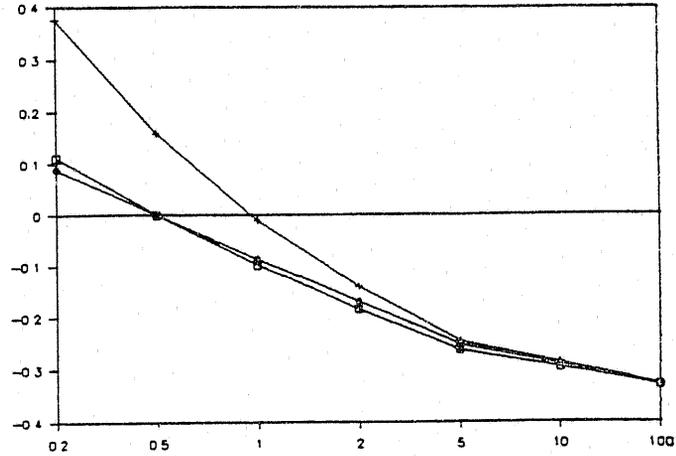
Starting with the current account multipliers for a given government expenditure increase, the more elastic is domestic demand (i.e. the higher the value of  $\sigma$ ) the less is the real exchange rate appreciation and hence the smaller is the corresponding increase in the current account deficit. The full employment case lies between the two fixed wage cases. When the wage is fixed with respect to the world price of imports, the semitradable sector can

Figure 7  
Real Exchange Rate Multipliers \*/

IMPORT TARIFF



EXPORT TAX RATE



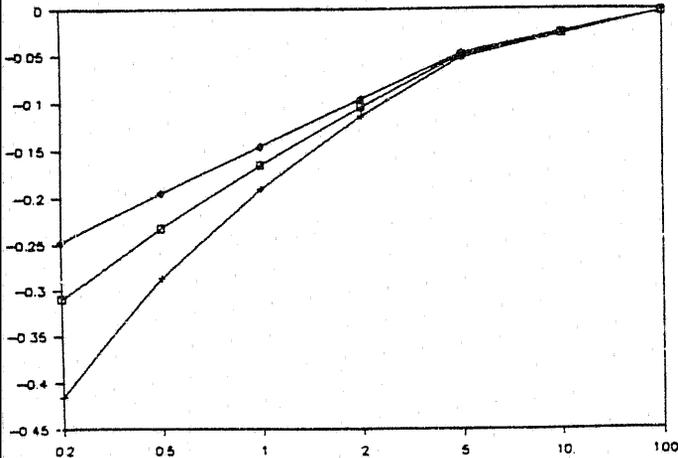
Substitution Elasticity (sigma)

□ FLEXIBLE WAGE

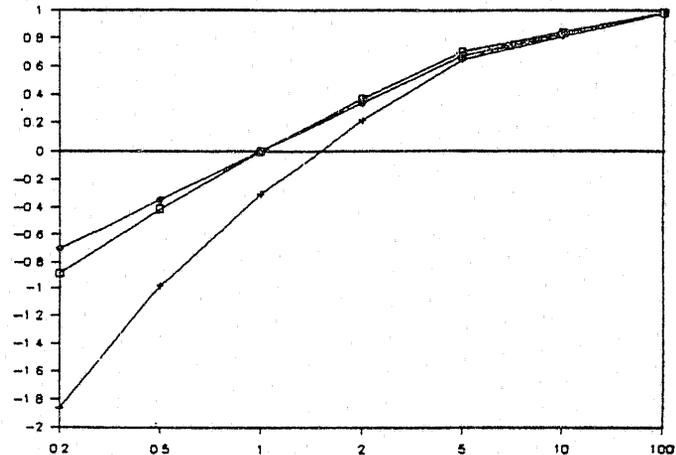
+ FIX WAGE  $P*(1+t)$

◇ FIX WAGE (P)

GOVERNMENT EXPENDITURE



TERMS OF TRADE



\*/ Multipliers are defined as the percentage change in the real exchange rate  $RER = (\pi(1-s)/P)$  for a one percent change in the corresponding exogenous variable (e.g. the import tariff).

expand without limit, reducing the current account worsening. Fixing the real wage in semitradables curtails its supply response which in turn raises the value of the current account multiplier. Sensitivity analysis with the assumption that all government spending is on semitradables reveals that this conclusion is qualitatively robust. If 20 percent of government spending is on imports, the full employment deficit multiplier ranges from 3.7 to 3.4 as  $\sigma$  ranges from 0.2 to 100.

An improvement in the terms-of-trade on the one hand raises real income which contributes to an increase in the current account deficit. On the other hand, government revenues rise even though the export tax rate remains unchanged. In turn this windfall gain reduces directly the current account deficit as the government deficit declines, real government spending remaining constant. For low values of  $\sigma$ , the income effect dominates the substitution effect.  $P$  rises, attracting labor out of the cash crop sector, and leading to a shift in consumption towards imports. Both effects work to raise the current account deficit. Thus when the price elasticity of demand for imports is low, the current account will deteriorate when the terms of trade improve. The multiplier changes sign for values of  $\sigma$  around 2 except for the case when the wage is tied to the numéraire which restricts the labor migration out of cash crops. This in turn contributes to a smaller current account deficit and hence to switching at a lower value of  $\sigma$ .

Multiplier values with respect to export taxes and tariffs should be viewed together since they are alternative instruments for achieving expenditure switching towards semitradables. <sup>22/</sup> Raising a tariff reduces the current account deficit both because it increases government revenues and because it lowers imports. The reduction in imports is much lower than the

tariff increase, so that tariff revenues always rise. However, this positive effect is mitigated by the resource shift out of cash crops (into semitradables). The positive effect of raising a tariff to reduce the current account deficit is also mitigated in another way. Recall that government expenditure is fixed in quantities. The higher semitradable price accompanying the resource shift to semitradables increases the government's total expenditure which works to increase the current account deficit.

An increase in export taxes also raises government revenues, and hence reduces the budget deficit. Although exports decline, the net effect is an increase in revenues from this source. It appears from the multipliers in Figure 8 that an export tax is a more potent instrument than an import subsidy in reducing a current account deficit. This is because the current account is endogenous in our model. Note that this result obtains even though we assume an infinite foreign elasticity of demand for cash crop exports. If the current account were fixed, then Lerner symmetry would prevail and an import tariff would be equivalent to an export tax. Indeed, the two multipliers converge to the same value as  $\sigma \rightarrow \infty$  because, in this case,  $\hat{F} \rightarrow 0$  and we approximate balanced trade at the margin. However, for finite values of  $\sigma$ , especially in the plausible range  $0.5 < \sigma < 2$ , the export tax dominates the import tariff because of its impact on  $P$ . An export tax increase releases resources to the semitradable sector, increasing the latter's competitiveness and thereby lowering the deficit. By contrast, an import tariff, by increasing demand for semitradables, bids up  $P$  which counters the favorable impact of the increased tariff revenues on the deficit. In sum, raising the export tax on the cash crop sector lowers the level of exports, but the revenue effects

-- in reducing the government deficit -- are sufficiently strong to result in an improvement in the current account deficit.

The above analysis can be used to shed light on another issue of current interest to CFA Zone members. Since they cannot devalue the nominal exchange rate, some Zone members (Côte d'Ivoire and Senegal in particular) have introduced an import tariff combined with an export subsidy to "simulate" a real depreciation. In our framework, this amounts to combining the effects of the import tariff and a negative export tax. Our results show that, if the current account deficit were due to a fiscal deficit, such a tariff-cum-subsidy scheme may not have the desired effect. First, to the extent that the scheme is not revenue-neutral, it will affect the current account deficit, possibly in a perverse manner. Second, even if the scheme were revenue-neutral, it would not be "deficit neutral", given the change in the semi-tradable price. Unless government spending is also reduced, the tariff-cum-subsidy scheme can worsen the current account deficit and appreciate the real exchange rate.

In comparing the impact of various tax and subsidy schemes, we are not addressing the question of allocative efficiency or its analogue, consumer welfare. An export tax or import tariff may improve the deficit, but what does it do to welfare? To answer this, an explicit welfare function must be introduced, which is somewhat problematic in our model with separate government expenditure and a non-zero trade deficit. The only result we can claim is that, if the welfare function were that implied by the demand system in (3.3), then the welfare maximizing tax to raise a given level of revenue would be an export tax of zero combined with an import tariff and domestic tax on semitradables at equal positive rates. This is a special case of the

result of Diamond and Mirrlees (1971) and is one of the recommendations in Shalizi and Squire (1986) for tax policy in Sub-Saharan Africa.

Real exchange rate multipliers appear in Figure 7. Their interpretation is straightforward. As  $\sigma \rightarrow \infty$ , the autonomy of the relative price of the semitradable vanishes as the domestic relative price becomes determined by the fixed world price. Multiplier values approach zero, regardless of labor market assumptions. Also labor market assumptions do not affect multiplier values significantly in the range  $0.5 < \sigma < 2$ . Finally the tariff and terms-of-trade multipliers change sign at  $\sigma = 1$  for reasons associated with the slope of the demand curve in Figure 5.

We conclude with estimates of the likely range of real exchange rate and current account multipliers. The range is derived by assigning share parameters in the production functions that bracket the range of cash crop and manufacturing sector supply elasticities in the literature which we summarize in Appendix 2. This is done for the flexible wage model which is also likely to be more representative of labor market behavior in CFA countries. The multipliers are displayed in Table 1 for two sets of values for  $m$ , the import share of government expenditure.

How do these figures relate to the adjustment experience of Cameroon, Côte d'Ivoire and Senegal? Consider first the multipliers displayed in Table 1 resulting from a terms-of-trade improvement with and without increases in government spending and export taxation. The figures suggest that terms-of-trade improvements will result in real exchange rate appreciation if one considers the more realistic low elasticity case. This appreciation will be dampened by windfall taxation but is nonetheless likely to prevail. Contrast

Table 1

Multipliers Under Different Elasticities of Supply and Demand <sup>1/</sup>

	Low $\sigma = 0.5; \phi = 0.14$ $\Omega = 0.2$				High $\sigma = 2.0; \phi = 1.7$ $\Omega = 0.85$			
	Real Exchange Rate		Current Account Deficit		Real Exchange Rate		Current Account Deficit	
	m=0	m=.2	m=0	m=.2	m=0	m=.2	m=0	m=.2
Terms of Trade	-1.7	-0.6	4.9	2.9	0.3	0.3	-1.7	-2.4
Gov't Expenditure	-0.4	-0.1	6.7	5.5	-0.1	0.0	5.3	5.1
Export tax	0.0	0.0	-3.3	-3.0	-0.1	-0.1	-2.0	-1.8
Import tariff	0.1	0.1	-2.2	-2.1	0.0	0.0	-1.6	-1.6

<sup>1/</sup> See Appendix 2 for definition and derivation of parameters  $\phi$  and  $\Omega$  which stand for supply elasticities in agriculture and semitradable sectors, respectively; m is the share of government expenditure that is imported.

the experience of Cameroon and Côte d'Ivoire. Even though export taxes were raised in Côte d'Ivoire, government spending was increased sharply and real exchange rate appreciation occurred. By contrast Cameroon avoided real exchange rate appreciation by avoiding increases in government spending and by taxing the windfall gain.

Now consider the adjustment phase that corresponds to the need to reduce external financing. This was the situation facing Côte d'Ivoire in the early eighties. In the absence of devaluation, expenditure switching can in principle be achieved by a combination of decreases in export taxes and government spending, and increases in tariffs. However, in the low elasticity case, changes in export taxes have no effect on the real exchange rate, whereas when the elasticity is high, import tariffs become an ineffective instrument. Nevertheless, increases in export taxes are a more effective way of reducing the external deficit than increases in tariffs even when the supply elasticity in the cash crop sector is low. Reduction in the government deficit has the highest multiplier value on the current account and is not very sensitive to the range of elasticities considered. Note finally that the results are robust to variations in the import content of government expenditure, signifying that it is the size of the budget, rather than its composition, that is crucial.

#### IV. Determinants of the Current Account and Real Exchange Rates

The case studies as well as the model results suggest some fundamental determinants of the current account and the real exchange rate for CFA Zone countries. Therefore, we conclude with a statistical analysis of the current account and real exchange rate in the three countries. Ideally,

Table 2

Determinants of the Current Account (CAR)

		PUBDR (+)	DLNY (-)	WR (-)	DV (-)	$\bar{R}^2$	DW	$\chi^2$ (prob)	$\rho(-1)$
Cote d'Ivoire	1a	0.8 (2.4)**	-26.0 (2.5)**		-1.6 (0.7)	0.99	1.6	13.7 (0.13)	-0.4 (1.5)
1965-84	1b	0.9 (2.8)**	-19.1 (2.5)**	0.0 (0.0)		0.99	1.7	10.5 (0.40)	-0.4 (1.6)
Senegal	2a	1.1 (4.2)***	20.6 (2.5)**		-3.3 (4.9)***	0.99	2.2	9.5 (0.22)	-0.3 (1.6)
1965-83	2b	1.2 (5.2)***	18.9 (2.2)**	0.1 (2.1)**	-5.8 (4.2)***	0.99	2.1	5.9 (0.54)	(-0.3) (1.4)
Cameroon	3a	0.7 (4.6)***	20.9 (5.2)***		-0.3 (0.3)	0.92	1.9	7.5 (0.58)	-0.4 (1.8)
1965-83	3b	0.7 (4.5)***	20.7 (5.4)***	0.0 (1.2)		0.93	2.0	9.9 (0.45)	-0.3 (1.5)

Notes

Expected signs in parentheses (under the variables).

Definition of variables (also see text).

CAR = (X-M)/GDP; PUBDR = (GR-GE)/GDP; DLNY = First difference of natural logarithm of real national income; WR = real manufacturing wage; DV = dummy variable (set to 1 for 1974 - 85).

Estimation: Ordinary least squares with 1st order correction for auto-correlation after data deflation to remove heteroskedasticity.

$\chi^2$  is White's (1980) statistic for  $H_0: E(u_1^2) = \sigma^2$ ; Value in parentheses is Prob  $> \chi^2$ .

$\rho(-1)$  is the estimated value for the first order autoregressive process.

Intercepts omitted.

\*\*\* = significance at 1% level; \*\* = significance at 5% level;

\* = significance at 10% level.

econometric analysis would proceed from full-information estimation of a structural simultaneous equation model of the current account and the real exchange rate. Unfortunately, not enough restrictions can be imposed on the model in Section 3 for it to be identified. Availability of time series data for the three countries imposes further limitations. These considerations lead us to concentrate on reduced form estimation for the current account and the real exchange rate. Since our model suggests that these two variables are jointly and endogenously determined, neither variable is included in the estimation equation of the other.

The results from estimating the current account and real exchange rate equations appear in Tables 2 and 3. For the current account equation, the dependent variable is the current account surplus over GDP,  $(X-M)/GDP$ , and the regressors with expected signs are: the public sector surplus,  $(GR-GE)/GDP$  (+); real national income growth,  $DLNY$ ; the manufacturing sector real wage,  $WR(-)$ ; and a dummy variable,  $DV$ , taking a value of 1 for 1974 and beyond, zero otherwise. Since we do not report values for the intercept, a negative (positive) sign for  $DV$  implies a smaller (larger) current account surplus for the post 1973 period. The  $\chi^2$  statistic is White's (1980) joint test for misspecification and heteroskedasticity. Hence, the relatively low values of the statistic in Table 2 are reassuring as they suggest both low heteroskedasticity and no serious misspecification. 23/

The results indicate that public sector deficits consistently exerted pressure on the current account in the three countries, supporting the model of Section 3. Real income growth also contributed to the worsening external position in Côte d'Ivoire but not in Senegal where, to the contrary, the current account improved with income growth. This is not surprising since

Table 3

Determinants of the Real Exchange Rate Multiplier (RER)

		PUBDR (+)	TOT (-)	CONCR (-)	DV (-)	$\bar{R}^2$	DW	$\chi^2$ (prob)	$\rho(-1)$
Cote d'Ivoire	1a	0.7 (2.6)**	-0.5 (9.7)***		2.0 (2.0)*	1.0	1.8	16.7 (0.05)	-0.2 (0.8)
1965-84	1b	-0.9 (1.5)		-7.5 (1.8)*		0.99	1.6	11.3 (0.08)	-0.5 (2.7)
Senegal	2a	2.7 (3.2)***	-0.0 (0.4)		-1.8 (0.6)	0.99	1.9	11.6 (0.23)	-0.3 (1.4)
1961-83	2b	2.8 (3.4)***		2.0 (1.0)	-2.4 (0.9)	0.99	1.9	10.9 (0.28)	-0.3 (1.5)
Cameroon	3a	0.0 (0.1)	0.1 (2.7)**		3.1 (0.7)	0.99	1.2	16.0 (0.06)	-0.7 (4.0)
1965-83	3b	0.2 (0.6)		1.2 (0.5)	-2.4 (0.4)	0.99	1.1	16.3 (0.06)	-0.7 (3.9)

Notes

Expected signs in parentheses (under the variables).

Definition of variables (also see Table 2 and text).

RER = Ratio of agriculture and manufacturing price indexes to constructed and services price indexes.

PUBDR = See Table 2.

TOT = Ratio of indexes of exports to imports.

CONCR = Official development assistance/GDP

DV = Same as Table 2

Estimation: Ordinary least squares with 1st order correction for autocorrelation after data deflation to remove heteroskedasticity.

$\chi^2$  is White's (1980) statistic for  $H_0: E(u_1^2) = \sigma^2$ ; Value in parentheses is Prob  $> \chi^2$ .

$\rho(-1)$  is the estimated value for the first order autoregressive process.

Intercepts omitted

\*\*\* = Significance at 1% level; \*\* = significance at 5% level;

\* = significance at 10% level.

Senegal suffered from droughts which, in turn, hampered export earnings. The positive influence of income growth on the current account of Cameroon is also to be expected from the impact of the oil discovery. The regressions also show a marked deterioration of the average current account deficit after 1974 for Côte d'Ivoire and Senegal in comparison with the earlier period. Finally, the real wage variable does not enter significantly. This is not surprising since the wage series only pertain to manufacturing and had to be constructed from incomplete data.

Turning to the results from the real exchange rate equation estimations in Table 3, the results are more mixed as misspecification and/or heteroskedasticity is present in most equations. Two new variables are introduced, concessionary lending/GDP, CONCR(-), and the terms of trade, TOT (-). For example, for Côte d'Ivoire, much of the variation is captured by the intercept. Though to a lesser degree, this also occurs for other equation estimates, probably suggesting that our measure of the real exchange rate index which corresponds closely to our model (namely the relative price of agriculture and manufacturing) <sup>24/</sup> is inaccurately measured. However, the significantly negative value for the dummy variable in the equations for Senegal confirms a sharp real exchange rate appreciation after 1974, as government policy and droughts combined to sustain a deteriorating external balance.

## V. Conclusions

This paper has addressed the theme of medium-term macroeconomic adjustment with a fixed exchange rate in three countries in the CFA Zone: Cameroon, Côte d'Ivoire and Senegal. We showed how different adjustment

responses to similar shocks took place in the three countries. In Cameroon, despite improved terms of trade and windfall gains from the oil price hike of the late seventies, the government avoided real exchange rate appreciation by restraining public expenditure and sterilizing most of the foreign exchange gains. The real exchange rate was also stabilized by taxing the proceeds of coffee and cocoa exports during the boom and then raising producer prices when the boom was over. By contrast, Côte d'Ivoire expanded public sector investment, financing it partly by external borrowing. The real exchange rate appreciated and manufacturing sector competitiveness fell sharply for some time until adjustment to the growing external deficit took place. In Senegal, public sector subsidies continued to be financed by taxation of exports so the real exchange rate depreciation needed after successive droughts did not occur. The government remained in deficit and adjustment was postponed. Unlike Cameroon, therefore, neither Senegal nor the Côte d'Ivoire achieved the real exchange rate depreciation called for by adverse terms-of-trade and output trends.

These three cases led us to develop a stylized dependent-economy model to show the relationship between the instruments of adjustment (tariffs, taxes and government expenditure) and the associated targets (the real exchange rate and the current account deficit). This model was then used to illustrate the combination of current account deficits and real exchange rate changes resulting from a terms of trade shock and different government expenditure patterns. The model also highlighted the implications for the real exchange rate of changes in taxation of cash crops and in restrictions on imports.

Finally we used reduced-form estimation to analyze the determinants of the real exchange rate and current account in the three countries. The results indicate that a small number of variables explain a great part of the real exchange rate and current account variations in the three countries over the period 1963-85. Although a structural model corresponding to the stylized model would need to be estimated to explore further its usefulness, the reduced form results are consistent with the model in the text.

Solution of the Model

The model considered in the main text is repeated here for convenience in level form. Exogenous variables are indicated with a bar and parameters with greek letters. The equations describing the full employment version are:

$$E = \bar{A}L_1^\alpha \quad (3.1)$$

$$Q = \bar{B}L_2^\beta \quad (3.2)$$

$$\frac{C}{M} = K\left(\frac{P^*(1+t)e}{P}\right)^\sigma \quad (3.3)$$

$$L_1 + L_2 = \bar{L} \quad (3.4)$$

$$\alpha\pi(1-s)e\bar{A}L_1^{\alpha-1} = \beta PL_2^{\beta-1} \quad (3.5)$$

$$Q = C + \bar{G}(1-m) \quad (3.6)$$

$$e[F + tP^*M + s\pi]E = (1-m)P\bar{G} + mP^*\bar{G} \quad (3.7)$$

$$P^*(M + m\bar{G}) = \pi E + F \quad (3.8)$$

This is a system of eight equations with the following eight endogenous variables:  $Q, M, E, C, L_1, L_2, P, F$ . Exogenous policy variables are  $\bar{G}, t, s,$  and  $m$ , the fraction of government expenditures spent on imports. The terms-of-trade represented by  $\pi$ , are also considered exogenous. The model is homogenous of degree zero in all prices and the exchange rate, so we select  $P^* = 1$  as numeraire and by choice of units we choose  $e = 1$ . Thus, a terms of

trade change will come from changes in the exogenous export price  $\pi$ . When the wage is fixed in terms of the domestic price of the import good, (3.4) is replaced by  $W/(P^*(1+t)e) = \bar{W}$  and when it is fixed in terms of the price of the semitradable,  $P$ , (3.4) is replaced by  $W/P = \bar{W}$ .

Log-differentiation of the above system of equations yields the following (where  $\hat{Z} \equiv dZ/Z$ ):

$$\hat{E} = \alpha \hat{L}_1 \quad (A1)$$

$$\hat{Q} = \beta \hat{L}_2 \quad (A2)$$

$$\hat{C} - \hat{M} = \sigma(\hat{\tau} - \hat{P}) \quad (A3)$$

$$\lambda \hat{L}_1 + (1-\lambda) \hat{L}_2 = 0 \quad (A4)$$

$$\hat{\pi} + \hat{\zeta} + (\alpha-1) \hat{L}_1 = \hat{P} + (\beta-1) \hat{L}_2 \quad (A5)$$

$$\gamma \hat{G} + (1-\gamma) \hat{C} = \hat{Q} \quad (A6)$$

$$\mu_3 \hat{F} + \mu_1 (\hat{t} + \hat{M}) + \mu_2 (\hat{s} + \hat{\pi} + \hat{E}) = (1-\theta) \hat{P} + \hat{G} \quad (A7)$$

$$\hat{M} + \rho \hat{G} = \delta (\hat{\pi} + \hat{E}) + (1-\delta) \hat{F} \quad (A8)$$

where

$$\begin{aligned} \hat{\tau} &= \frac{t}{1+t} \hat{t} & \gamma &= \frac{G}{G+C} & \theta &= \frac{mP^* \bar{G}}{(1-m)P\bar{G} + mP^* \bar{G}} \\ \lambda &= \frac{L_1}{L_1 + L_2} & \mu_1 &= \frac{tM}{PG}, \mu_2 = \frac{s\pi E}{PG} \text{ and } \mu_3 = 1 - \mu_1 - \mu_2 \\ \hat{\zeta} &= \frac{-s}{1-s} \hat{s} & \delta &= \frac{\pi E}{M} & \rho &= \frac{m\bar{G}}{M + m\bar{G}} \end{aligned}$$

When  $W/(P^*(1+t)) = \bar{W}$ , (A4) becomes  $\hat{W} = \hat{\tau}$ , and when  $W/P = \bar{W}$ , (A4) becomes  $\hat{W} = \hat{P}$ .

Note from the definition of the parameters that an increase in the tariff rate implies an increase in  $\hat{\tau}$  but that an increase in the export tax implies a decrease in  $\hat{\zeta}$ .

Combining (A1), (A2), (A4) and (A5) gives us the following output supply elasticities for the export and semi-tradables sectors

$$\hat{E} = \phi (\hat{\pi} - \hat{P} + \hat{\zeta}) \quad (A9)$$

$$\hat{E} = \phi^* (\hat{\pi} + \hat{\zeta}) \quad (A9')$$

$$\hat{Q} = \Omega (\hat{P} - \hat{\pi} - \hat{\zeta}) \quad (A10)$$

$$Q = \Omega^* \hat{P} \quad (A10')$$

where  $\phi = \frac{\alpha (1-\lambda)}{\lambda(1-\beta) + (1-\lambda)(1-\alpha)}$ ;  $\phi^* = \frac{\alpha}{1-\alpha}$

and

$$\Omega = \frac{\lambda\beta}{\alpha(1-\lambda)} \phi \geq 0; \quad \Omega^* = \frac{\beta}{1-\beta}$$

In the above expressions, an asterisk denotes the value of the parameter for the case when the wage is fixed in terms of the numéraire. Similar expressions can be derived for the case when the wage is fixed in terms of P. Expressions (A9) and (A10) show that an increase in the relative price of the semitradable ( $\hat{P} > 0$ ) elicits a positive supply response for the semitradable sector and that an increase in the export tax ( $\hat{\zeta} < 0$ ) decreases the supply of the cash crop sector.

The model is solved by matrix inversion letting  $\hat{X}$  and  $\hat{Z}$  denote the vectors of endogenous and exogenous variables respectively and A and B the corresponding coefficient matrices, the multipliers are obtained as:

$$\hat{X} = A^{-1} B \hat{Z}$$

APPENDIX 2

Parameters for Model Simulation

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The parameter values used to calculate the multipliers in Table 1 are:

Low case	High Case
$\sigma = 0.50$	2.0
$\alpha = 0.40$	0.8
$\beta = 0.30$	0.6
$\lambda = 0.40$	0.4
$\gamma = 0.05$	0.05
$\mu_1 = 0.40$	0.4
$\mu_2 = 0.40$	0.4
$\mu_3 = 0.20$	0.2
$\delta = 0.95$	0.95
$t = 0.10$	0.10
$s = 0.25$	0.25

The parameter values for the multipliers reported in Figures 7 and 8 are the same except that  $\alpha = 0.6$ ,  $\beta = 0.4$  and  $\lambda = 0.5$ .

The parameter values for  $\alpha$ ,  $\beta$  and  $\lambda$  are chosen to calibrate supply elasticities. In agriculture, the range is  $0.4 < \phi < 1.7$  and in manufacturing  $0.2 < \alpha < 0.85$ . Berthelemy and Morrison (1985) report the following supply elasticities for agriculture from estimation of a Nerlovian production function (t-values in parenthesis): Cameroon: 0.8 (3.2); Côte d'Ivoire: 0.4 (3.3); Senegal: 0.2 (1.4). Their results are statistically more significant than those reported in Bond (1985) and, for the most part, fall within the range of elasticities implied by our parameter choice. The crops included in

their analysis are export crops: Cameroon (cocoa, coffee, cotton); Côte d'Ivoire (cocoa, cotton); Senegal (groundnuts, cotton). Berthelemy and Morrisson also find a statistically significant elasticity of agricultural supply to manufacturing output (elasticities around 0.4) which is consistent with our full employment formulation in which  $\phi$  depends on  $\beta$ .

In other calculations reported in Castillo, Devarajan, Jakobeit and de Melo (1986), we also varied the share of labor in semitradables. The resulting supply elasticities have a wider range of values, but the qualitative implications of the multiplier analysis remain unchanged.

FOOTNOTES

- 1/ The institutional characteristics of the CFA Zone and their implications for macroeconomic adjustment are described in Bhatia (1985), and P. and S. Guillaumont (1983). The implications of real exchange rate volatility are analyzed in Macedo (1984). Mundell (1972) provides a historical analysis of monetary integration in Africa. Devarajan and de Melo (1987) evaluate and analyze the growth implications of participation in the CFA Zone.
- 2/ This is not strictly true for BEAC members.
- 3/ This does not include borrowing by public enterprises, an important qualification for certain countries.
- 4/ For a more detailed description of these case studies, see Castillo, et al (1986).
- 5/ Davies (1983) provides a comparative study of how major commodities exporters reacted to the 1975-77 commodity boom. He shows that Cameroon and Cote d'Ivoire made extensive use of their commodity stabilization funds to tax the windfall gains to producers.
- 6/ Following Brazil's frost in July 1975 which reduced world production by one-third, coffee prices doubled in 1976 and rose another 60 percent in 1977. The price of cocoa futures showed increases of 64 and 85 percent in 1976 and 1977.
- 7/ In 1974 phosphate prices increased by almost 400 percent.
- 8/ In presenting the real exchange rates, we are not distinguishing between changes in the price ratio caused by external circumstances and those attributed to domestic price changes, (i.e., policy influenced). This is because our analysis will be based on relative prices. Regardless of what determines it, the real exchange rate remains the most important signal for domestic agents to engage in tradable activity.
- 9/ The equality between  $\Delta NFA$  and  $CA$  is strictly valid only if there are no changes in the French Franc-US Dollar exchange rate vis-a-vis the currencies in which debts are denominated.
- 10/ Data about oil exports are systematically underreported in the official statistics, but oil revenues estimates are included as government receipts in our data.
- 11/ The increased shares of government investment and expenditure in GDP are, of course, largely due to adjustment by the private sector.
- 12/ Phosphates account for 10 percent of the country's exports, and groundnuts for about 50 percent.

- 13/ Institutional monetary reforms in 1973 gave greater autonomy from France to the two Central banks (BEAC, BCEAO) in setting money supply targets. As a result, money supply growth which had averaged 10% annually since independence, rose to 45% in 1974. Obviously this change accounted for the observed drop in PPPRER index in the three countries in 1974. For further discussion see Castillo, et al (1986).
- 14/ Recent presentations are Bruno (1976), Dornbusch (1980) Corden (1980). Jones and Corden (1976) present the analytics of the case with fixed nominal wages and sector-specific capital. Prachowny (1980) provides a detailed analysis of the standard model with factor-specific capital.
- 15/ All one can say from a current account deficit is that the net financial asset position of the country is deteriorating. Private capital inflow could be so great that reserves are increasing. The country may be increasing its real assets (foreign direct investment) if expenditures are mostly for investment.
- 16/ In the CFA Zone, the monetary mechanism to eliminate an external deficit implies ending sterilization so as to let the money supply fall. Even though the monetary reforms of 1974 have included some decentralization of power, with credit policy becoming less controlled by the Bank of France and more by each union member, monetary policy remains by and large in the hands of each Union's Central Bank which sets targets for total central bank financing in each member state and has other means to control domestic credit (e.g. setting reserve requirements for individual commercial banks, varying interest rates, etc.). In turn, the Central Bank of each Monetary Union must maintain a certain level of total external reserves of its Union with the Banque de France (for example the statutes of BCEAO require it to act whenever its level of external reserves fall below 20 percent of its sight liabilities).
- 17/ For recent case studies of macroadjustment using this approach see, e.g. Ahamed (1985).
- 18/ So many applications of the dependent economy are available that most options we introduce have been treated in one form or another in the literature. For example the distinction between private and public deficit which is usually not made has been exploited, though in a simpler model, by Soderstrom (1985). Perhaps our model is closest in spirit to Jones' (1974) two sector model where the export good is not consumed domestically.
- 19/ In the case of a budget surplus  $\bar{G} < 0$ , the demand curve for C would be downward sloping.
- 20/ Note that, as drawn, the top of Figures 5b and 5c show that for  $P_1$  private demand exceeds supply of the semitradable. Hence  $P_1$  will not be an equilibrium.

- 21/ Multipliers for the other endogenous variables are omitted since these variables were not discussed in the case studies.
- 22/ The export tax rate is defined as a positive number. Hence an increase in the export tax is defined as a positive number. See Appendix 1.
- 23/  $\chi^2$  values are final values after correction for heteroskedasticity. We corrected for heteroskedasticity by assuming a mixed form i.e.  $E(u_i^2) = \alpha_1 + \alpha_2 Z_i$  where we chose the logarithm of real income as instrument to regress on the residuals. Estimated values of this regression were then used as deflators.
- 24/ Similar results were obtained when tradeables were confined to agriculture. We do not include estimated equations with WR as that variable was usually not significant.

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