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Pre-commitment mechanism and policy credibility in African trade reform

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Pre-commitment mechanism and policy credibility in African trade reform

by

Sylvain Hounkponou Boko

A dissertation submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Major: Economics

Major Professor: Harvey E. Lapan

Iowa State University

Ames, Iowa

1996

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DEDICATION

This dissertation is dedicated to the memory of my father, Basile A. BOKO. May he rest in peace.

To my mother.

And

To the most important people in my life: my wife Tandeka, my daughter Chrystelle and my son Sèmassa.

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ABSTRACT

The issue of the credibility of economic policies has been the topic of many studies since the 1970s. While the theory is quite well established, little work has so far been done on its empirical applicability. This dissertation first develops a two-game model: the pre-commitment game and the time consistent game to show that, in the absence of a pre-commitment mechanism, a government's ex-ante optimal tariff choice is different from its ex-post optimal choice. We show that because of the subgame imperfection of the pre-commitment solution, forward looking private agents, will find the announcement of a trade reform policy by the government at the beginning of the pre-commitment game, to be time inconsistent, and therefore not credible. We further show that a pre-commitment mechanism is required to enhance the credibility of the pre-commitment solution and we propose such a mechanism that could be applied in developing countries.

But it is the empirical investigation of the dissertation that constitutes its real contribution to the literature. Indeed, using data from eight African countries, we examine whether international agreements, such as the World Bank/IMF sponsored Structural Adjustment Programs, can serve as pre-commitment mechanisms which could bolster policy reforms announcements in Africa.

The *bootstrap* technique is used to test for the real effects of adjustment

agreements signed by African nations with the Bretton Woods institution on actual tariff policy. The results of the test show that we cannot reject the null hypothesis that African governments' precommitment policies had an impact on their actual tariff policies. Further, we estimated a trade flow equation, which allowed us to examine the response of the private sector to the adjustment process in Africa. Using a fixed effects approach to panel data modeling, we are able to determine country specificity in each of our empirical models.

Overall, our results show that between the pre- and post-agreements periods there occurred a structural break in both the tariff and the trade models. We obtain statistical evidence that in general, African governments adhered to the announced policy reforms. But, this implementation was not perfect, as reversals occurred in later years of adjustment in many countries. We also obtain clear evidence that the trade response of the private sector to the adjustment programs was positive, for the results show that there occurred a statistically significant increase in trade flows in the adjustment period. We believe that these results indicate that the private sector generally lent credence to policy adjustments in Africa. We conclude that programs such as the structural adjustment programs undertaken in Africa in the 1980s can serve as pre-commitment mechanism for government policy making, but these programs must be developed firmly on the basis of the social, political and cultural realities of each country.

1. INTRODUCTION

1.1 Overview

There are several reasons why a government may impose tariffs on internationally traded goods. The usual arguments include protecting the domestic infant industry, national defense, anti-dumping policies, etc... With regard to developing nations, numerous countries had pursued import substitution policies in the 1950s and 1960s, the general objective of which was to decrease the dependency of the concerned nations on foreign made goods by spurring growth in the import-competing sector. The usual policy actions included the imposition of various price and quantity restrictions on foreign imports in order to reduce competition with the domestic import sector.

However, in the 1970s and 1980s, it was apparent that although high protective tariffs and quotas did limit imports, the decline in demand for foreign exchange that resulted from these policies led to an appreciation of the domestic currency, and thus a heavy tax on exports. In addition, duties on intermediate goods implied a tax on export activities using these intermediate goods. In Turkey, for example, during the protective years of the 1970s imports were growing at a rate of 2% per year, whereas, exports were actually declining at 1% per year. In contrast, during the liberal years of 1979-1989, Turkish imports grew by 10.4%, while its exports grew by 19.2%. (Dornbusch, 1992). All in all, under import substitution

policies, developing countries saw a decline in the competitiveness of their export goods, and overvaluation of their currencies; they suffered severe balance of payments problems, and accumulated large amounts of foreign debt.

This economic crisis meant that, in most cases, international credit was curtailed or cut off for these countries, and in some cases (as was the case for Cote d'Ivoire), the debt service to exports ratio escalated above 400% in 1989, according to World Bank figures. In an attempt to address the economic crisis they were facing, several countries signed economic agreements with the Bretton Woods institutions in the late 1970s and the 1980s. Almost invariably, these structural adjustment programs called for, *inter alia*, the liberalization of the concerned country's trade regime.

But, is the announcement of a trade liberalization as part of an agreement sufficient to ensure a welfare increasing response from the private sector? This is the main issue studied in this paper. The paper establishes that while it is always in the interest of a government to pre-commit, *ex ante*, to a policy such as trade liberalization, this policy may be time inconsistent *ex post*, and it would therefore not be credible to private agents, unless there exists an irreversible mechanism to support the announced policy.

After presenting a review of the literature on time inconsistency of policies, we develop two models: the time consistency model and the pre-commitment model to discuss the issue of time inconsistency of government policies. Next, we propose an example of a pre-commitment mechanism that may aid governments in their

relationship with private agents. Finally, under the assumption that Structural Adjustment Programs could play the role of a pre-commitment mechanism in the African context, we present an empirical study that tests if the tariff policy reforms announced as part of the adjustment programs agreed to by African governments in the 1980s had any real effect on the government tariff policy rule and the production and trade behavior of private agents in Africa.

1.2 A Review of the Literature

1.2.1 On the Theory of Credibility

In their seminal articles, Kydland and Prescott (1977), and Calvo (1978), developed the theory of the credibility of economic policies. In particular, Kydland and Prescott discussed the importance of credibility with respect to inflation-reduction policies. Suppose that the monetary authorities of a country wanted to put in place a stabilization program, the objectives of which are to reduce inflation and eliminate unemployment. Under the traditional Phillips curve's assumptions, these objectives are contradictory. Suppose that at the beginning of time t , the monetary authorities announced a strategy of zero inflation. As long as this announcement is credible to private agents, the authorities have a discretionary control over unemployment reduction. Thus, in the absence of a binding, pre-commitment mechanism, the monetary authorities have a great incentive to renege on their announced policy. This is to say that, once the private sector has chosen a strategy consistent with the zero inflation policy, the monetary authorities can make a surprise move by keeping to a

positive inflation policy, thereby fully exploiting a potential Phillips curve relationship. Of course, rational private agents can see through the authorities' smokescreen, and will determine that the latter's announcement of a zero inflation policy is time inconsistent and therefore not credible.

Further theoretical discussions on the dynamic (time) inconsistency of policy reforms are the focus of Lapan (1988) for large country application; Hillier and Malcomson (1984), Fischer (1980), Tesfatsion (1984), and Tesfatsion (1986). Indeed, in his 1980 article in the *Journal of Economic Dynamics and Control (JEDC)*, Fischer raised the issue of time consistency as it pertains to the type of control policy the government has at its disposal. According to Fischer, the problem of dynamic inconsistency arises when the government does not have a "non-distortionary control instrument (i.e., lump sum tax or transfer) at its disposal" and when current private agents' decisions take into account their expectations of future policy variables. However, in a two-period model, Hillier and Malcomson (1984), show that lump-sum tax is not necessary nor sufficient to achieve dynamic consistency. The Hillier and Malcomson paper consisted of three models. The first is a two-period model composed of a private sector and a public sector. There is a large number of individuals in the private sector who are assumed to have perfect foresight. The authors show that an optimal open-loop policy for the economy is dynamically consistent, if the government has sufficient policy instruments to control period one prices. The second and third models used by Hillier and Malcomson consist of an

exchange economy, with a public good present in the former, and a consumption externality in the latter, and two types of individuals in both models. Both models are used to show that the absence of distortionary tax/transfers is not necessary to achieve dynamic consistency.

Similar findings were made in Tesfatsion (1984b) and Tesfatsion (1986). The former extends the Fischer model to include a firm sector. The latter develops necessary and sufficient conditions for a dynamic Walrasian economy to exhibit inconsistency. In both papers, the author shows that reliance on non-distortionary policies is neither necessary nor sufficient to achieve consistency in government policies.

1.2.2 On the Application of the Theory of Credibility to Trade Policies

With respect to the application of the problem of time inconsistency to trade, Lapan (1988) discusses the issue as it relates to time lags, and the sequence in which decisions are made. Indeed, the two-good, two-country (one of them large) model, focuses on the timing of decisions and shows that when the domestic government has the ability to revise a policy that it has announced, then the announcement is irrelevant. Furthermore, the government has an incentive *ex post* to increase the tariff above its *ex ante* level, and the optimal policy is time inconsistent. To remedy this problem, the author suggests that an irrevocable pre-commitment mechanism, either through legislation or treaty, is necessary for the government to establish and maintain credibility.

Other models in the literature do not rely so much on the dynamic inconsistency of policies, but on ad hoc assignment of a belief structure to agents. For example, Aizenman (1992) proposes a model that analyzes the effects of trade liberalization on investment and development in a situation where the credibility of the reformer is in doubt. The model put forth by Aizenman has the following general features. The economy is a dual sector producing outputs X and Y, using both private and public investments. The country is assumed to have comparative advantage in the production of X. The representative agent maximizes the value of his expected lifetime utility function, and the country has access to the international credit market. However, the degree of accessibility is restricted by the perceived openness of the country, which can be measured by the ability and willingness of the country to service its debt. A country that will default on its external debt will face a penalty.

This is a two-period model, where in period 1 the policy makers liberalize trade by eliminating tariffs and other trade impediments. However, the public only attaches a probability (ρ) to the possibility that the trade reform will succeed, and therefore a probability ($1-\rho$) to the possibility that it will fail. The probability of success, ρ , is affected by the profile of government investment. The author assumes that the greater the public investment in the X sector (the export sector), the greater the cost of reneging on the policy, therefore the higher the probability of success. Conversely, if a higher proportion of government investment is done in the import competing sector, then the probability of failure of government policies as perceived by agents would be

higher. Thus, to enhance its credibility, the paper suggests that the government should tilt its investment profile towards the export sector. The extreme form of this type of pre-commitment mechanism was suggested in Srivastava (1994), where the author recommended that to achieve credibility in trade liberalization, a government should nationalize the export sector of the country.

With respect to the operational reasons why credibility problems may arise in an economy, Rodrik (1989a) suggests that the possibility of inconsistency between a trade reform, for example, and other policies pursued simultaneously by the government may cause the private sector to doubt government policy. Secondly, there may exist a time inconsistency problem, meaning that it is possible that the government has an interest to adopt a strategy *ex post* which would be different from its *ex ante* strategy (see discussions above). This means that, pursuant to a policy reform, once the private sector has made the expected adjustments, it may not be very costly for the government to reverse its policies. Finally, there may exist incomplete or asymmetric information in the economy. In this case the private sector may not be able to determine the true type of a government. It may not be able to distinguish between a government committed to true trade reform, and one that is just enacting reform policies in order to conform to conditionality requirements necessary to receive foreign aid. Thus private agents may not be able to tell how committed the government is to reform. In this situation, in order to achieve credibility, the government needs to signal its true type. According to Rodrik (1989b), "the rate at which the reform is introduced

may serve to convey the government's future intention and hence as a signal of its 'type'" (p 758).

While the present research presents the time inconsistency (and therefore the credibility) problem by focusing on the sequence of decisions, it distinguishes itself from earlier discussions in two ways: first, we propose a simple, and achievable mechanism, to support a pre-commitment optimal policy. The government is not required to modify its actions, but rather *ex ante*, it must credibly pre-commit to its a tariff policy. We derive the necessary condition under which the government would agree to the proposed mechanism. The second contribution of the paper consists in the development and estimation of two econometric models to analyze the effect of the trade liberalization provisions of actual agreements signed by African governments in an attempt to spur their trade sector in Africa. We assume that the lack of credibility may be one of the reasons behind the poor performance of the trade sector, and we test whether the tariff agreements can serve as a vehicle to establish credibility. The theoretical model is presented in the next section.

2. THE CREDIBILITY OF GOVERNMENT POLICY ANNOUNCEMENTS UNDER TWO MODELS: THE PRE-COMMITMENT MODEL AND THE TIME CONSISTENT MODEL

2.1 Overview

The theoretical discussion of the credibility problem is carried out in this dissertation under two types of games (or models): the pre-commitment game and the time consistent game, played (possibly) infinitely, but with the same games played in each, isolated time period. We do not allow government's reputation from preceding periods to effect plans in any current period; and there is no linkage between periods through savings, or lending (and borrowing). The issue of time inconsistency arises thus, not from any dynamics in the model, but from the sequence in which each game is played. In the next section, we present a sketch of the economy. Subsequent sections discuss the solutions to the two models.

2.2 The Economy

Consider a small, open economy which produces, in each period, two types of tradable goods: Q_m , the importable, and Q_x , the exportable. The economy exports all of its output of Q_x , and uses the revenue to purchase the additional amount of the importable good necessary to satisfy the domestic demand of Q_m . The economy comprises three sectors: a production sector; a consumer (or household) sector; and the government. There are H numbers of households in the economy. The firms in the

production sector are owned by the households. Each agent faces a utility function U^h which is a function of a private consumption good, as well as a public good provided by the government. Agents are assumed to behave non-cooperatively. Thus, each private agent in each sector makes his/her decision treating everybody else's decisions as given. Therefore, with a large enough number of agents in each sector, any individual agent's decision will have only infinitesimal effect on other agents' behavior. We also make the assumption, as in Fischer (1980), that agents are forward-looking, that they form beliefs or expectations about government policy, and that these expectations coincide with the actual government policy. Thus, agents have rational expectations, or even perfect foresight, since there exists no uncertainty in the model. We further make the assumption of full-information in this economy. Also, the economy starts each period with an endowment of a fixed resource, which we call E_t .

The objective of each household is to maximize its utility; and the government is benevolent and uses its policy choices to maximize a social welfare function, to be specified. We ignore factor market decisions in our analysis. The import good is the numéraire in this economy, such that, at each time, its price is set to equal to 1.

The government imposes a tariff (tax) on the exportable good in each period t . Thus, letting the world relative price of the export good (taken by the economy as given) in period t to be denoted by P^w_t , and τ_t to denote the tariff rate in period t , the domestic relative price of the export good is found as:

$$P_t = P_t^w(1 - \tau_t) \quad (1)$$

2.3 Agents' Decisions

2.3.1 Decisions in the Private Sector

In each period, and for each agent, the production possibility frontier is given by:

$$Q_{mt}^h = g(Q_{xt}^h; E_t^h), \quad (2)$$

for $h=1 \dots H$, where h denotes individual households.

In equation (2), g , the transformation function for each agent is a decreasing, concave function of Q_{xt}^h , and it is a function of each agent's endowment of the fixed resource in time t .

Also, let G_t denote the public good provided by the government in each period t ; and C_{mt}^h denote total private consumption of good M by each household in period t . Then, we represent the utility faced by each household in each period as:

$$U_t^h = U^h(C_{mt}^h; G_t) \quad (3)$$

We assume U_t^h to be at least twice continuously differentiable, positively increasing in its arguments, and strictly concave in all its arguments.

Since all of the domestic production of Q_m is consumed at home, and additional demand is fulfilled with the importation of Q_m , we represent private consumption as:

$$C_{mt}^h = Q_{mt}^h + Q_{xt}^h(1 - \tau_t)P^w \quad (4)$$

Equation (4) is the budget constraint of each agent, expressed in terms of the numéraire price. It also models the import good as a perfect substitute for the domestic importable good.

In each period, the public good is created by the government through the aggregate tariff revenue that it collects. The import good is transformed into the public good on one-to-one basis. Thus, we represent G_t as:

$$G_t = \sum_h \tau_t P^w Q_{xt}^h \quad (5)$$

Substituting (4) and (5) into (3), we get:

$$U_t^h = U \left(g(Q_{xt}^h; E_h) + P^w(1-\tau_t)Q_x^h; \sum_j \tau_t P^w Q_{xt}^j \right) \quad (6)$$

for $j=1 \dots H, h=1 \dots H$.

The objective of each household is to choose the optimal output supply of the export good to maximize (6). However, the precise method of maximization will depend on the sequence of decisions appropriate to each game.

2.3.2 Government's Decisions

The objective of this benevolent government is to maximize a social welfare function, which we designate by W . A general representation of the welfare function is that it is function (ψ) of the utility functions of all the agents in the society. Thus, we can represent the welfare function generally, as:

$$W_t = \psi(U_t^1 \dots U_t^H). \quad (7)$$

However, more specifically, we represent the social welfare function as additive in the private utility functions, taking the form:

$$W_t = \sum_h \lambda^h U_t^h(C_{mt}^h; G_t), \quad (8)$$

where λ^h is the weight accorded to each agent's utility. For simplicity, we assume that $\lambda^1 = \dots = \lambda^H = 1$.

The welfare function in (8) is assumed to be strictly quasi-concave. This is achieved by the assumption that each of the component utility functions is strictly concave. The government's objective can now be expressed as choosing the best tariff to maximize (8). But, again the methods of maximization, and its solutions, will depend on the sequence in which the two games are played.

2.4 Solution Methods

2.4.1 An Excursion on Optimum Control Theory

In optimum control theory, open- and closed-loop solutions can be explained as follows. Suppose that the control law of a *Markov* model is derived as:¹

$$u_t = u(x_t, t) \quad (9)$$

Since u_t in equation (9) depends on the current state, it is known as a *feedback* or *closed-loop* control. However, if we can solve for x_t and u_t in terms of an initial condition x_0 , then (9) becomes:

1. See, Whittle, 1982, p 57

$$u_t = u^*(x_0, t) \tag{10}$$

Equation (10) expresses control as an *open-loop*, because, in the words of Whittle, “actions are determined by the clock rather than by the current state” (p 57). As Whittle points out, “the closed-loop form has a potential adaptivity to changing circumstances which the open-loop form lacks” (p 57). These notions of optimum control theory will guide the solution methods we present below.

We will now discuss the precommitment (or open-loop) and time consistent (or closed-loop) solutions to our model. For this analysis, we will suppress the time subscript, since the solution forms will be the same for each period.

2.4.2 The Precommitment Solution

As we have noted above, the discussion of the solutions to each model will assume a given sequence of decisions. For the precommitment solution, decisions are made in the following sequence: (i) in the first stage, the government announces a precommitment tariff rate, τ^P ; (ii) in the second stage, production decisions are made, based on the announced tariff; (iii) in the third stage, consumption decisions are made.

2.4.2.1 Private Agents' Decisions

The pre-commitment game assumes that the announcement of τ^P is believed by private agents, and is irrevocable by the government. The household's problem then becomes:

$$\text{Max}_{Q_x^h, \tau^p} U^h = U^h \left[g(Q_x^h; E^h) + P^w(1 - \tau^p) Q_x^h + \sum_j \tau^p P^w Q_x^j \right] \quad (11)$$

Using backward induction (or *Bellman's Optimality Principle*), we first determine each household's optimum choice as the solution to the following first order necessary and sufficient conditions (we assume throughout that second order conditions hold):

$$\frac{\partial U^h}{\partial Q_x^h} |_{\tau^p} = U_1^h \left[g(Q_x^h; E^h) + (1 - \tau^p) P^w \right] + U_G^h P^w \tau^p = 0 \quad (12)$$

The solution to equation (12) is the household's optimum choice of Q_x , which we denote by Q_x^{*h} . We represent this optimum choice as:

$$Q_x^{*h} = Q_x^h(\tau^p; \bar{Q}_x^h), \quad (13)$$

where, $\bar{Q}_x^h \equiv \{Q_x^j; \dots; Q_x^j; \dots; Q_x^H\}$; $j \neq h$, and $h=1 \dots H$.

For each household, the optimum solution in equation (13) depends on the precommitment tariff and the output of all other agents, with each household taking as given the choice of all other agents. A simultaneous solution to (13) for all agents gives rise to the reduced form solution:

$$\hat{Q}_x^h = \hat{Q}_x^h(\tau^p) \quad (14)$$

Thus, when each private agent determines his/her optimum choice, the solution takes as given the choices of all other agents. However, when the government solves (12) simultaneously for all agents, the solution for the typical household depends on the precommitment tariff only.

2.4.2.2 The Optimal Solution Set for the Pre-commitment Game

Given (14), the government now makes the optimum selection of its policy to maximize the welfare function (8), subject to the government constraint (5).

Substituting (5) and (6) into (8), we represent the government's problem as:

$$\text{Max}_{\tau, Q_x^h(\tau^h)} W = \sum_h U^h \left[g(Q_x^h; E^h) + P^w(1-\tau)Q_x^h; \sum_j \tau P^w Q_x^j \right] \quad (15)$$

Taking the derivative of (15) with respect to τ , we obtain:

$$\begin{aligned} \frac{\partial W}{\partial \tau} = \sum_h \left[-U_1^h P^w Q_x^h + U_G^h \left(P^w \sum_j Q_x^j \right) + U_1^h \{ P^w(1-\tau) + g' \} \frac{\partial Q_x^h}{\partial \tau} \right] \\ + \left[U_G^h \tau P^w \sum_j \frac{\partial Q_x^j}{\partial \tau} \right] = 0 \end{aligned} \quad (16)$$

However, since from (12), we have:

$$U_1^h \left[g'(Q_x^h; E^h) + (1-\tau)P^w \right] = -U_G^h P^w \tau \quad (17)$$

Then, substituting (17) into equation (16) we obtain:

$$\frac{\partial W}{\partial \tau} = \sum_h \left[-U_1^h P^w Q_x^h + U_G^h P^w \left(\sum_j Q_x^j \right) + U_G^h \tau P^w \left(\sum_j \frac{\partial Q_x^j}{\partial \tau} - \frac{\partial Q_x^h}{\partial \tau} \right) \right] = 0 \quad (18)$$

For simplicity we can transform this model into a representative agent one.

This is accomplished by assuming that all agents have identical utility functions, technology, and endowments. Therefore, the solution (not necessarily the individual action at any particular time) to the optimization problem (8) is the same for all agents.

Under this assumption, equation (12) becomes:

$$\frac{\partial U}{\partial Q_x} = U_1 [g'(Q_x; E) + (1 - \tau)P^w] + U_G P^w \tau = 0 \quad (19)$$

where, we have dropped the superscript h .

Further, since all agents are assumed to be alike, we can rewrite equation (18)

as:

$$\frac{\partial W}{\partial \tau} = P^w Q_x [H U_G - U_1] + \tau P^w U_G (H - 1) \frac{\partial Q_x}{\partial \tau} = 0, \quad (20)$$

where H is the total number of private agents. Finally, equation (20), can be represented in elasticity form as:

$$\frac{\partial W}{\partial \tau} = \left\{ P^w [H U_G - U_1] + P^w U_G (H - 1) \left(\frac{\partial Q_x}{\partial \tau} \frac{\tau}{Q_x} \right) \right\} Q_x = 0 \quad (21)$$

Note that there are H numbers of equations of type (19) representing the private conditions, and one equation of type (21) representing government conditions. Using these $(H+1)$ equations, we derive the set of equilibrium solutions to the precommitment model as:

$$\left[\tau^p(P^w; E, H, \dots); Q^p(\tau^p) \right] \quad (22)$$

In (22), the tariff rate $\tau^p(P^w; E, H)$ represents the pre-commitment tariff that the government announces at the beginning of the pre-commitment game.

We present some additional remarks at this point. In the absence of any distortion associated with the provision of the public good G , the government's first best solution for welfare maximization is to set the sum of the marginal rate of substitution equal to the marginal rate of transformation. In our model, given that the

marginal rate of transformation is equal to one, this implies that the first best solution is achieved when the following holds:

$$\frac{HU_G}{U_1} = 1 \quad (23)$$

If we further assume that there is a single agent in the economy, i.e., that $H=1$, then (21) reduces to the following:

$$\frac{\partial W}{\partial \tau} = P^* [U_G - U_1] = 0 \quad (24)$$

And from (24) the first best solution with a single agent becomes:

$$\frac{U_G}{U_1} = 1 \quad (25)$$

To understand the importance of this analysis, we arrange condition (12) to obtain:

$$U_1 [g'(Q_x; E) + P^*] + \tau^p P^* [U_G - U_1] = 0, \quad (26)$$

which, from (24) implies,

$$U_1 [g'(Q_x; E) + P^*] = 0 \quad (27)$$

Equation (27) is the first order condition for utility maximization for an individual household in an economy without distortion. Thus, in the context of an economy composed of a single private agent, and a benevolent government, the tariff would not be distortionary [as is clear from (25) and (26)], since all tariff revenues will be rebated to that agent in the form of a public good provided by the government. Hence, the issue of time consistency will not arise.

However, in the present model, there are $H > 1$ number of agents, and the results are different. Indeed, with $H > 1$, and assuming $\frac{\partial Q_x}{\partial \tau} < 0$, then the first best solution derived from (23) fails to hold, and the solution to (20) implies that:

$$\frac{HU_G}{U_1} > 1, \quad (28)$$

Thus, due to the responsiveness of export supply to changes in the tariff, there is an under-provision of the public good in the pre-commitment game. Further, unlike the case of a single agent, when $H > 1$, the first order condition for utility maximization in (27) is no longer valid. This is because, with $H > 1$, (24) does not obtain, and equation (27) becomes:

$$U_1[g'(Q_x; E) + P^*] \neq 0 \quad (29)$$

The implication of this discussion is that with many private agents who do not cooperate in their decisions, the imposition of a tariff will be distortionary, because the tariff affects output decisions. The issue is that the private sector is not certain that the value of the marginal benefit received by each agent in terms of the public good, is equal to his/her marginal contribution. There is a potential free-rider problem and the issue of inconsistency of policies becomes relevant in this situation.

2.4.3 The Time Consistent Game

Now, in the absence of a pre-commitment mechanism, forward-looking private agents recognize that once their production decisions have been made in response to the announcement of (22), the government may have an *ex-post* incentive to change its

policy. As we will show, once private decisions have been made, the export supply becomes inelastic, and the government therefore has an incentive to impose a higher tariff *ex post*, unless it can be prohibited from doing so. Thus, the policy implied by (22) is not time consistent, and is therefore not credible to private agents. The only credible policy, in the absence of a commitment mechanism, is the time consistent policy, since it is the subgame perfect solution to this problem. We now present the time consistent game.

For the time consistent (TC) game, the sequence of decisions are different from the ones for the precommitment game. Agents move as follows: (i) in the first stage, private agents make their optimal output selection; (ii) in the second stage, the government selects its optimal policy, based on private decisions in the first stage; (iii) finally, based on stages (i) and (ii), consumption decisions and the choice of the public good are made.

2.4.3.1 The Government's Solution

Once again, we use *Bellman's Optimality Principle* to select, first, the government's policy, and then, based on this policy, we select private actions. We use \bar{Q}_x^h to underscore the fact when the government makes its policy selection, private decisions, from the perspective of the government, are predetermined.

The government's problem is, therefore, to maximize a restricted welfare function, say, \tilde{W} , that takes the form:

$$Max_{\tau} \tilde{W} = \sum_h \lambda^h \left[U^h \left\{ g(\bar{Q}_x^h, E) + P^w(1-\tau)\bar{Q}_x^h; \sum_j \tau P^w \bar{Q}_x^j \right\} \right] \quad (30)$$

Once again, assuming all $\lambda^h = 1$, and taking the derivative of (30), then the first order conditions become:

$$\frac{\partial \tilde{W}}{\partial \tau} = \sum_h \left[-U^h_1 P^w \bar{Q}_x^h + U^h_G P^w \sum_j \bar{Q}_x^j \right] = 0 \quad (31)$$

The solution to (31) is:

$$\tau^* = \tau^*(\bar{Q}_x^1, \dots, \bar{Q}_x^H) \quad (32)$$

Notice that, in contrast to (18), equation (31) does not involve terms relating to the responsiveness of export supply to tariff. In fact, in the TC game, export supply is not responsive to tariff changes. There is no distortion associated with the provision of the public good via tariff, and the government has no incentive to reduce tariff. Further, since from (31) the summed marginal rate of substitution is equal to the marginal rate of transformation, equation (32) is the first best solution for each individual, if all agents select the same output supply, \bar{Q}_x .

2.4.3.2 Equilibrium in the Time Consistent Game

Given (32), private agents derive the optimal output choice by solving the following problem:

$$Max_{Q_x^h, \tau^*(\bar{Q}_x^1, \dots, \bar{Q}_x^H)} U^h = U^h \left[g(Q_x^h, E^h) + P^w(1-\tau^*)Q_x^h; \sum_j \tau^* P^w Q_x^j \right] \quad (33)$$

In (33), each agent recognizes that the tariff responds to changes in his/her own output

choices, but he/she treats all other agents' output as given. The first order conditions are:

$$\frac{\partial U^h}{\partial Q_x^h} = U_1^h [g^h + (1 - \tau^*) P^w] + U_G^h P^w \tau^* + \left[U_G^h P^w \sum_j Q_x^j - U_1^h P^w Q_x^h \right] \frac{\partial \tau^*}{\partial Q_x^h} = 0 \quad (34)$$

There are H equations of the form (34) and one government condition of the form (31). Solving these (H+1) equations yields the TC solution.

But, once again, we simplify the model by assuming that the solution (34) is identical for all agents. Under this assumption, equations (31) and (34) become:

$$\frac{\partial \tilde{W}}{\partial \tau} = (H U_G - U_1) P^w Q_x = 0, \quad (35)$$

which is the condition that solves for the government's optimal instrument.

And,

$$\frac{\partial U}{\partial Q_x} = \left[U_1 \{g^h + (1 - \tau^*) P^w\} + \tau^* P^w U_G \right] + \left[(H U_G - U_1) P^w Q_x \frac{\partial \tau^*}{\partial Q_x} \right] = 0, \quad (36)$$

which is the household's condition. By the envelope theorem, (35) and (36), yield:

$$\left[U_1 \{g^h + (1 - \tau^*) P^w\} + \tau^* P^w U_G \right] = 0 \quad (37)$$

The set of solutions to (36) and (37) is:

$$(\tau^c, Q^c), \quad (38)$$

which is the Nash equilibrium solution for the time consistent game.

2.5 Comparing the Time Consistent and Pre-commitment Solutions

We put forth the following propositions to analyze the time consistent and pre-commitment solutions.

Proposition 1

The precommitment and time consistent solutions will coincide only if, in the precommitment game, the supply elasticity of the good Q_x is equal to zero.

Proof of Proposition 1:

A comparison of the pair of equations (35) and (37) to the pair (19) and (20) reveals that: a) for both the time consistent and precommitment solutions, the first order conditions corresponding to the private agents' problem are the same. That is, condition (37) is the same as condition (19); b) however, for the government's problem, the first order conditions are not the same. When evaluated at the same tariff rate, (21) differs from (35) by the second batch of terms in (21), which are:

$$P^*U_G(H-1)\left(\frac{\partial Q_x}{\partial \tau} \frac{\tau}{Q_x}\right) \quad (39)$$

The terms (39), represent the aggregate change in the private utility function with respect to a change in the public good times the responsiveness (or elasticity) of the supply of good Q_x to a change in tariff. Since we have no *a priori* reason to believe that $P^*U_G(H-1) = 0$, then the two solutions will coincide only if $\left(\frac{\partial Q_x}{\partial \tau} \frac{\tau}{Q_x}\right) = 0$.

Q.E.D.

But, the equality between the time consistent and precommitment solutions is a trivial case in our analysis. The more interesting case arises when the two solutions are not the same. This is discussed through the following proposition.

Proposition 2:

The pre-commitment tariff, τ^p is less than the time consistent tariff, τ^c (i.e., $\tau^p < \tau^c$), if $\frac{\partial Q_x}{\partial \tau} < 0$.

Proof of Proposition 2:

Compare the conditions [(35) and (37)] to [(19) and (20)]. When evaluated at the same tariff rate, equations (19) and (37) are the same and they are used to solve for the output $Q_x(\tau)$. Now, assume $\frac{\partial Q_x}{\partial \tau} < 0$.² Then, evaluating (20) at the TC tariff, we obtain: $\frac{\partial W}{\partial \tau}|_{\tau^c} < 0$. If $\frac{\partial^2 W}{\partial \tau^2}|_{\tau^c} < 0$, then $\tau^p < \tau^c$. Q.E.D.

We also provide a graphical explanation of *Proposition 2*. Consider the following general representation of the first order conditions (35) and (37), as loci of points under the TC game.

$$J(Q_x, \tau) = 0, \quad (40)$$

denotes the private agent's locus; and,

$$K(Q_x, \tau) = 0, \quad (41)$$

denotes the government's locus.

2. For proof see Appendix A

Similarly, for the PC game, we represent (19) and (20) as:

$$J(Q_x, \tau) = 0, \quad (42)$$

the private agent's locus (same function as (40)); and,

$$\pi(Q_x, \tau) = K(Q_x, \tau) + Z(Q_x, \tau) = 0, \quad (43)$$

the government locus, with $Z(Q_x, \tau) < 0$.

Assume, $T_r < 0$, $J_r < 0$, $T_{Q_x} < 0$ and $K_{Q_x} < 0$. Then, consider Figure 1.

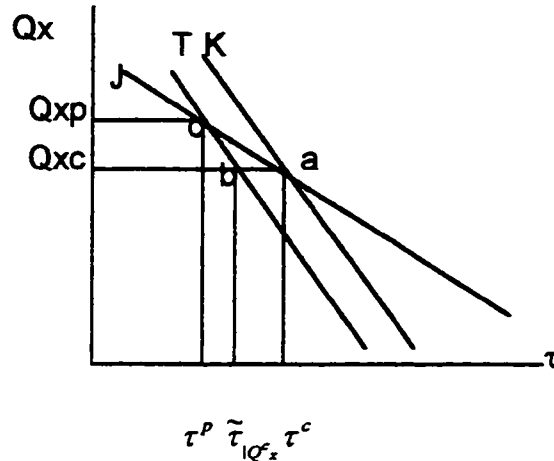


Figure 1. Comparing the time consistent and pre-commitment solutions.

At point (a) we provide the graphical representation of the TC solution, where the TC private and government loci intersect. Now, since the Z function in (43) is negative, the PC government locus lies below the TC government locus. We then show, at point (b), the tariff rate, $\tilde{\tau}_{|Q_x}$ that would prevail if we evaluate the PC solution at the TC output level. This is the optimum tariff level selected by the government if all

agents choose the time consistent level of output.. Point (c) represents the PC solution. As the graph shows, the solution that generates the lowest tariff rate and the highest output level is the pre-commitment solution.

One explanation for this result is that, in the case of the pre-commitment game, the private agent can modify his/her decision in response to an increase in tariff. Thus, in setting its policy, the government must take into account the private agents' reaction, to changes in the tariff policy. However, for the time consistent game, the government does not have to consider such a response from the private sector, since the elasticity of supply, in that case is zero.

We offer an alternative explanation to understand *Proposition 2*. In the standard analysis of the incidence of tax on private agents, it can be shown that the level of taxation that government can impose may depend on the responsiveness (or elasticity) of the offer curve of the group being taxed. Further, according to the *LeChatelier Principle*, "the long-run supply response to a change in price is at least as large as the short-run supply response", when evaluated at the same price level (Varian; 1992, p 47). We can think of the domestic export supply curve for the pre-commitment game as the long run (or *ex-ante*) export supply curve, and the export supply for the time consistent game, as the short run (or *ex-post*) export supply curve. From the *LeChatelier Principle*, we know that the elasticity of the *ex-ante* export supply curve is at least as large as that of the *ex-post* one. Thus, the tariff imposed by the government would be different depending on whether it is faced with the *ex-ante*

(long run) export offer curve, or the *ex-post* (short run) export offer curve. In fact, by *Proposition 2*, the short run tariff would be higher than the long run one.

Proposition 3:

The time consistent solution is dominated by the pre-commitment solution.

Proof of Proposition 3:

Let W^p be the welfare function resulting from the pre-commitment choices, and W^c be the welfare function resulting from the time consistent choices. At the same

tariff rate, say, τ^c , we have: $W^p(\tau^c) = W^c(\tau^c)$. However, if $\frac{\partial W^p}{\partial \tau} \Big|_{\tau=\tau^c} \neq 0$, then

$\text{Max}_{\tau} W^p > W^p(\tau^c)$. More particularly, following *Proposition 2*, if $\frac{\partial W^p}{\partial \tau} \Big|_{\tau=\tau^c} < 0$,

then $\tau^p < \tau^c$, and $\text{Max}_{\tau} W^p > W^p(\tau^c)$. Q.E.D.

The issue raised in *Proposition 3* is really one of policy options available to the government in its policy choice set. When the government selects the pre-commitment policy, the time consistent policy remains an option. If at the beginning of a game, a welfare maximizing government chooses to announce the pre-commitment policy, then this implies that the welfare benefit it expects to receive from announcing such a policy must be greater than the expected benefit from the alternative time consistent policy. But, the question to be posed regards whether or not the government has the ability to change its announced policy, *ex post*, i.e., once the private sector has made its output selection. This points to the issue of credibility that will be raised in the next proposition.

Proposition 4:

In the absence of an irrevocable pre-commitment mechanism, the government's policy announcement of the optimal precommitment tariff is not credible to private agents.

Proof of Proposition 4:

Lapan (1988) and Srivastava (1994) have made similar propositions. In this paper, it is sufficient to note that the PC game is subgame imperfect (see Kreps, 1990). Therefore, assuming the government could subsequently modify the actual tariff, any move announced by the government at the beginning of the PC game other than the time consistent tariff, would not be credible to private players. Credibility can only be established by an irreversible mechanism that supports the government's announced move. Q.E.D.

Note that the problem of credibility does not arise from a malicious motive on the part of the government. Rather, by its very nature, the pre-commitment game has an intrinsic credibility problem, because of other options (the ability to change tariffs) available to the government once the private sector has "locked in" its action. In the next section, we provide an example of a pre-commitment mechanism which could help to support the pre-commitment solution.

2.6 An Example of a Pre-commitment Mechanism

Assume (for simplicity) that there is an outside institution (IMF, World Bank, etc...) that has a similar objective function as the government. Further, suppose that in

order to help the government to maintain its credibility, the institution presents it with the following proposition:

(a) If the government maintains its announced tariff policy then it will receive a benefit of size, say, $\beta > 0$ (expressible in utils), from the institution;

(b) but, if the government signs the agreement and fails to maintain its precommitment policy, then it loses access to the transfer payment from the institution, and, in addition, pays a penalty of size $\varepsilon > 0$ (also, expressible in utils), to the institution.

We now derive the conditions under which the government will enter this agreement, and which will make the pre-commitment policy credible.

Let \bar{Q}_x designate the production level selected by the private sector when the pre-commitment policy is credible. Given \bar{Q}_x , the restricted welfare function can be expressed as: $\tilde{W} = \tilde{W}(\tau, \bar{Q}_x)$. Also, let $\tilde{W}^A(\tau, \bar{Q}_x)$ represent the net welfare attained by the government under the agreement, and \tilde{W}^F as the time consistent welfare level (derived earlier). Then, we formalize the agreement conditions (a) and (b) as:

$$\tilde{W}^A(\tau, \bar{Q}_x) = \tilde{W}(\tau, \bar{Q}_x) - \varepsilon, \text{ if } \tau \neq \tau^p, \quad (44)$$

and,

$$\tilde{W}^A(\tau, \bar{Q}_x) = \tilde{W}(\tau^p, \bar{Q}_x) + \beta, \text{ if } \tau = \tau^p \quad (45)$$

The decision to enter into the agreement depends on the net welfare anticipated under the agreement. From (44) and (45), if the sum of the benefit of compliance plus the

cost of renegeing is such that:

$$(\beta + \varepsilon) < \left[\text{Max}_{\tau} \tilde{W}(\tau, Q_x(\tau^P)) \right] - \left[W(\tau^P, Q_x(\tau^P)) \right], \quad (46)$$

meaning that the net benefit anticipated if the government renege on the agreement is higher than the net benefit anticipated if it complies, then the announcement of the pre-commitment solution under the agreement would not be credible. Private agents will expect the government to renege on τ^P ; hence they will not choose $\bar{Q}_x = Q_x(\tau^P)$.

Further, if the government enters into the agreement, with (46) prevailing, then the net welfare to the economy is $W^F - \varepsilon$ (since under this condition, the private sector would produce $Q_x(\tau^c)$). And, if the government does not enter into the agreement, the economy's welfare remains at W^c . The welfare ranking for this case is then:

$W^c(\text{do not enter}) > \{W^F - \varepsilon\}(\text{enter and renege})$, and the government is better off not to sign the agreement.

However, suppose the inequality in (46) is reversed, then we would have:

$$(\beta + \varepsilon) > \left[\text{Max}_{\tau} \tilde{W}(\tau, Q_x(\tau^P)) \right] - \left[W(\tau^P, Q_x(\tau^P)) \right] \quad (47)$$

In (47), the net benefit anticipated from compliance is greater than the net benefit anticipated from non-compliance; the announcement of the pre-commitment solution is credible under the agreement, and the government is better off signing the agreement. Thus, assuming no exogenous uncertainty, equation (47) is a necessary condition for the government to sign the agreement.

We have shown that, if appropriately formulated, an international agreement such as the one we propose, may serve two purposes: to enhance the welfare of the society, and to act as a precommitment mechanism that would bolster the credibility of the government from the point of view of private agents. Our is only one of many possible pre-commitment mechanisms. Other mechanisms may include, in a democratic society for example, constitutional requirements that may prohibit present and future governments from altering a pre-commitment policy.

We also note that our proposal for a pre-commitment mechanism is an approximation of part of the conditions African (and other developing) countries had to fulfill when they signed the IMF/World Bank sponsored Structural Adjustment Programs (SAPs).³ Among other reforms, these programs required countries to remove barriers to trade, reduce their tariffs, devalue their exchange rates, and rationalize government expenditure.

In the next section, we attempt to determine, using data from African countries, whether the announcement of this type of international agreements affected the behavior of private agents in Africa. We do not attempt to measure credibility per se, but rather we wish to determine whether trade reforms in the SAP agreements have a measurable impact on actual government policies, and private plans and actions. If we do find that the announcements made as part of SAPs had significant impacts on private actions and plans, then we might be able to infer that private agents found

3. See Kanbur (1991) for a discussion of the theory of structural adjustment and the role of trade policy.

government announcement to be credible. Now, we turn to the empirical section of our paper.

3. ESTIMATING THE EFFECTS OF TRADE REFORMS ON GOVERNMENT POLICY AND PRIVATE ACTIONS IN AFRICA

In this section, we study the impact of the structural adjustment programs on government tariff policy making, and private sector decisions in Africa. We will first present a brief account of country specific evidence on the reform programs. Then, we review the body of work concerning the empirical modeling of credibility. Next, we present the model we propose to conduct our empirical investigation; finally, the results of our model are presented and discussed.

3.1 An Overview of the Recent Developments in Africa

Our model will attempt to capture the historical economic development that has occurred in most African countries since they achieved independence from colonial powers in the early 1960s. The immediate post-independence period (1960-1970) was marred with political turbulence, as newly created nations were attempting to discover their development paths. During this period, nations had not yet created an atmosphere (infrastructure, political stability, an established credit market, and other incentives) conducive to increased private (domestic as well as foreign) investment. However, during the decade of the 1970s African countries became more or less fully integrated into the world market. Many African countries such as Côte d'Ivoire, Ghana, Zaire, South Africa, Nigeria, Gabon, Cameroon, became premier producers of mostly primary and mineral products, such as cocoa, coffee, lumber, oil, diamonds, gold,

etc.... By the end of the 1970s and in the early 1980s Africa began to experience a period of severe and lingering economic crisis. Indeed, during 1980-1989, several countries experienced a negative growth rate in their GDP: in Nigeria, the rate was -0.4; in Niger it was -1.6, and in Mozambique it was -1.4. (World Development Report, 1991) In order to remedy this situation, African countries began to look for help from the Bretton Woods Institutions. Thus, began the period of the so-called structural adjustment in many African countries.

The empirical justification for our two-period model lies then, in the fact that since Independence, we can identify two main periods characterized by major shifts in economic policy-making in Africa: the period pre-Structural Adjustment Programs (SAPs), where countries followed (more or less) their own economic paths, without a given structure for economic policy choice agreed to with an outside agency; and the period post-SAPs where countries have agreed to follow a set of conditions, including the making of economic policy choice, in exchange for increased foreign aid.

3.2. The Empirical Evidence on Reform Programs in Eight African Countries

This section presents country case studies on the adjustment process in eight African nations. These countries were selected because they are the ones for which we are able to obtain the data that we require for our analysis.

3.2.1 Côte d'Ivoire

3.2.1.1 Main Features of the Economy

The Republic of Côte d'Ivoire gained independence from France in August 1960. The country covers an area of 322,463 sq. km. and has a population of 14 million inhabitants that is growing at approximately 3.8 annually. Between 1965 and 1980, the economy was growing at a high rate of 6% to 8%, but from 1981 onwards, the country suffered from severe economic crises due to both internal (macroeconomic imbalances) and external forces (such as a slump in the terms of trade).

Figure 2 displays the performance of the country's GDP from 1970. As the figure shows, after growing at a higher than average rate during most of 1970s, the

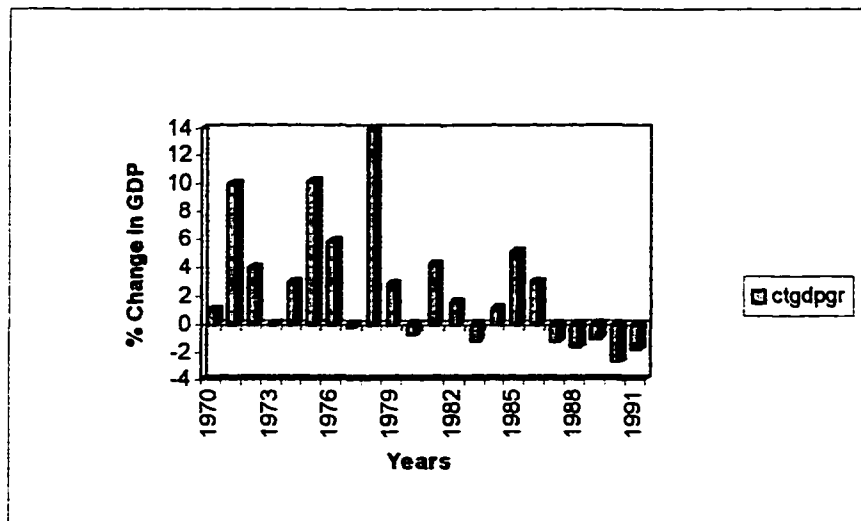


Figure 2. Average Annual Growth Rate of GDP in Côte d'Ivoire since 1970

growth rate of GDP was negative from the early 1980s onwards, and the country has not recovered since. The balance of payments presents a grim picture of the economy's performance since 1975. The current account balance is shown in Figure 3. The figure shows that the Ivorian current account has consistently posted a negative balance since 1975. This negative balance in the current is driven mostly driven by the persistent negative balance in the trade account.

Figure 4 depicts Côte d'Ivoire's balance of trade since 1970. The persistently poor performance in the country's balance of payments is indicative of underlying structural problems. One of the most important factors in the development of the Ivorian economy is foreign direct investment. Figure 5 depicts how foreign

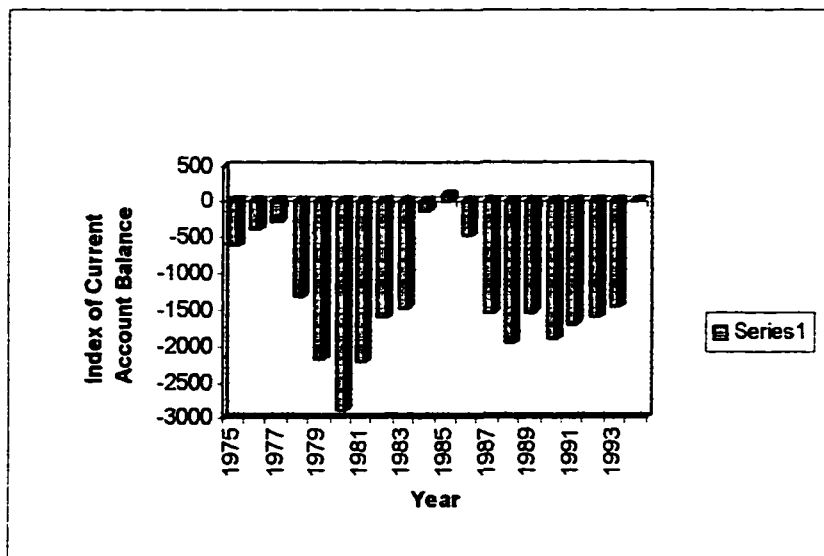


Figure 3. Côte d'Ivoire's Current Account Balance

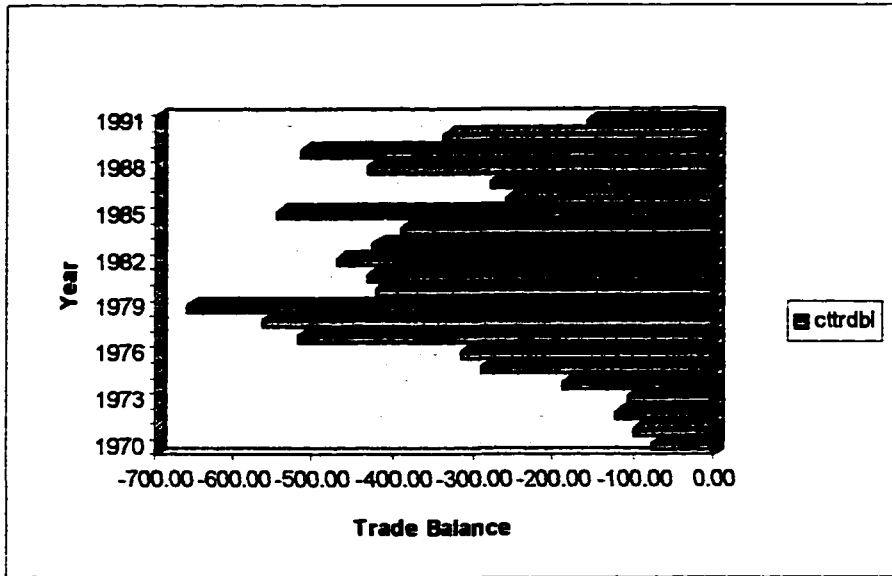


Figure 4. The Ivorian Trade Balance since 1970

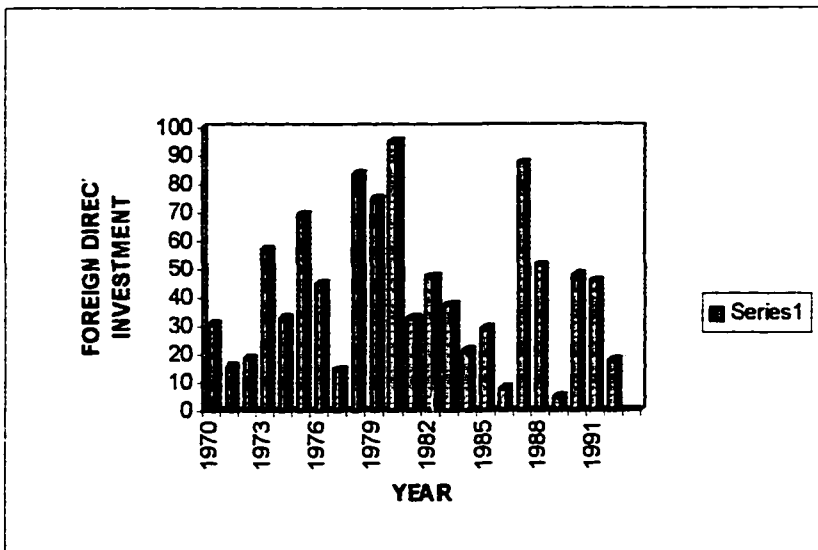


Figure 5. Direct Foreign Investment in Côte d'Ivoire since 1970

direct investment (in million of \$) has changed over the last two decades in the country. As the figure shows, foreign direct investment in Côte d'Ivoire has gone up and down over the past two decades, but more particularly, in some years in the mid to late 1980s foreign direct investment (FDI) into the country became almost non-existent. From Figure 5 and Figure 2, we observe that during the years when the Ivorian FDI declines heavily, the country's GDP worsens also. Now, we provide details as to how the economic situation led to the adoption of adjustment programs in Côte d'Ivoire (see Figure 6 for the relationship between the Ivorian terms of trade and its exports).

With an average annual growth rate of 8% during the period of 1965-75, Côte d'Ivoire had been branded as a success story in Africa. However, this characterization began to change from the mid-1970s. In 1976, a production slump in Brazil resulted in a boom in export prices of cocoa and coffee (the country's main export crops). Expecting this increase in world prices to last, the government of Côte d'Ivoire undertook ambitious investment programs, and accumulated enormous external debt (see Figure 7 for the country's debt to exports ratio). This increased spending had a significant adverse effect on the country's macroeconomic stability, especially since between 1977 and 1980, export prices fell by 6.5 % (Figure 6), annually, and the country's terms of trade declined from 140.2 to 98.1 in the same period (Figure 6). This price shock led to many of the economic problems that the country faced in the 1980s.

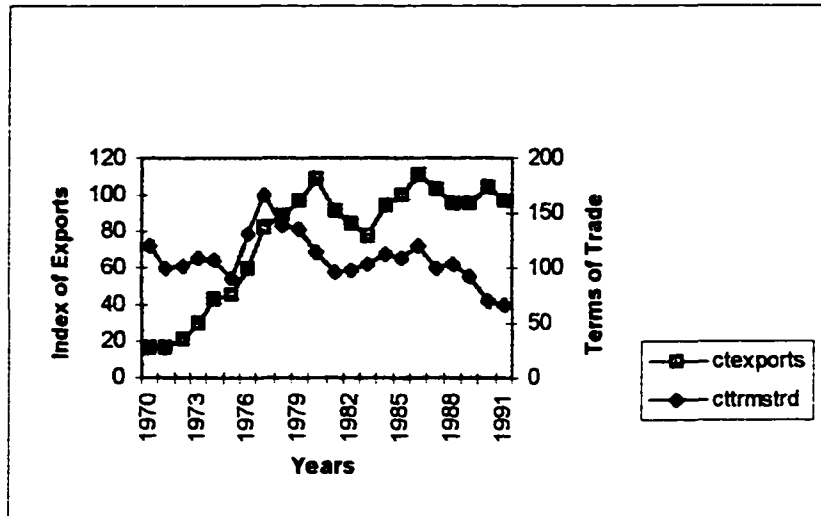


Figure 6. Terms of Trade and Exports in Côte d'Ivoire since 1970

3.2.1.2 Policy Reforms in Cote d'Ivoire

In an attempt to address its dire economic circumstances, Côte d'Ivoire sought assistance from the Bretton Woods institutions. Thus, in February 1981, the country signed an extended arrangement with the IMF covering a three-year period. This was to be followed by six standby agreements up to 1991, making the total support from the IMF during the decade equal to SDR 1 billion. On its part, the World Bank provided three structural adjustment loans between 1981 and 1986 totaling \$650 million, and six sectoral adjustment loans between 1989 and 1991, totaling \$780 million (Hussain and Faruquee, 1994).

3.2.1.3 The Reform Package

In the period of 1984-86, Côte d'Ivoire attempted to reform its incentive regime in order to encourage industrial production in the export sector. The reforms were to be implemented in the following stages. First, the country was to eliminate quantitative restrictions and replace them by temporary import surtaxes. The second

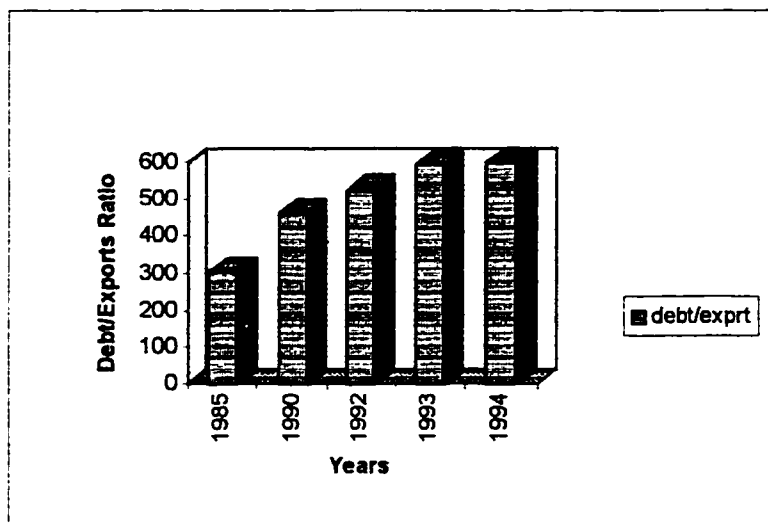


Figure 7. Debt to Exports Ratio in Côte d'Ivoire for Selected Years

stage consisted of a comprehensive tariff reform, where a uniform effective tariff rate of 40% was to be established. In the third stage, a subsidy of 40% of value added was to be granted to industrial exports and later to agricultural exports, in order to compensate exporters for the overvaluation of the exchange rate, and to offset the

anti-export bias of the import protection regime (World Bank, 1994). In the last stage, tariff exemptions on the purchase of intermediate inputs were to be abolished.

The implementation of the first stage of the reform program took place in 1985. Although quantity restrictions (QR's) were removed, and the average import duty was increased from 26% in 1985 to 33% in 1986 (see Figure 8), the payment of export subsidies was delayed until late 1986. However, by 1988, due to pressures from internal interest groups, some reversals started occurring. The QR's returned, and as of 1991 tariffs ranged from 0 to 151%. Thus, by 1991, the reform program that was announced in 1985, had been reversed.

We must note here that as a member of the CFA⁴ currency zone, the exchange

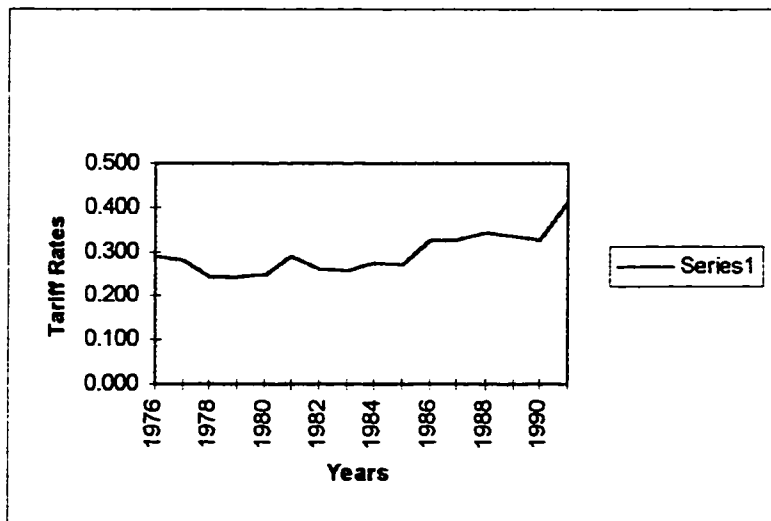


Figure 8. Average Tariff Rates in Côte d'Ivoire since 1976

4. CFA is Communauté Financière Africaine, the currency zone for Francophone African countries.

rate was not an instrument of adjustment for the country. This is because, until 1994, the CFA was pegged to (and fully backed by the French treasury) the French Franc at a fixed rate of 50CFA per FF. Thus, the changes (devaluation) in exchange rate policies required by the structural adjustment programs could not be implemented in the CFA zone. Some have argued that the lack of the exchange rate as an adjustment instrument may have hurt the sequencing coordination of the different components of the reform programs in the countries in the CFA zone (Rouis; 1994).

A second trade reform package was introduced in 1990. The intention again was to promote export and rationalize the system of import duties so as to lower the average level of tariff rates, as well as their dispersion (World Bank, 1994; Coulibaly, 1993). In the period of 1992-95, the new program was to eliminate most non-tariff barriers, and abolish reference prices on imports. The government had a medium objective of a two-duty tariff structure in the following range: a minimum of 10-15%, mode of 20-25%, and a maximum of 25-35%. Also, export subsidies were to be gradually phased out.

3.2.2 Senegal

3.2.2.1 Overview of the Economy

Senegal is a West African former French colony which gained its independence in August 1960. This country of about eight million people covering an area of 196,192 sq. km., is one of the stable democracies of Africa, even though in more than thirty years, the country has only been led by two different presidents: Léopold Sedar

Senghor from 1960 to 1980 and Abdou Diouf from 1981 to the present. The country is at the bottom of the lower-middle-income income countries, with a per capita income of \$750 in 1993. In Figure 9, we present the average growth of the Senegalese GDP since 1970.

As the figure clearly shows, after a slow start in the 1960s, the country, which by all accounts inherited a well developed physical and administrative infrastructure (Dakar was the capital of the former French West Africa), displayed dynamism throughout the 1970s, before experiencing economic crisis in the late 1970s to early 1980s. As Figure 10 shows, the current account balance, already consistently negative, worsened during the period of 1979-1981 and remained negative throughout the

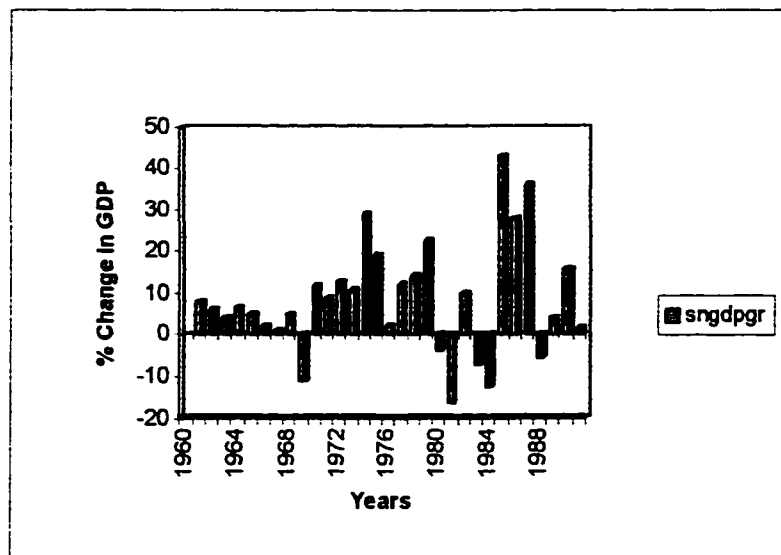


Figure 9. The Annual Percentage Change in GDP in Sénégal since 1960

1980s. There were several factors that could explain the negative growth of the economy in the early 1980s. According to a 1987 report by the World Bank, a “combination of poor financial and investment policies, worsened terms of trade and successive droughts plunged an already weakened economy into a severe crisis” (Rouis; 1994, p 291). Indeed, between 1978 and 1981, Senegal suffered two major droughts, a dive in the world price of its exports crop, peanuts (see Figure 11), a current account deficit of 12.5% of GDP, negative savings, external debt to GDP ratio of 67.4%, and an inflation rate of 12% (p 291).

The negative growth of GDP in the early 1980s can thus be explained by both

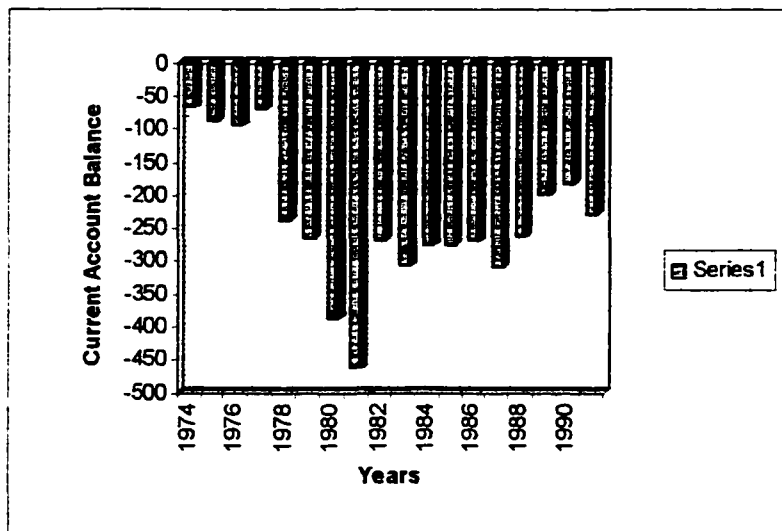


Figure 10. Performance in the Current Account Balance since the 1970s

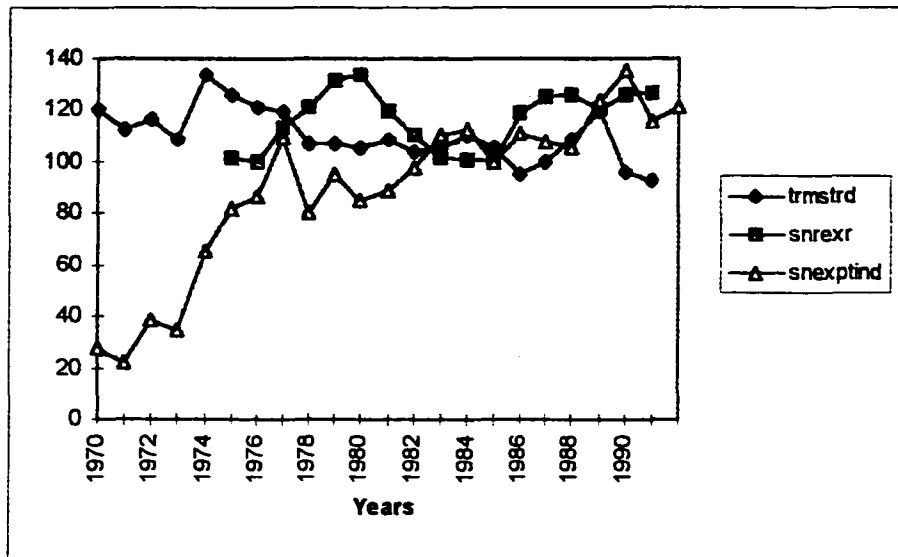


Figure 11. Indices of the Terms of Trade, Real Exchange and Exports in Senegal

internal and external economic conditions. By the late 1970s the government of Senegal began to initiate reform programs with consultations with the World Bank and the IMF. Until 1990, the country has received four structural adjustment loans (1980, 1986, 1987, 1990) supported by the World Bank. However, trade reforms did not go into effect until 1986.

3.2.2.2 The Reform Package

In 1986, Senegal undertook trade reform measures as part of the New Industrial Policy. According to the UNDP and the World Bank, the objectives of the reform policies consisted in liberalizing the import sector, by abolishing non-tariff barriers (NTB's), eliminating special tariff regimes, and "rationalizing" the tariff

structure. These reforms were to be phased in between 1986 and 1989.

In fact, according to the World Bank (1992), by 1988, the composition of the tariff structure was to include average rates of 60%, 40% and 20% for luxury goods, final goods, and raw materials, respectively (see Table 1). On the export side, the export subsidy was to be reformed by changing the basis for the calculation of export subsidies, and simplifying the procedures for obtaining trading licenses. (UNDP/World Bank, 1993).

3.2.2.4 The Results

The Senegalese economy, even more than many countries in Africa, depends on trade revenues. In fact in a 1994 study conducted by the World Bank, Senegal was ranked first among African countries with the highest tariff rates. Among other things, the reduction of revenues caused the government to reverse some of the policy initiatives. Indeed, tariff reforms caused tax revenues as a percentage of GDP to drop from 18.1% in 1984 to 14.3% in 1988.

Table 1. Indicators of Senegal's Import Protection

<i>Table 1: Import Protection in Senegal, 1985-1991</i>							
Indicator	1985	1986	1987	1988	1989	1990	1991
Average rate of protection	165.4	111	111	89.3	94.6	97.7	
Effective tariff rates(%) ^a	18.1	23	25.6	23	25.2	28.6	30.3

a. Calculated as customs receipts as % of imports (cif) by original author

Other factors that contributed to the drop in tariff revenues included smuggling, imports exemptions, and underinvoicing (Rouis; 1994). In any case, whereas the average rate of protection (with all surcharges included) had been reduced from 111% in 1986 to 89.3% in 1988, it rose back up in 1990 to 98%.

3.2.3 Mali

3.2.3.1 Overview of the Economy

Mali is the third CFA zone country in this study. It is a West African country of about eight million people covering an area of 1,240,000sq. km. Mali achieved independence in September 1960, and has been led mostly by military regimes until the multipartite elections of April 1992, that brought President Konare to power.

The structure of the sectoral contribution to the gross domestic product has not changed since 1970, although the magnitude of each sector's contribution has changed. Thus, in 1970, whereas agriculture contributed 61% to GDP in 1970, industry 11%, and manufacturing 15%, the numbers stood at 42%, 7%, and 9%, respectively in 1993. The most important change occurred in the services sector however. In 1970, this sector contributed 28% to GDP, but in 1993, the contribution stood at 42%.⁵ Figure 12 shows the growth rate GDP in Mali since 1960. The country's GDP performed quite well during the 1970s, but took a downturn in the early 1980s, and has not quite recovered yet. Droughts, territorial dispute with neighbors, internal political instability, (Mali has suffered a Tuareg rebellion in the

5. See the 1995 World Bank World Development Report

North until a tentative accord was signed between the government and the rebels in 1993), worsening terms of trade, and poor economic policies may have contributed to the poor performance of the economy. Figure 13 shows the movement in the country's real exchange rate, terms of trade and exports.

A combination of appreciation in the real exchange rate, and a worsening terms of trade seemed to have caused exports to fall in the late 1970s to mid-1980s. Exports picked up again from the mid-1980s onwards. Prior to 1986, Mali had complex import and export tax schemes, consisting of a large number of tax instruments, and a highly dispersed tariff structure. The reforms began in 1986, and were reintroduced at an increased rate in 1990. As in the case of Senegal and Cote d'Ivoire, the objectives of the reforms consisted in simplifying and streamlining the structure of trade taxation, and reducing the dispersion in trade protection. Thus, in 1990, all import licensing requirements and quantity restrictions were removed, export monopolies, export licensing requirements, and most exports taxes were also abolished. By 1988, most import monopolies were eliminated, and quantity restrictions on 10 import goods, which constituted 40% of all imports were also removed. Once again, due to its membership in the CFA currency zone, the country could not use nominal exchange rate as policy tool with which to achieve devaluation of the real exchange rate and enhancement of the country's competitiveness. We must note here that, generally, since they could not use the nominal exchange rate as a policy tool, the CFA zone countries attempted to achieve real depreciation of the exchange rate by lowering

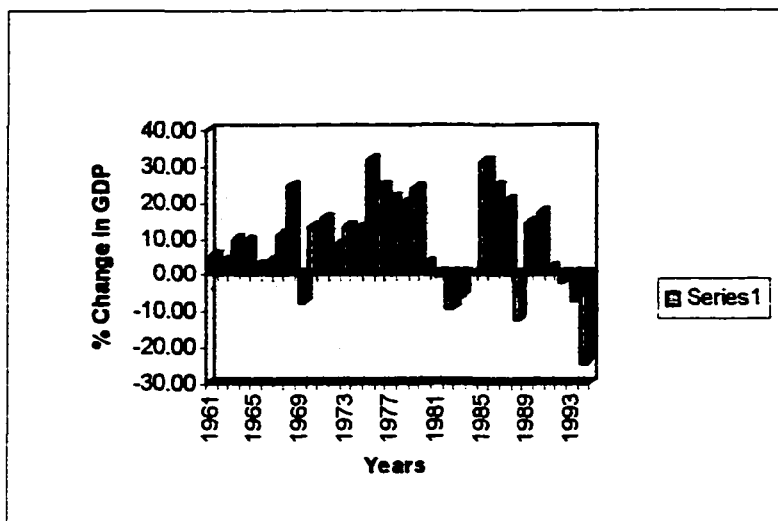


Figure 12. The Annual Growth Rate of the GDP in Mali

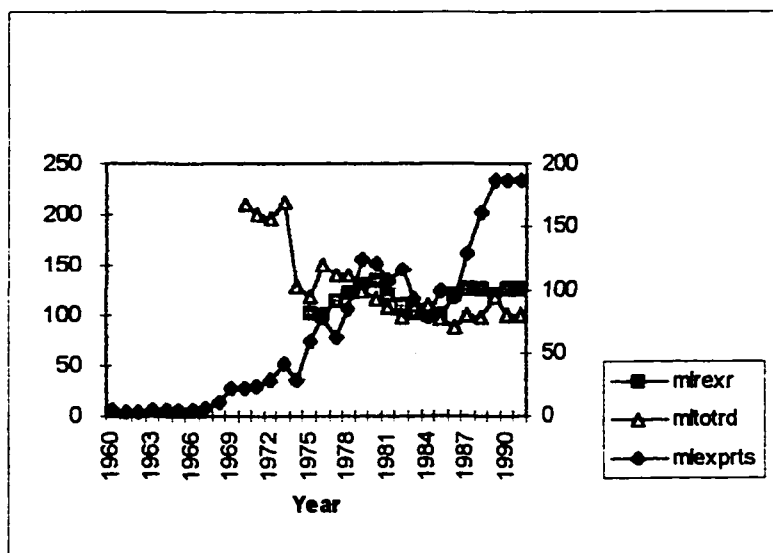


Figure 13. Movements in Mali's Terms of Trade, Real Exchange Rate and Exports Indices for the past three decades

domestic inflation (through fiscal and monetary policies) below the rates of competitor countries.⁶

3.2.3.2 The Reform Results

According to the 1995 issue of the World Bank's *Trend in Developing Economies*, it is estimated that the reform program helped to improve economic performance in Mali over the adjustment period. As Figure 12 above shows, real GDP growth increased from an annual average of less than 2% in the early 1980s to about 3% between 1988 and 1993. Figure 14 shows the current account balance as a ratio of GDP. The fiscal deficits declined from 12% of GDP in 1991 to 9.6% in 1993, and, the current account balance improved from a deficit of 14% of GDP in 1985, to 9.77% of GDP in 1993 (Figure 14). The adjustment policies also resulted in the reduction of the range of import duties from 0%-200% to 6%-41% in 1990 (World Bank, 1990).

3.2.4. Kenya

3.2.4.1 Overview of the Economy

Kenya is an Eastern African country which achieved its independence from Britain in 1963, after the bloody Mau Mau revolution led by the first president of the country, Mr. Jomo Kenyatta. Since 1978, Kenya has been led president Daniel Arap Moi, who replaced Mr. Kenyatta after his death. During the first decade after independence, the Kenyan economy grew at a remarkable average rate of more than

6. Generally, the real exchange rate is found by multiplying the nominal exchange rate by the ratio of the trade-weighted world wholesale price index to the concerned country's CPI. Hence, a reduction in the CPI will be expected to result *ceteris paribus*, in the increase in the real exchange rate, thus achieving the desired depreciation.

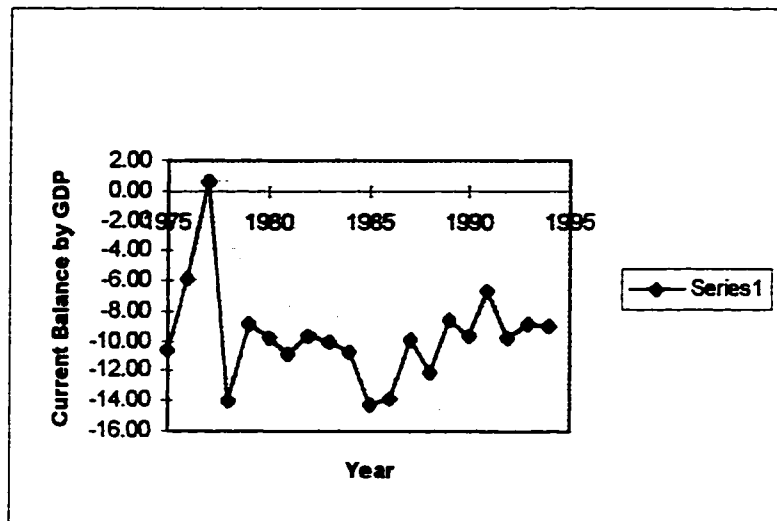


Figure 14. The Current Account Balance as a Ratio of the GDP in Mali

8% per annum. Government policies and expanding domestic demand helped to foster higher production in both the agricultural and the industrial sector.

Figure 15 depicts the annual growth rate of GDP in Kenya since 1964. The Kenyan economy decelerated in the mid- to late 1970s because of the two oil embargoes of 1973 and 1979, and again in the early 1990s because of the inability of the government to maintain the stabilization programs which it had begun to implement in the 1980s. In any case, structural problems such as extensive government intervention in marketing, inward-looking industrial policies, and the reliance on a few exports crops such as coffee and tea, which account for 40% of the merchandise exports, rendered the economy vulnerable to potential inefficiency on the part of

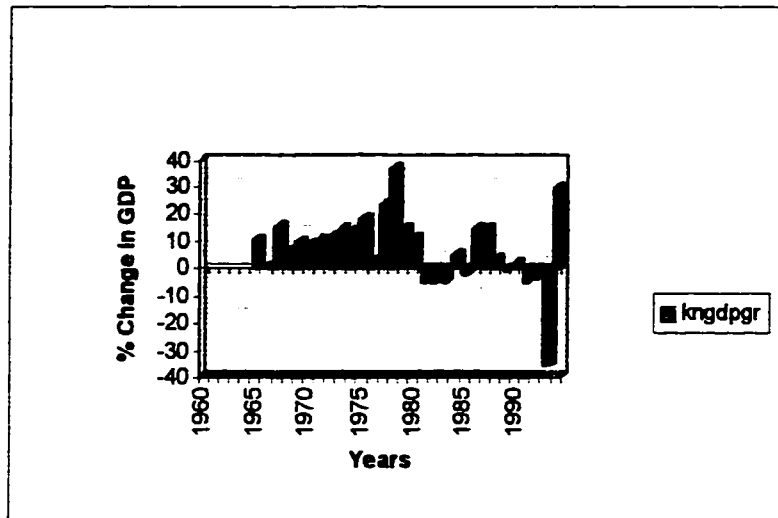


Figure 15. The Annual Growth Rate of GDP in Kenya (%)

parastatals, and the vagaries of external factors such as the terms of trade. Figure 16 depicts the indices of the real exchange rate, the terms of trade and exports in Kenya at various times since 1960. In Figure 16, successive yearly declines in the terms of trade in the early 1980s were accompanied by a corresponding worsening of exports. The real exchange rate depreciated during the same period but was unable to help the performance of the country's exports. Devaluation of the real exchange rate again occurred in the mid- to late 1980s, as fulfillment of the adjustment programs. A favorable terms of trade, liberalization in the trade sector, and real devaluation of the exchange rate helped the exports sector in the late 1980s and early 1990s. In fact, as Figure 17 shows, the Kenyan current account posted a positive balance in 1993!

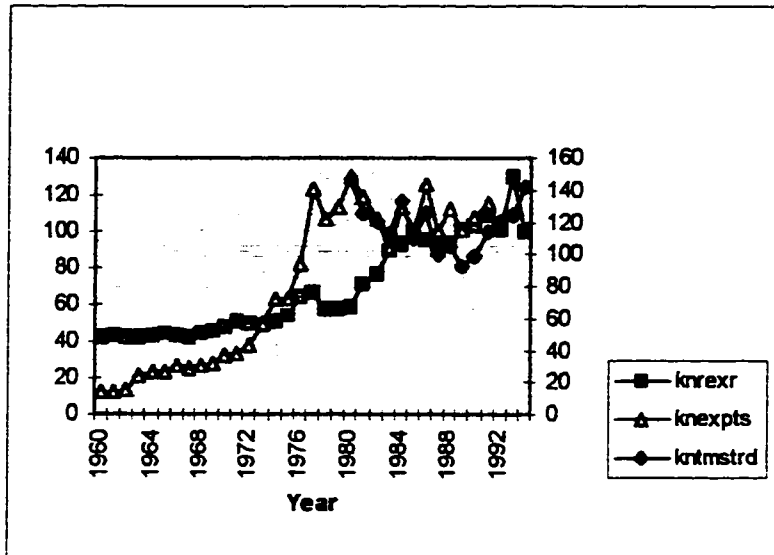


Figure 16. Movements in the Kenyan Terms of Trade, Exchange Rate, and Exports since 1960

Due to the dismal performance of the economy in the early 1980s, the government undertook several reform and stabilization programs. However, several factors contributed to an uncertainty as to the sustainability of these programs. These factors included a failed coup attempt by members of the Air Force in 1982 (this branch of the military was subsequently disbanded), a drought in 1984, and a lack of transparency of the implementation of the reforms. This first attempt at adjustment therefore did not succeed. A second adjustment program was put into place in the second half of the 1980s.

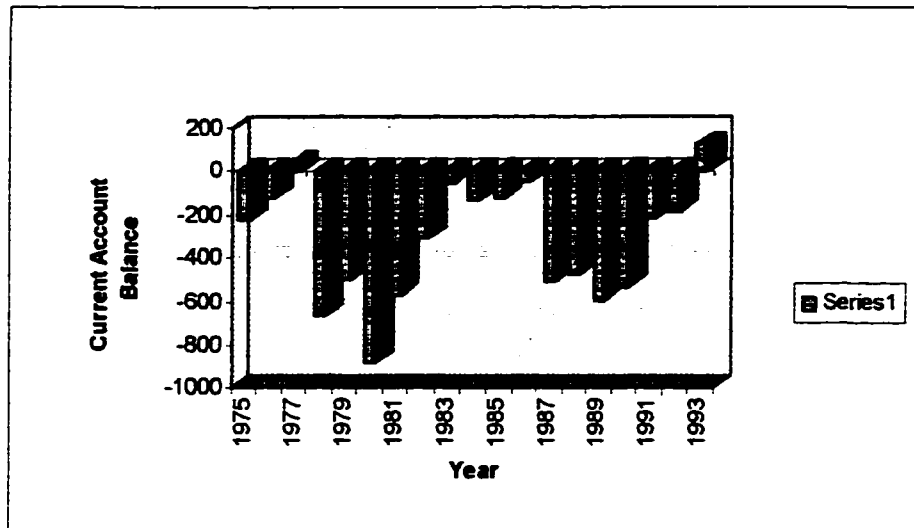


Figure 17. The Current Account Balance in Kenya since 1975

3.2.4.2 The Reform Package

Due to the high level of quantitative restrictions (QRs) in the form of quotas and import licensing which prevailed throughout the 1980s, one of the major targets of the reform program undertaken in 1987 consisted in replacing the QRs by near-equivalent tariffs, and rendering the licensing process more speedy and transparent. Another objective was to reduce and rationalize tariff rates, to enhance the promotion of alternative exports products. According to World Bank accounts, the government of Kenya was committed to achieving these objectives by June 1995.

Quantitative restrictions were indeed removed, with the coverage being reduced from 71% of all imports in 1985 to just 0.2% in 1992. Progress was also

reported in tariff reforms. First, in 1988, most specific tariffs were replaced by ad valorem rates, and then the number of rates were reduced from 25 to 17. Overall, the adjustment programs led to a reduction in the unweighted average rate of tariff from, 40% in 1987/1988 to 34% in 1991/1992, and the import weighted tariffs fell from an average of 30% to 20% during the same period (Figure 18.) In addition, after being pegged to a basket of the same currencies found in the Special Drawing Rights (SDR) basket, the Kenyan Shilling began to follow a flexible regime in 1988, and by 1991 the real exchange rate depreciated by 43% in 1991, relative to its 1985 value (see Figure 16 above).

In the export sector, efforts were made to reduce the anti-export biases, such

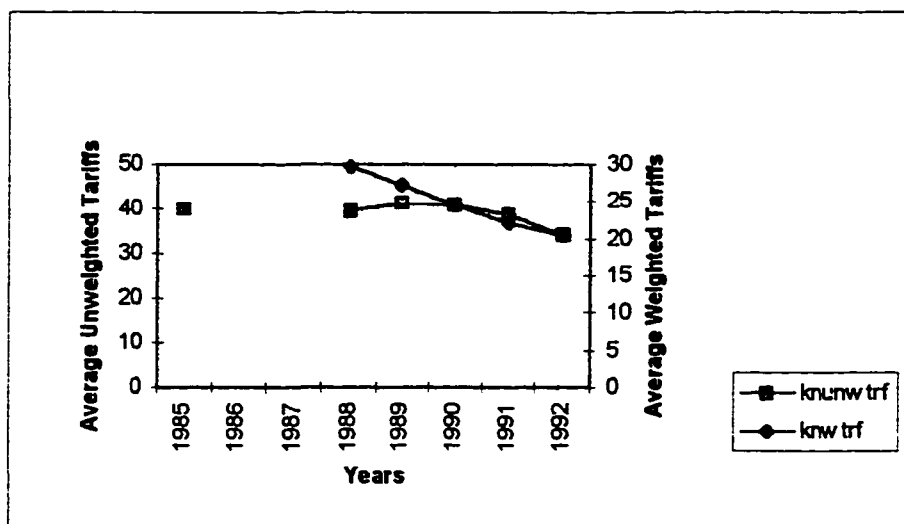


Figure 18. Average Unweighted Tariffs and Imports Weighted Tariffs in Kenya since 1985

as the licensing requirements that had to be renewed annually. In 1988, the government of Kenya removed existing export taxes on coffee and tea, and in 1990, the Export Development Project (EDP) broadened the coverage of an existing export compensation scheme and established an export processing zone. As with all other countries, adjustment in Kenya has not followed a smooth course, and needs to be strengthened in many areas.

3.2.5 Tanzania

3.2.5.1 Overview of the Economy

Tanzania, a neighbor of Kenya, is also a former British colony. The country, in its present form, was established in 1964 through the union of the Republic of Tanganyika and the People's Republic of Zanzibar, an Island off of the coast of the Indian Ocean. Out of the eight African countries that we consider in this thesis, Tanzania is a unique case because until 1985, the country was led by President Julius K. Nyerere, a strong socialist and marxist ideologue. With a per capita GNP estimated to be only \$90 in 1993 (World Bank, 1995), the country is one of the poorest in the world. The economy is mainly agricultural based, as this sector accounts for over 50% of the country's GDP.

Figure 19 depicts the annual percentage change in the country's GDP. The growth rate of the GDP of Tanzania since independence has not been fantastic. Between 1965-80, the economy grew at an annual average of 3.9%, whereas in 1980-89, it grew at 2.6%. However, these aggregate statistics mask the sometimes

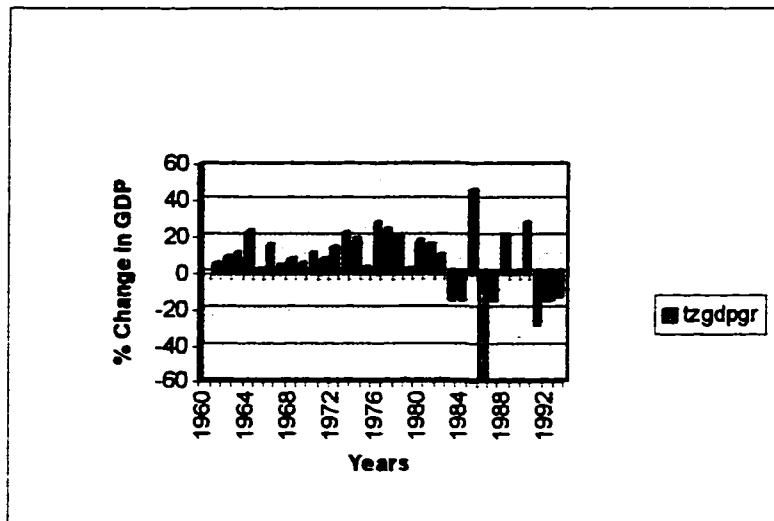


Figure 19. The Annual Growth Rate of GDP in Tanzania (%)

abysmal negative growth that the country has experienced, particularly in the 1980s (e.g. -57% between 1985 and 1986).

The performance of the Tanzanian economy has been very much tied to the social and economic policies promulgated by the government since 1967. For instance, the Arusha Declaration laid the foundation for the ideology of *Ujamaa*, which is the Tanzanian brand of socialism, and meant among other things, self-reliance, collective villagization, and the nationalization of banks, insurance and industrial companies.⁷

Tanzania established one the best social systems in Africa (maybe in the world), however this social system relied extensively on government welfare programs.

⁷ See Campbell and Stein (1992)

Furthermore, the socialist policies put into place by the government inhibited private sector development and contributed to the creation of parastatals whose performance was plagued with inefficiencies. The country had to cope with droughts, a very costly war with Uganda, a fall in the terms of trade, and higher energy prices, factors which, combined, led to a deep internal economic crisis. Figure 20 presents the movements Tanzania's exchange rate, terms of trade and exports. Because of the economic deterioration, the Tanzanian government, which has, on numerous public occasions, lambasted the IMF for attempting to introduce capitalism into the country, was forced to approach the organization not only to draw on its non-conditional gold tranche, but

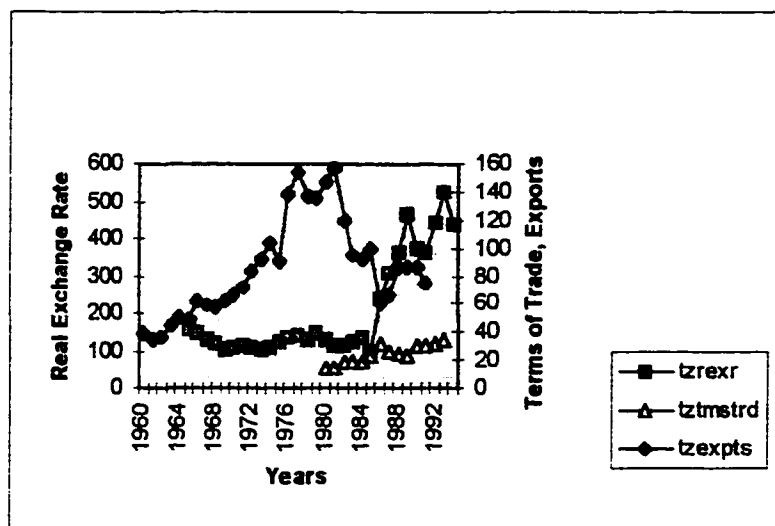


Figure 20. Movements in the Tanzanian Real Exchange Rate, Terms of Trade, and Exports

for additional credit facility as well (Stein, 1992). Subsequent to talks that began in 1974, the IMF presented the government with a conditional program for economic adjustment in 1981. The government rejected the conditions set in the program, and negotiations broke down. However, as Figure 21 shows, the country's crisis continued to deepen.

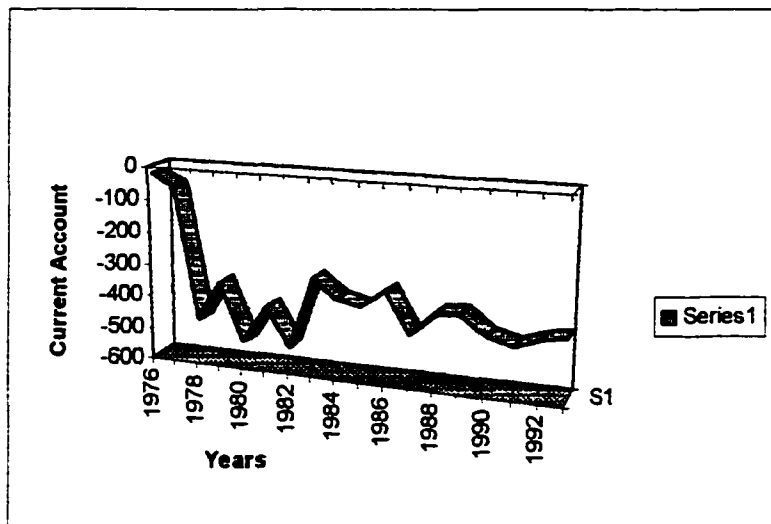


Figure 21. The Current Account Deficit in Tanzania since 1976

The figure shows that since 1976, the current account deficit has been persistent and high. The government approached the IMF again in 1986. A new program was introduced containing the same conditions as the 1981 package. But, this time a new president was in place, and the terms of the agreement were written into

the government's budget. Below is an overview of the adjustment program undertaken in 1986 in Tanzania.

3.2.5.2 The Reform Package

In 1986, the government of Tanzania entered into a new agreement with the IMF. This agreement was formulated as the Economic Recovery Program which was proposed as part of the national budget in 1986 (Campbel and Stein; 1992, p 15). The main objectives of the program concerned the liberalization and rationalization of the exchange rate, as well as liberalization in the trade sector. According to Dean, Desai and Riedel (1994), "prior to reform, the main constraint on imports was the extensive system of foreign exchange constraints [in Tanzania]." (p 47) It is estimated that compared to its 1980 value, the Tanzanian Shilling has appreciated in real terms, by 74% in 1983, with an accompanying black market rate of 300%.

Under liberalization programs, most foreign exchange constraints were abolished; the Tanzanian Shilling, valued at 17 to the U.S. dollar in March 1986, fell to a rate of 40 per dollar in June 1986, by 1987, the rate was 90, and by 1990, it was 193 to the dollar (Campbell and Stein, 1992). In the trade sector, non-tariff barriers (NTB's) in the form of import licensing and foreign exchange control, had been the main instrument of import control. Under the adjustment programs, NTBs were dismantled, and the role of tariffs as revenue generating instruments for the government became prominent. Tanzania maintained 18 different rates ranging between 15 and 200% prior to adjustment. By 1990, the number of rates had been

reduced to four. Also, the maximum tariff was lowered to 100% in 1988, and the trade weighted average tariff fell to 33%, 16% and 23% for consumer, intermediary and capital goods, respectively. Further, restrictions on exports were removed, and adjustment occurred in other sectors, including banking, infrastructure, and government finances.

According to the World Bank (1995), the adjustment programs combined with increased availability of external financing to produce some positive results for the economy of Tanzania. The gross domestic product and exports grew by an average of 4% between 1987-1994. Small scale industrial activities, and agricultural production also grew during this time.

3.2.6 Malawi

Malawi is a small East African country, with a population of 8.8 million, occupying an area of 118,484 sq. km., that achieved independence from Great Britain in 1964. Dr. Hastings Kamuzu Banda, a U.S. educated physician, became the first and only president of the country (Dr. Banda declared himself President for Life in 1970), until 1994, when pressures from the donor community and internal economic malaise forced him to call for multipartite elections, which he lost.

The country posted a per capita GNP of \$200 in 1993. Since 1970, there has not been a dramatic change in the structure of production. In 1970, agricultural production contributed 44% to the GDP, industrial production contributed 17%, and services, 39%. In 1993, the same statistics stood at 39% for agriculture, 18% for

industry, 43% for services, and 12% for manufacturing. The following chart represents the growth rate of GDP in Malawi since 1960.

The development strategy adopted by the government during the 1960 and 1970s focused on infrastructure and agricultural development. In addition, the country was open during this period, and enjoyed a highly favorable terms of trade for its main exports: tobacco, tea, coffee and cotton. These conditions led to a strong growth rate in the GDP, and a growth in the real per capita income of 3% per year (World Bank, 1995). In the 1980s however, the country became progressively protectionist. Rationing of the foreign exchange and quantity restrictions were instituted, and the average tariff rate was raised (see Figure 24). As Figures 22 and 23 show, the trade sector responded negatively to these protectionist policies, and the economy grew at negative rates during the early 1980s.

The protectionist policies brought imports down in the early 1980s, but during the same period, external shocks such as terms of trade deterioration, and worldwide increase in oil prices, dampened production and trade of export products. Figure 23 shows that the decline in imports outstripped that in exports, producing an improvement in the trade balance in the early 1980s. However, this did not last. By 1987, the effects of the aforementioned shocks in addition to the disruption in transportation routes caused by the war in Mozambique, and the drought suffered by the region, caused exports to decline, imports to increase and a worsening of the trade balance.

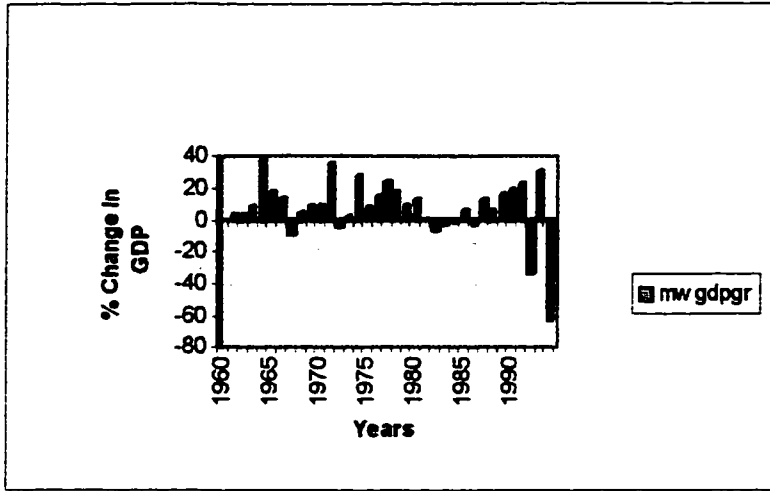


Figure 22. The Annual Growth Rate of GDP in Malawi

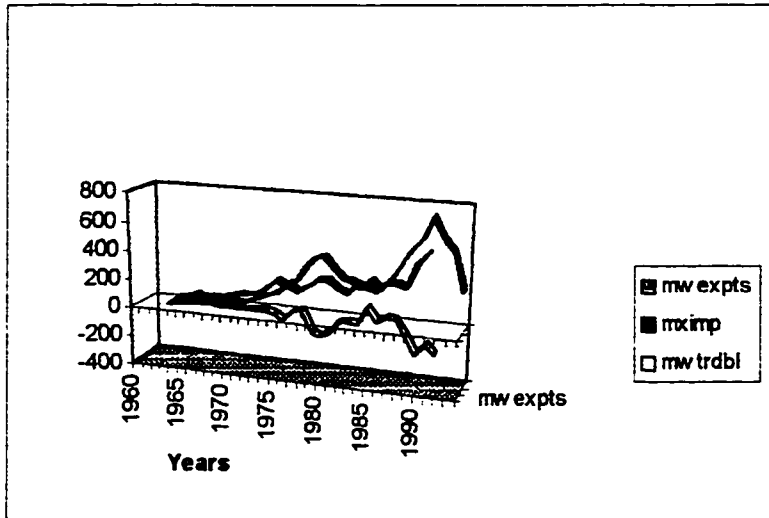


Figure 23. Imports, Exports and the Trade Balance in Malawi

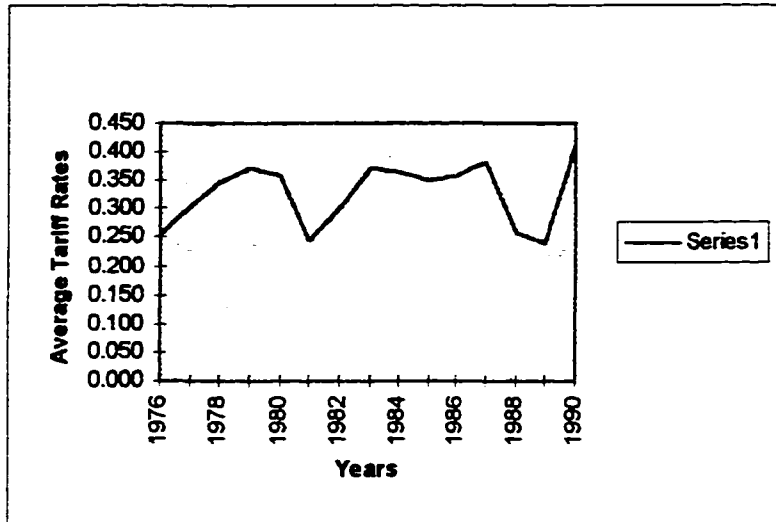


Figure 24. Average Tariff Rates in Malawi since 1976

The government began trade reforms in 1988, with the unification of the tariff schedule, as the range shrank from 0-220% prior to 1988, to 0-45% in 1988. Imports licensing were removed except in the case of alcohol, gems, electric goods, and luxury goods (World Bank, 1994).

The kwacha, the country's currency was significantly devalued, and foreign exchange restrictions were removed. However, internal issues such as smallholder farmers' access to cash crops, human rights, and social structures remain an impediment to sustained economic recovery and development.

3.2.7 Ghana

Ghana has been hailed as the “star pupil of adjustment” (Harold Alderman, 1994), and a “front-runner in adjustment” (Leechor, 1994). Ghana located on the gold coast in West Africa, is the first African country to attain independence from Great Britain, in March 1957.⁸ It was led from independence to 1966 by the Mr. Kwame Nkruma, a U.S. educated man, widely known and respected for his philosophy on African Unity and self-reliance. The country is endowed with considerable natural resources, including vast reserves of gold, diamonds, bauxite, manganese. Forests, and arable land are also abundant in the country. It has enormous potential for electric power. For example, the Akossombo dam supplies electricity to neighboring countries including the author’s own country of Benin. The annual growth rate of the GDP in Ghana is displayed in Figure 25.

The figure shows that Ghana enjoyed a relatively high level of growth throughout the 1970s. The economy has traditionally depended on primary production and exports (cocoa is the main export crop), but its industrial sector, which accounts for about 16 of the gross domestic product, is relatively well developed and diverse. Ghana has also enjoyed a relatively high level of living standards. Figure 26 depicts the per capita GDP in Ghana since 1960 (if the per capita GDP can be used a measure of living standards). At one point Ghana was classified as part of the lower middle-income countries, with a per capita income which grew consistently since 1960, with a

8. Note Ethiopia and Liberia were never colonized by a foreign power.

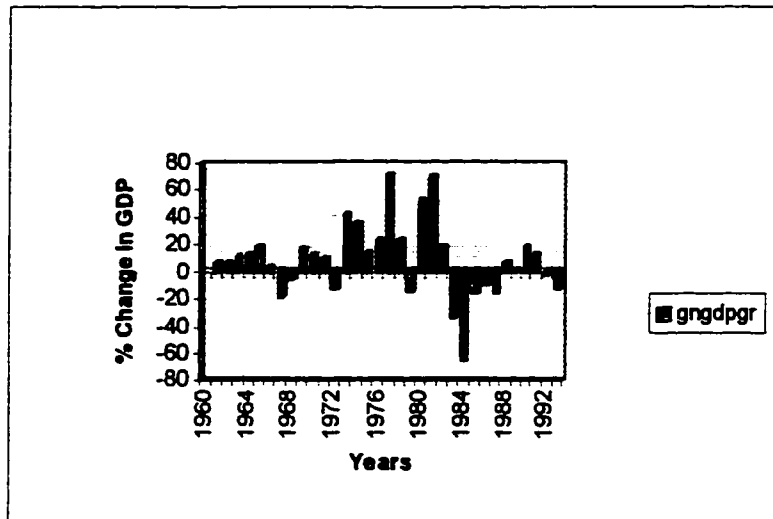


Figure 25. The Annual Percentage Change in GDP in Ghana

peak of \$2740 in 1982. We note that instead of a surplus shown in the current account balance in the late 1970s, the account posted a negative balance in 1981, and has not recovered from that position as of yet.

However, as was the case in many developing countries, external shocks such as deterioration in the terms of trade, and the two oil shocks of the 1970s and poor internal economic management led the country into a deep economic crisis beginning in the late 1970s. Between 1970 and 1982, real exports earnings fell by 52%, and savings and investment as a percentage of GDP which had been at a 12% level, all but disappeared (World Bank, 1995). Figure 27 depicts the change in the country's current account balance since 1975. Also, Figure 28 shows inflation rates in Ghana have

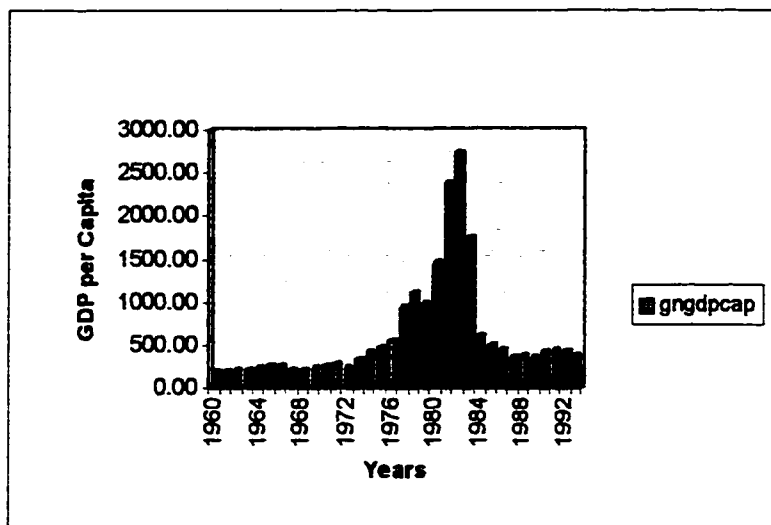


Figure 26. The Per Capita GDP in Ghana since 1960

traditionally hovered around 7%, but peaked to record highs in the late 1970s and early 1980s. Reform measures were first introduced in 1983 to restore macroeconomic balance, encourage private sector savings, and streamline government finances.

A three-year structural adjustment program was also undertaken in 1987-89, 1989-91, and 1991-92. Under this plan, steps were undertaken to devalue the cedi, the nation's currency.⁹ Foreign exchange licensing and rationing were eliminated. In addition, the import licensing and other NTBs were prohibited. Tariff policies have not been consistent however. Although average tariffs were reduced from 30% to 17%

9. This was not an easy feat. An earlier attempt at devaluation under the Busia Administration resulted in street riots, and a successful coup (Leechor, 1994)

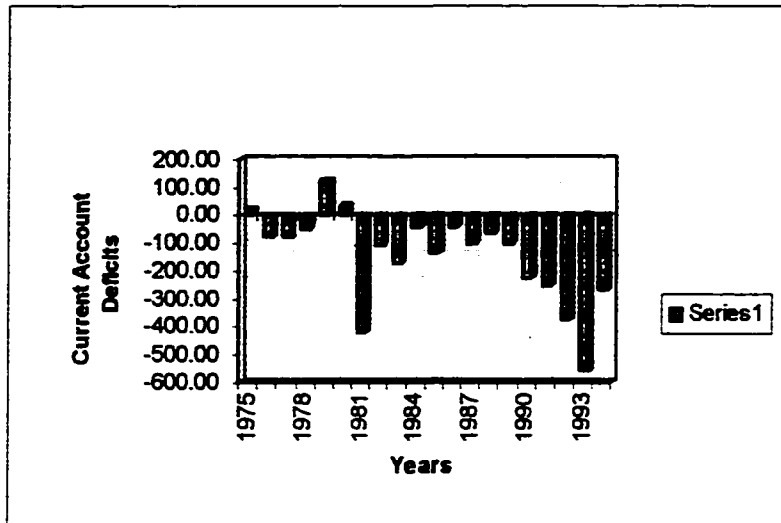


Figure 27. The Current Account Deficit of Ghana since 1975

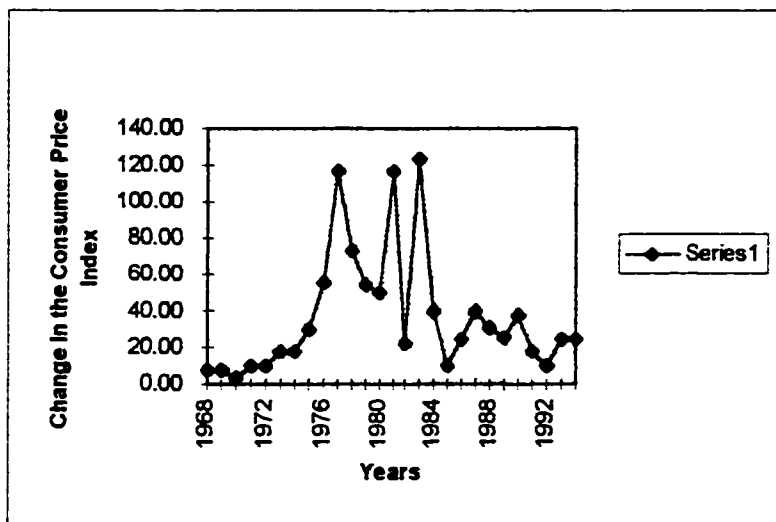


Figure 28. The Rate of Inflation in Ghana since 1968

between 1983 and 1991, they were raised in 1987, and 1990, and 1994 (see Figure 29). Further adjustment has occurred in the export sector.

The export licensing system was abolished, tax and price incentives were extended to exporters, particularly to cocoa farmers who saw an increase in the producer prices for cocoa for the 1990/91 season. Subsidies on inputs to cocoa production were eliminated during the same period, resulting in an effective nominal increase in the farmers' price by 22% (World Bank, 1994). Figure 30 depicts the change in export, real exchange rates, and Ghana's terms of trade. The recovery program undertaken by the government of Ghana resulted in an average real growth rate of the GDP of 5% per year during the 1980-90 decade, as compared to negative growths during the preceding decade, both exports and imports (see Figure 30, and Figure 31) have increased because of the removal of barriers in both sectors, farmers' incomes increased, real food prices fell (see Figure 28) and social spending was increased as well.

We note that foreign assistance played a considerable role in the adjustment process in Ghana. Official aid to Ghana increased from \$270 million in 1984 to \$385 million in 1986, and again to \$480 million in 1990 (World Bank, 1994). Finally, while adjustment programs have, in general, produced desirable results in Ghana, the government must increase its efforts in maintaining macroeconomic stability, fiscal discipline, and enhancing its incentives for increased private investment. Maintaining these factor will result in a sustained performance by the economy.

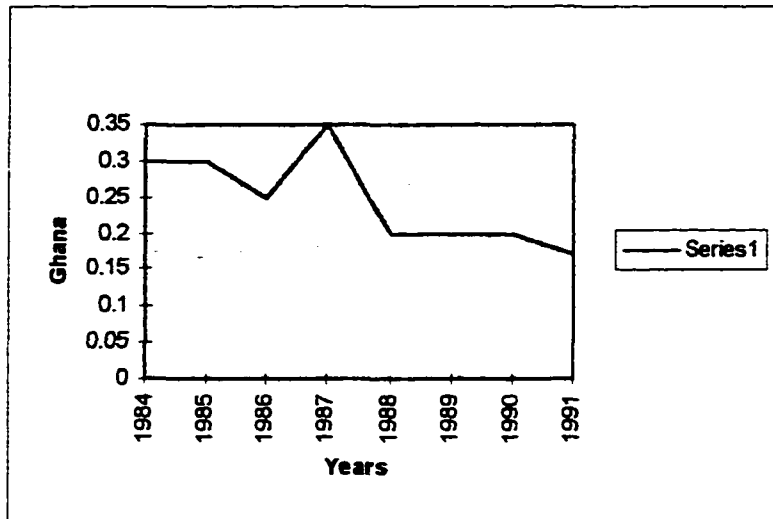


Figure 29. Tariff Rates in Ghana since 1984

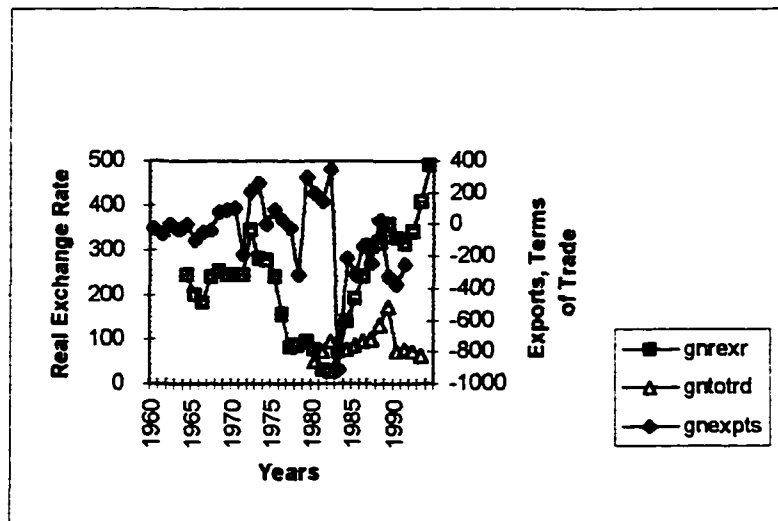


Figure 30. Real Exchange Rate, Terms of Trade and Exports in Ghana

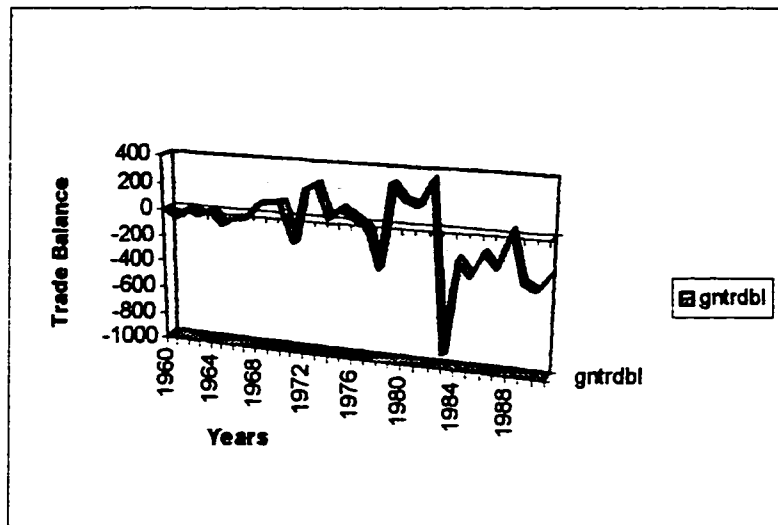


Figure 31. The Balance of Trade in Ghana since 1960

3.2.6 Nigeria

Nigeria is the most populous country in Africa. Its population, standing presently at 105.3 million, represents 20% of the total population of Sub-Saharan Africa. As an oil producing country, and member of the OPEC, Nigeria possesses enormous potential for development and growth.

However, since its access to independence from the United Kingdom in 1960, the country has fought a major civil war, the Biafran War, which devastated and divided the country, it has known numerous military coups (the most recent occurred in 1993), and its attempts to return to civilian rule have all failed so far. The recent economic history of Nigeria presents an interesting case study in development economics. First, we present, in Figure 32, the growth rate of the Nigerian economy.

The first observation that we make from Figure 32 is that the performance of the Nigerian economy was not spectacular in the 1960s. In fact, in the mid to late 1960s, when the Biafran War was raging and ravaging the country, the economy was growing at a negative rate. However, in the 1970s, heightened exploration and exploitation of oils fields led to periodic booms in the economy. Indeed, with petroleum constituting 34% of GDP, over 97% of total exports, and contributing 80% to government revenues, movements in the economy closely follows movements in the exports sector, or rather in the petroleum sector.

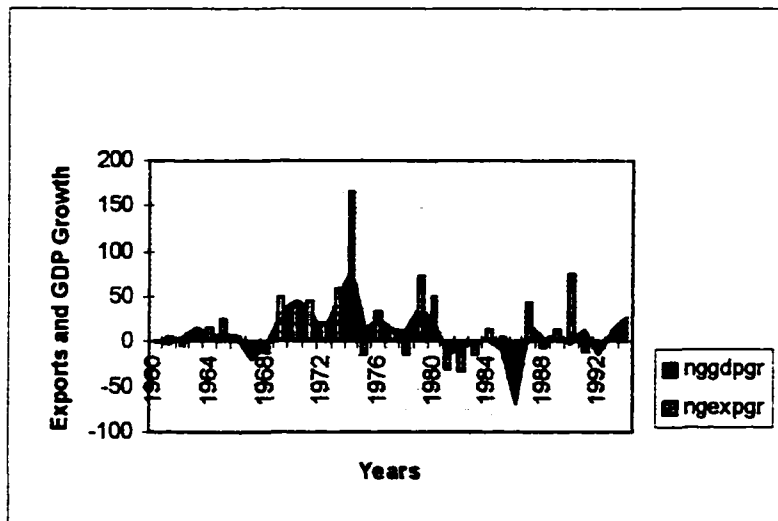


Figure 32. The Growth Rate of GDP and Exports in Nigeria since 1960

As Figure 32 shows, during the boom years of 1973 and 1979 (the two oils embargo which sent oil prices soaring), the export sector was experiencing a high growth rate, which is paralleled by the growth rate of the GDP. Figure 33 depicts the changes in the Nigerian terms of trade and real exchange rates.

When oil prices fell in the mid 1980s, exports fell as well, leading the GDP to grow, at times, at negative rates. There occurred another oil boom during the Gulf War. The war created an oil shortage which sent the world price of oil soaring, and Nigeria's terms of trade to a higher level. From Figures 32 and 33, we note that as the country's terms of trade ameliorated, GDP growth turned from a negative rate to a positive one.

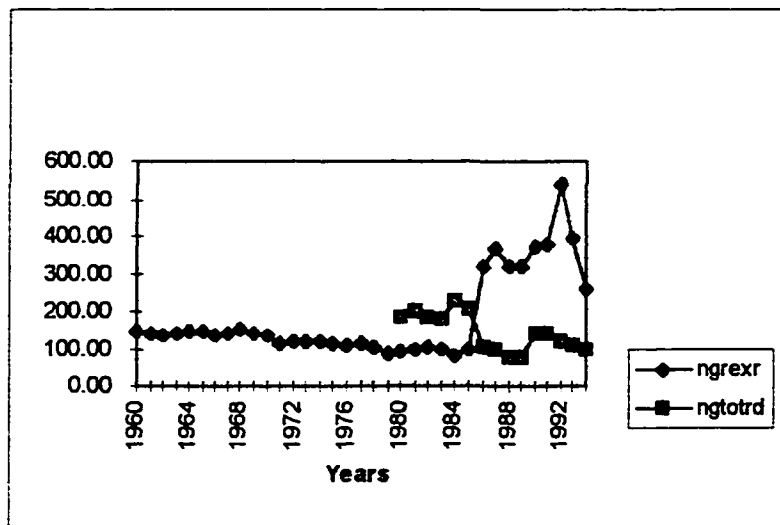


Figure 33. Nigeria's Terms of Trade and Real Exchange Rate

But, Nigeria is not a monolithic society. Furthermore, there are constant political struggles between the military and the rest of the society on the one hand, and among the many different ethnic and religious entities of the country. We believe that this constant battle over the control of the country's vast resources distracts the planners from focusing on a rational allocation of resources that would enhance the economic growth and welfare of the society. But, more tangibly, the usage of the considerable oil revenues of the country in the 1970s laid the foundations for its abysmal economic record in the 1980s.

3.2.6.1 The Inefficient Usage of the Nigerian Resources

During the oil booms of the 1970s, the government of Nigeria (or the different governments that succeeded each other) undertook expensive infrastructure expenditures which were ostensibly designed to raise the productive capacity of the country and to heal the wounds of the Biafran War (World Bank, 1995). While these ventures may have achieved the latter target, their potentiality for long term viability were not well studied. Such projects as the construction of transportation facilities (roads, ports), and heavy social spending were implemented without enough attention paid to their efficacy and financial viability.

What is more, the massive expenditure campaigns were almost entirely dependent on oil revenues. In the meantime, development in other non-oil based exports crops such as cocoa, peanut and cotton was neglected. Thus, when there occurred a shift in the Nigerian terms of trade in the early 1980s, the government's

budget deficit began to worsen. The data on the government expenditure and budget deficit is shown in Figure 34.

The budget deficit was nonexistent or insignificant throughout the 1970s, and became more prominent in the early 1980s due to the ever increasing government expenditure. Remarkably, during this period, massive government expenditure raged on even as oil revenues were plummeting (Abuja, a city that rivals any in the West, and the current seat of the government was built from scratch with oil revenues and large external loans). But, this expenditure did not translate into a sustained improvement in the standards of living of the Nigerian population. Figure 35 shows that in the late 1970s to early 1980s, Nigerians enjoyed a relatively higher standard of living (the per capita GDP reached over \$1000 in 1980) than their neighbors in the region. We

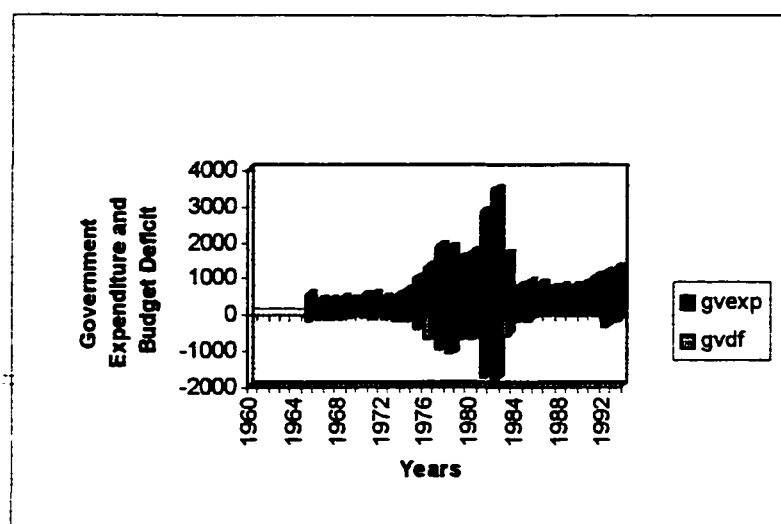


Figure 34. Government Expenditure and Budget Deficit in Nigeria

observe however that there occurred a precipitous drop in the GDP per capita after 1984, as oil prices fell. Nigeria was not able to adjust to price shocks in the oil market for its export base was not diversified or well developed to full potential. Austerity measures were introduced by the government in late 1983 and in 1984.

However, the plan, which included across-the-board budgetary cuts, and restrictions on imports and foreign exchange, did not address the distortions and structural problems of the economy (World Bank, 1995). Finally, in July 1986, against fierce domestic opposition, the government of Babangida entered into agreement with the IMF to initiate a host of economic reforms, a prerequisite to secure new loans (and reschedule old debt) from the country's creditors.

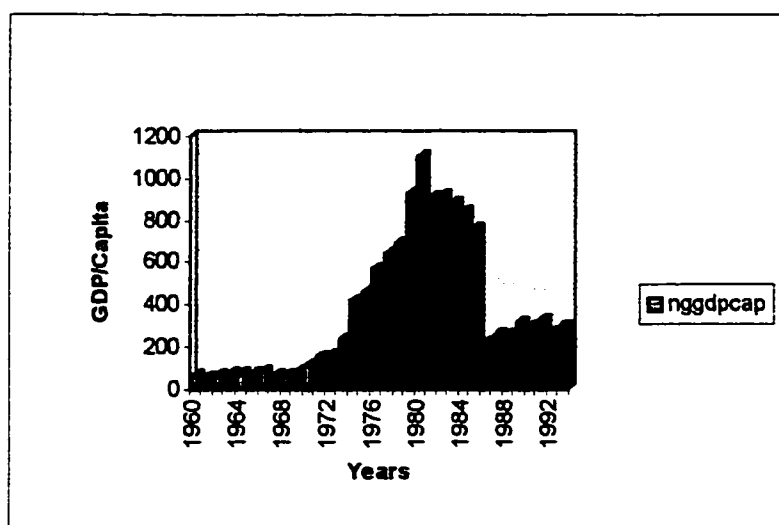


Figure 35. The Nigerian GDP per Capita since 1960

3.2.6.2 Key Components of the 1986 Structural Adjustment Program

The major element of the adjustment program initiated in Nigeria concerned exchange devaluation and trade liberalization (Faruqee, 1994). With respect to the foreign exchange regime, the objective was to remove exchange controls and establish a market determined exchange rate policy. Nigeria had pursued a fixed exchange rate and exchange rationing policy prior to adjustment. As a result, the parallel market premium was as high as 200%. A dual exchange rate regime was introduced in September 1986, with the secondary market rate determined by auction. In 1989, the two windows were merged into a unified market, and currency was traded through the Interbank Foreign Exchange Market. By 1991, the Naira stood at only 24% of its 1980 value, and the parallel market premium had been cut to 23% (World Bank, 1984).

The objectives of the trade reforms included abolishing the import licensing system, which had been the main instrument of trade control. A new tariff regime was developed and policies were implemented to promote exports. Before 1986, a surcharge of 30% was levied on imports into Nigeria. This was abolished as part of the reform program, and the average tariff rate (see Figure 36) was decreased to 23% (World Bank, 1994).

Reforms in the export sector included removal of export duties, prohibitions, and most licensing requirement (World Bank, 1994). Exporters who used imported

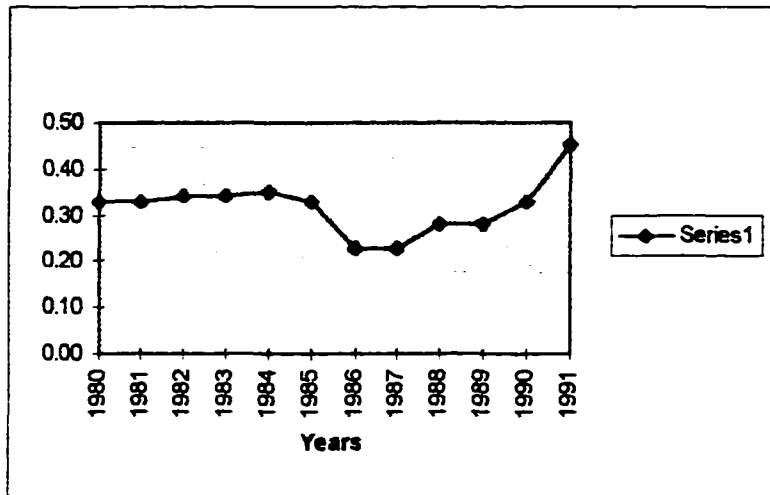


Figure 36. Tariff Rates in Nigeria since 1980

raw material in their production process were given preferential tariff rates, and these intermediary goods were also exempted from the 30% import surcharge. Incentives were given to encourage export of non-oil products, including the dismantling of marketing boards for cocoa, cotton, rubber, peanut, and palm kernel, and the liberalization of producer prices. (World Bank, 1994). Domestic opposition to the implementation of reforms in 1986 was adamant. Some arguments were based on the social cost of adjustment. But, even members of the business community (people and entities with enough wealth and clout to influence government decisions) feared that they may lose market shares and profits due to trade liberalization. Thus, by 1990, some reversals have occurred in the adjustment process. A new tariff schedule was introduced in 1988, which provided for rates slightly higher than the 1986 program. In

addition, a 7% surcharge was imposed on all imports. By 1990, the average unweighted tariff rates had risen to 33%, with wide dispersion (Dean, Desai, and Riedel, 1994).

By mere economic measures, the adjustment programs in Nigeria, including liberalization (though patchy) of the trade regime, devaluation of the real exchange rate, and abolition of price control, produced some positive results for the country. As Figure 32 shows, both exports and GDP posted positive growth in the late 1980s to early 1990s, with the latter growing at an average of 5% a year between 1987 and 1992 (World Bank, 1995). Ultimately, economic problems in Nigeria can be properly addressed only after the country's messy political affairs are sorted out, beginning with the return to civilian rule. Next, we present a review of the literature on the empirical modeling of the credibility of reform policies.

3.3 A Review of the Literature on the Empirical Modeling of the Credibility of Policy Reforms

Several studies have presented empirical evidence on policy reversals and/or the importance of credible reforms in developing countries. For example, in their review of 59 countries that undertook IMF-supported Structural Adjustment Programs in the period of 1990-1992, Calika and Corsepilus (1994) found evidence for actual trade policies reversals. They reported that in 13 out of the 59 countries reviewed, trade reforms were partially reversed. Of these 13 countries, all but 3 "increased tariffs or imposed new surcharges on imports, [and] 4 widened the scope of

quantitative restrictions" (p 39). Further, Serven and Solimano (1992) estimated a simple investment equation, using pooled cross-section time series data for a group of 15 developing countries. One set of the explanatory variables of the equation consisted of the sample variability of some key macroeconomic variables. These were used as proxies for uncertainty, and therefore credibility. Their results indicated that the uncertainty proxies had a significant negative impact on investment.

Many research projects have attempted to assess the impact of policy reforms on investment in developing nations. With respect to the Structural Adjustment Programs, Vittorio Corbo and Patricio Rojas (1992), of the World Bank, propose measuring the marginal contribution of adjustment programs to economic growth, by calculating the difference between actual performance and an estimated counterfactual scenario of what would have happened in the absence of the program. Using four indicators to assess the performance of adjustment programs: rate of growth of GDP, ratio of saving to GDP, ratio of investment to GDP, and ratio of export to GDP, they propose three different approaches to evaluating liberalization programs.

The first approach is the simple "before-and-after" approach. This method consists in comparing a given indicator of performance after a specific program or policy is adopted, to the performance of that indicator prior to the program. The following model is used to analyze the impact of a new program on economic performance:

$$\Delta y_i = \beta \quad (48)$$

where Δy_i is simply the change in the target variable between the program period and the previous one. The estimator β calculates the mean change across the group of countries that adopted adjustment programs (program countries), for each of the macroeconomic variable to be analyzed.

There are several shortcomings to this approach. The main problem is that this method makes a *ceteris paribus* assumption, which, for the purpose of the analysis of the impact of adjustment programs is not realistic. Furthermore, according to this method, any change in the target variable is due exclusively to the newly adopted policy.

In an attempt to correct for these shortcomings, the authors propose two other methods of estimation. The first one is the "control-group approach". The equation used for this method is:

$$\Delta y_i = \beta_0 + \beta_1 d_i, \text{ for } i \in Q \quad (49)$$

where Q is a set of non-program and program countries, d_i is a dummy variable which takes the value of 1 if a country is a program country, and 0 otherwise. Notice that the non-program countries are the control group. A statistically significant β_1 means that a change in the target variable in the program countries is different from a corresponding change in the control group.

This method allows us to control for the effect of changes in the global environment. However, the assumption is that the nonprogram and the control groups are equally affected by those changes. An attempt to find solutions to the problem led

the authors to propose a third approach: the "modified control-group approach".

The main idea behind the "modified control-group" approach concerns accepting that the selection of program countries is not random, identifying the differences between program and non-program countries, and controlling for these differences in the performance analysis. The main equation used for this method is:

$$\Delta y_i = \beta_0 + \beta_1 (y_i)_{-1} + \beta_2 (x_i)_{-1} + \beta_3 W_i + \beta_4 d_i + e_i. \quad (50)$$

Thus, a change in a target variable y in country i , is postulated to be a function of the set of macroeconomic policies that would have prevailed in the absence of the new program (x_i), the change in world economic conditions (W_i); the total effect of adjustment programs, if these are in place (d_i); and a set of unobserved shocks specific to a country (e_i). This model, according to the authors, allows for changing world conditions to affect different countries in different manners.

With respect to the measurement of credibility, the literature offers several approaches. Many studies have used the Taylor and Jodice (1983) approach to assess political instability. The idea is that events such as the annual number of coups, revolutions, riots, demonstrations, executive adjustment, affect the probability of a government collapse. Thus, if the political and social landscapes are unstable, then there is increased uncertainty with respect to future government policies, the private sector will find it difficult to make plans for future investment and production activities, and policy reform announcement by a sitting government may not be credible.

Aizenman and Marion (1991) measure political instability by focusing on changes in macroeconomic policies, rather than changes in governments. The variables they constructed include government consumption expenditure, the share of public investment in GDP, government revenue, budget deficits, domestic credit expansion, monetary growth and inflation. These variables can then be used by an investor, in the decision to expand investment in the wake of a policy reform or not.

Serven and Solimano (1992), postulate that private investment in developing nations is a function of the real GDP, the real exchange rate, the real public investment to GDP ratio, the foreign debt to GDP ratio, and a measure of instability. The model they use is:

$$IP/Y = F(\Delta Y, e, IG/Y, D^*/Y, \sigma) \quad (51)$$

where, IP is real private investment; Y is real GDP; e is the real exchange rate; IG is real public investment; D* is the foreign debt; and σ , which the authors use as a proxy for credibility, is constructed by using key macroeconomic variables, such as the variability of the real exchange rate, and the variability of inflation.

However, according to Borner, Brunetti and Weder (1995), the above methods have shortcomings because they do not directly capture the insecurity faced by investors. For them, a direct approach, whereby investors are asked about what factors most directly influence their decision to invest in a country would produce more robust results. Therefore, they prepared and sent questionnaires to a selected number of company managers in different countries. On the basis of the responses received, an

indicator of political credibility, POLCRED was constructed, which the authors used in various equations, including investment equations.

We do not approach the question of credibility in a direct fashion. Rather, any inference we make with respect to credibility is based upon the results of our study of private responses to government policy reforms in Africa. We provide the full details of our empirical models and their results below.

3.3.1 The Research Question

We test two main hypotheses in this study:

- a) *Tariff reforms announced as part of Structural Adjustment Programs, produced significant effects on actual government policy;*
- b) *The change in government policy due to trade reforms had a significant effect on private actions (e.g., investment or production or trade activities) in African countries.*

The inference here is that in order for private agents to react significantly to an announced policy by the government, they must have determined that the announcement was credible.

3.3.2 The Modeling Issues

We use two models to test hypotheses (a) and (b). The first equation is used to model government tariff policy. In the absence of precise data on policy rules in African countries, we postulate that, in general, the tariff is set as a function of its own one-period lag, of private actions such as trade, and other selected economic variables.

Let τ_t represent period t tariff, FT_{t-1} represent the one-period lag of trade flows (the sum of total exports and imports), and \bar{X} be the matrix of appropriate economic variables such as the country's external debt, government spending or deficit, foreign exchange reserves, etc.... We would expect that high external debt, high budget deficit, and low levels of foreign exchange reserves would lead the government to increase tariffs. The tariff model is presented as:

$$\tau_t = \alpha_0 + \alpha_1 \tau_{t-1} + \alpha_2 FT_{t-1} + \bar{X}\bar{\alpha} + \varepsilon_t \quad (52)$$

where, α_0 is a constant, α_1 , and α_2 are the lagged tariff and trade flows parameters respectively, $\bar{\alpha}$ is a vector of coefficients for the variables included in \bar{X} , and ε_t is the error term, assumed to be normally distributed, with mean=0, and a constant variance. Now, suppose that the government pre-commits to a particular tariff level, say, τ_t^p which is announced to the public. Then, (52) is modified to become:

$$\tau_t = \alpha_0 + \alpha_1 \tau_t^p + \alpha_2 \tau_{t-1} + \alpha_3 FT_{t-1} + \bar{X}\bar{\alpha} + \varepsilon_t \quad (53)$$

We would declare that the government has fully adhered to its precommitment policy, if we cannot reject the null hypothesis that:

$$\alpha_0 = \alpha_2 = \alpha_3 = 0, \bar{\alpha} = \mathbf{0}, \text{ and } \alpha_1 = 1 \quad (54)$$

However, in the absence of a full adherence, then partial adherence obtains, if α_1 is (statistically) significantly greater than zero and the remaining coefficients are close to zero.

Next, we present the trade flow model, which describes private agents'

behavior in the trade sector. We use the trade flow variable (the sum of total imports and total exports) to measure total activities in the trade sector. Below is an explanation of the relationship between our trade flow variable, and tariff policy.

Theoretically, we would predict that, in a two-tradable-good economy, where the government actively uses trade policy, an increase in the domestic relative price of the export good (due, say, to a reduction in export the export tariff), would lead to an increase in the domestic production and trade of the exportable good. However, since an increase in the domestic relative price of the export good is equivalent to a decrease in the domestic price of the importable good, then, domestic production of the import good will decrease. But, in the absence of any change in total domestic demand, a reduction in domestic production of the import good will necessarily lead to an increase in the import of the good from the rest of the world. Thus, a reduction in the export tariff leads to an increase in both total exports, and total imports.

Now, assume that instead of an export tariff, the government maintained an import tariff, and suppose there occurred a reduction in the import tariff. The lower tariff will lead to a decrease in the domestic relative price of the import good, and a decrease in its domestic production. Again, in the absence of an accompanying reduction in domestic demand, imports will increase. And, since a decrease in the domestic relative price of the importable is equivalent to an increase in the domestic relative price of the exportable, then domestic production and trade of the export good will increase.

In all, we would predict that there will be an increase in a country's total trade activities as a result of tariff reduction, and the converse holds as well. Let $\hat{\tau}_t$ be the predicted tariff that results from equations (52) or (53), \bar{Y} to be a matrix of relevant economic variables, and $\bar{\beta}$ to a vector of coefficients corresponding to \bar{Y} . Then, we propose the following model to estimate trade flows in the Africa countries under study:

$$TF_t = \beta_0 + \beta_1 TF_{t-1} + \beta_2 \hat{\tau}_t + \beta_3 \hat{\varepsilon}_t + \bar{Y} \bar{\beta} + \mu_t. \quad (55)$$

The interpretation of (55) is that total private agents' activities in the trade sector in period t , is a function of the one-period lag of the trade flow, the private sector forecast of tariffs and the disturbances from this forecast, and a matrix of other relevant economic variables. The inclusion of the tariff forecast and its residuals rests on the theoretical prediction that in general, the response of trade flows to anticipated changes in tariff should be different from what it would be for unanticipated changes. Note that in equation (55), the predicted tariff has a direct effect, and an indirect effect through investment decisions on trade flows. But, the tariff residuals only have a direct effect on trade flows. Now, suppose that the announcement of a pre-commitment policy is credible. Then, the private sector's prediction of tariffs becomes more certain, and agents would therefore be willing to commit more fixed resources to trade. Thus, if credible, a pre-commitment policy causes a shift in the short run supply curve or a movement along the long run supply curve. Given these commitments of fixed

resources in the case of a credible announcement, we would predict that the response of the private sector to anticipated changes in tariff should be less than its response to unanticipated changes.

Another method of testing for the response of the private sector to reform policy is to simply add a time dummy variable in equation (55). The issue then concerns whether countries became more open by eliminating invisible barriers not present in the regressors in (55). This approach is quite appropriate in the African contest because, in all of the countries we analyzed, all forms of non-tariff barriers were used in the pre-adjustment period to curtail imports (and sometimes exports.)¹⁰

We include the one-period lagged tariff because we believe that any unsold inventory from one period may be regarded by private agents as investment for subsequent periods. This empirical necessity represents a slight deviation from our theoretical assumption of no link between any two periods. In the next section, we present our empirical results.

3.4 The Empirical Results and Data Sources

3.4.1 The Data and Methodology

Our data are collected from several sources. We used World Bank and IMF (IFS) data for trade flows and prices; import tariff, and the macro economic data. For most countries, we calculated the tariff rates from tariff revenues. Also, some countries had missing data for some years. These were filled in by the author's

10. See Ezran and Svedberg (1991).

calculations. Most of the data covers the period of 1960 to 1994. However, the data on tariffs span only the period of 1980/81 to 1991/92 for most countries.

There are eight African countries in our sample: Ghana, Kenya, Côte d'Ivoire, Mali, Malawi, Tanzania and Nigeria, and Senegal. All have signed a reform program with the Bretton Woods institutions at various times since 1981. The data on tariff announcements come from various publications, and studies conducted by the World Bank. We were not able to obtain a specific schedule for tariff reduction for each country. Rather, the data usually provided for the target percent reduction in tariff rates at the end of the program period. We then generated an announced tariff series with the assumption that tariff rates will decrease by equal amounts each year until the target year.

We used a panel data approach in this study instead of cross-sectional approach. Hsiao (1986) defines a panel, or longitudinal data set, as "one that follows a given sample of individuals over time, and thus provides multiple observations on each individual in the sample" (p 1) There are several advantages to using a panel data approach. Among those of interest to this study are that it allows us to use a relatively "large" number of data points. This is important in our case, because we only have 11 years of usable data, and our study requires dividing the sample into two. A conventional cross-sectional approach would not have provided enough data points for our estimations. Further, as Hsiao points out, the panel data approach allows us to utilize information on both the "intertemporal dynamics and the individuality" of the

countries we are studying. Thus, in addition to studying a sample of countries over time, we can “observe” and, if need be, make inferences about the behavior of each individual country in our sample over time.

Specifically, the basic model that is generally used for this discussion has the form:¹¹

$$y_{it} = \alpha_i + \beta' X_{it} + \varepsilon_{it}, \quad (56)$$

where the matrix X_{it} contains K regressors, not including the constant. The error term, ε_{it} , represents the effects of omitted variables that are particular to both the individual units and time periods. It is assumed that ε_{it} can be characterized by an independently distributed random variable with zero mean and variance equal to σ_u^2 .

The intercept α_i measures the individual effect. This effect taken to be constant over time t and specific to each individual i, can be assumed to be the same across all individuals, in which case equation (56) can just be estimated by ordinary least squares, yielding consistent and efficient estimates of both α and β .

However, as stated above, it is commonly assumed that there exists differences across units (or countries in the case of the present study). In this case, the model can be modified to become (this is known as fixed effects estimation. An alternative method is the random effects or error components model. For further discussion, see Judge et. al. (1982), Hsiao(1986), and Greene (1993) and the section, in the present

11. See Econometric Analysis 2nd Edition, by Greene.

work, on specification tests):

$$y = D\alpha + X\beta + \varepsilon, \quad (57)$$

where, $D = [d_1, d_2 \dots d_n]$ is a matrix of country-specific dummy variables (n is the number of countries), and X is a $1 \times n$ matrix of regressors, excluding the constant. This model can also be estimated by OLS to obtain efficient and consistent parameters. We estimated the tariff and trade flows models using both equations (56) and (57).

3.4.1.1 On the Issue of Sampling

The implementation of models (52)-(55) requires the splitting of our sample into two subsamples representing the pre-agreement period and the post-agreement period, respectively. Our data indicate that even though countries signed agreements in different years throughout the 1980s, most of the countries that we study have signed SAP agreements by 1986. For example, in 1986, Nigeria, Mali, Tanzania, Senegal, introduced major reform programs. Both Kenya and Ghana introduced major reforms in 1987, and the process began in Malawi in 1988. Overall, we consider the period between 1980 and 1985 as the pre-announcement period, and the period between 1986 and 1991 as the post-announcement period. We conduct our estimations using the windows version of RATS (4.20).

3.4.2 The Regression Results

We estimated two types of equations in an attempt to explain tariff policy and private trade choices in Africa: the first type of model assumes a common cross-

country effect, and the second is the fixed effects model. The next two sections report the results of the tariff and trade models assuming a common cross-country effect.

Then we report the results of the fixed effects tariff and trade models. In each case, we indicate the best model to be selected. Among the tests we perform are unit root tests and Chow tests for possibility of structural change, for both the tariff and trade models.

Further, in each model, we test for the significance of the pre-commitment tariff in explaining the variable of interest. In addition, using the bootstrap technique, we test for the response of tariff policy to changes in exogenous conditions when a government has made a pre-commitment announcement. Finally, we perform a specification test (Hausman) for each model.

3.4.2.1 The Results of the Tariff Model Assuming Common Effects

Across Countries

We report the results of the model where we assumed the constant term is the same across countries. Then the results of the fixed effects model, where we capture differences across countries are reported.

We first estimate model (52) for the pre-agreement period. The equation (denoted *Model TRFPRI*) includes the following variables: a constant, the lag of tariff ($TRF\{1\}$), the one-period lag of trade flows ($LTRDFL\{1\}$), government expenditure as a percentage of GDP ($GVEXPG$), the exchange rate (EXR), the log of GDP ($LGDP$), the external debt, as a percentage of GDP ($EXDTG$), the current account

deficit, as a percentage of GDP (CACG). The choice of these variables was based mostly on the author's economic intuition. For example, we believe that, if a government uses commercial policies, and particularly for those governments who rely on trade revenues for a major portion of their expenditures, we should observe that tariffs would be higher during periods of high government expenditure, high external debt, high current account deficits, and lower otherwise. Further, by including trade flows in the tariff regression, we are postulating that government policy responds partially to private decisions.

The results of this first model are summarized in Table 2. The equation appears to be a good fit with an R^2 of .97 and \bar{R}^2 of .82. However, we believe that a combination of low t-statistics and high F-statistics may indicate the presence of multicollinearity in the model. To correct this problem, we eliminate those variables which, from our correlation matrix, appear to be the most highly correlated. We denote the resulting model as *Model TRFPR2*. This model regresses tariff on a constant (t-statistics=2.98) and three other variables: the one-period lag of tariff, TRF{1} (t-statistics=14.57), the exchange rate, EXR (t-statistics=-2.34), and the external debt, as a percentage of GDP, EXDTG (t-statistics=1.89). As the t-statistics indicate, all variables are significant, at least, at the 10% level. The model is parsimonious, with only four variables, and is a good fit with the R^2 remaining at 0.97, and the \bar{R}^2 increasing slightly to 0.84. As Table 2 (Model TRFPR2) indicates, all of the explanatory variables have the expected signs. The one-period lag of tariff appears

to be an important predictor of the level of tariff, and we would expect the relationship between the two variables to be positive. The exchange rate¹² is expressed as the number of local currency per dollar. A higher exchange rate implies a higher trade revenue for an unchanged world price and quantity traded. Thus, we would expect that, *ceteris paribus*, a rise in exchange rate will lead to higher revenue for the government, which can then be translated into a smaller tariff rate. We would therefore expect a negative relationship between tariff and exchange rate. Further, as indicated above, in periods of high external debt, a government which uses commercial policies, may increase tariffs in order to acquire more funds to service the debt. Thus, we expect tariff and government's external debt to be positively correlated.

Throughout the paper, we will use residual plots to check the validity of the models we select for our study.¹³ Examining residual plots is a simple way of checking if the assumptions that have been made regarding model error terms are valid. Thus, a residual plot may be used to detect unequal variances, at different levels of the independent variables (Mendenhall and Sincich, 1989). If the assumptions on the error term are valid, then we would not detect any particular pattern in the plot of the residual series.¹⁴ Figure 37 presents the plot of the residuals of the pre-agreement tariff

12. We used nominal exchange rate for this first estimation. Later, we substitute this for the real exchange rate, using the procedure described in footnote 5. For this purpose, we used the British wholesale price for English-speaking countries, and France's wholesale price for French-speaking countries.

13. A formal test for model specification is provided below.

14. Notice that we can detect individual country effects from residual plot since each time interval on the X-axis of the residual plot refers to each individual country. The order of the countries is as follows: Ghana, Kenya, Cote d'Ivoire, Mali, Malawi, Tanzania, Nigeria and Senegal.

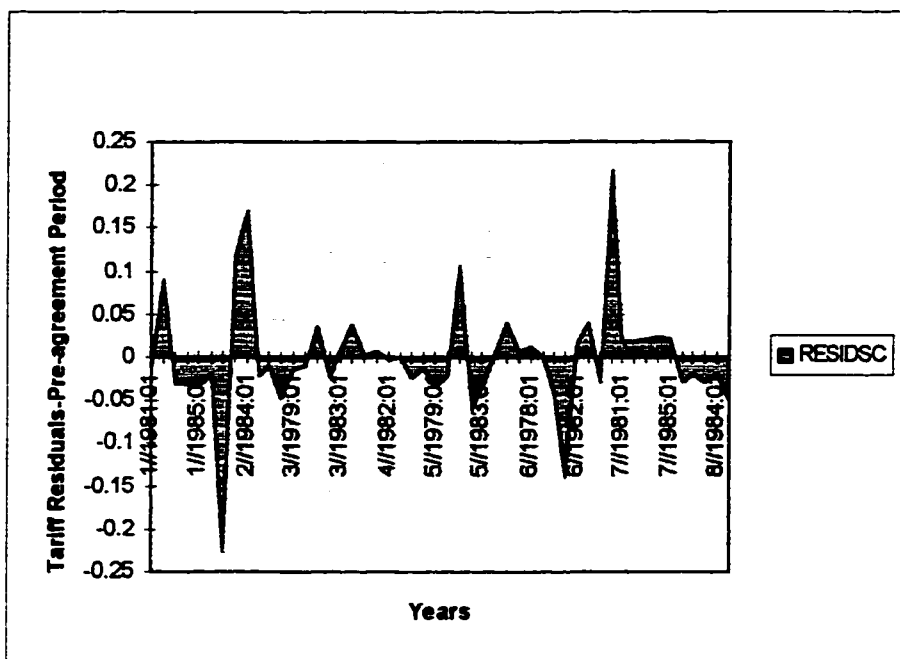


Figure 37. Graph of the residuals of the selected pre-agreement tariff model

periods. The Chow test constitutes one method of testing for structural break between two periods. This test involves estimating a given model over a pooled sample, as well as the sub-samples, and then performing a F-test using the sum of squared residuals and the degree of freedom from the three estimations.

The null hypothesis of this test is that there is no structural break in the government's tariff setting policy between the pre-agreement period and the post-agreement period. An F-statistic which is higher than the critical F-statistics would imply that we cannot accept the null hypothesis.

Table 3 summarizes the results of the estimation of our model over the post-agreement period. Model TRFPST1 estimates the pre-agreement model, but without the pre-commitment tariff included. Other models are alternatives, with the pre-commitment tariff included.

For Model TRFPST1, the R^2 is 0.95, and the \bar{R}^2 is 0.48. The EXR and EXDTG variables have very low t-statistics: 0.66, and 0.22, respectively. The lagged-

Table 3. Post-agreement tariff model: testing the effect of the pre-commitment tariff

Depd. Var: TRF																		
Model TRFPST1				Model TRFPST2				Model TRFPST3				Model TRFPST4						
Variables	Coeff.	Stand. Error	t-stats	2-tail signif.	Coeff.	Stand. Error	t-stats	2-tail signif.	Coeff.	Stand. Error	t-stats	2-tail signif.	Coeff.	Stand. Error	t-stats	2-tail signif.		
Constant	0.120	0.030	3.400	0.001	0.020	0.060	0.440	0.660	0.033	0.060	0.540	0.580	0.540	0.090	5.930	0.000		
TRF{1}	0.600	0.090	6.710	0.000	0.540	0.090	5.880	0.000	0.540	0.090	5.700	0.000	0.540	0.090	5.930	0.000		
EXR	0.00002	0.00003	0.660	0.510	0.000008	0.00002	0.330	0.730										
EXDTG	0.001	0.004	0.220	0.820	0.001	0.004	0.400	0.680										
TFRPC					0.450	0.260	1.710	0.090	0.450	0.250	1.810	0.070	0.570	0.131	4.360	0.000		
DOF: 44																		
SSE=0.29																		
$R^2 = 0.95$					$R^2 = 0.95$					$R^2 = 0.95$								
$\bar{R}^2 = 0.48$					$\bar{R}^2 = 0.50$					$\bar{R}^2 = 0.52$					$\bar{R}^2 = 0.53$			

tariff, TRF{1} has a t-statistics of 6.71, and which is significant at the 1% level, and the constant's t-statistics is 3.40, also significant at the 1% level. The residuals of model TRFPST1 are graphed in Figure 38.

Figure 38 shows that there is no discernible pattern in the residual series for any of the countries in the post-agreement period, with perhaps the exception

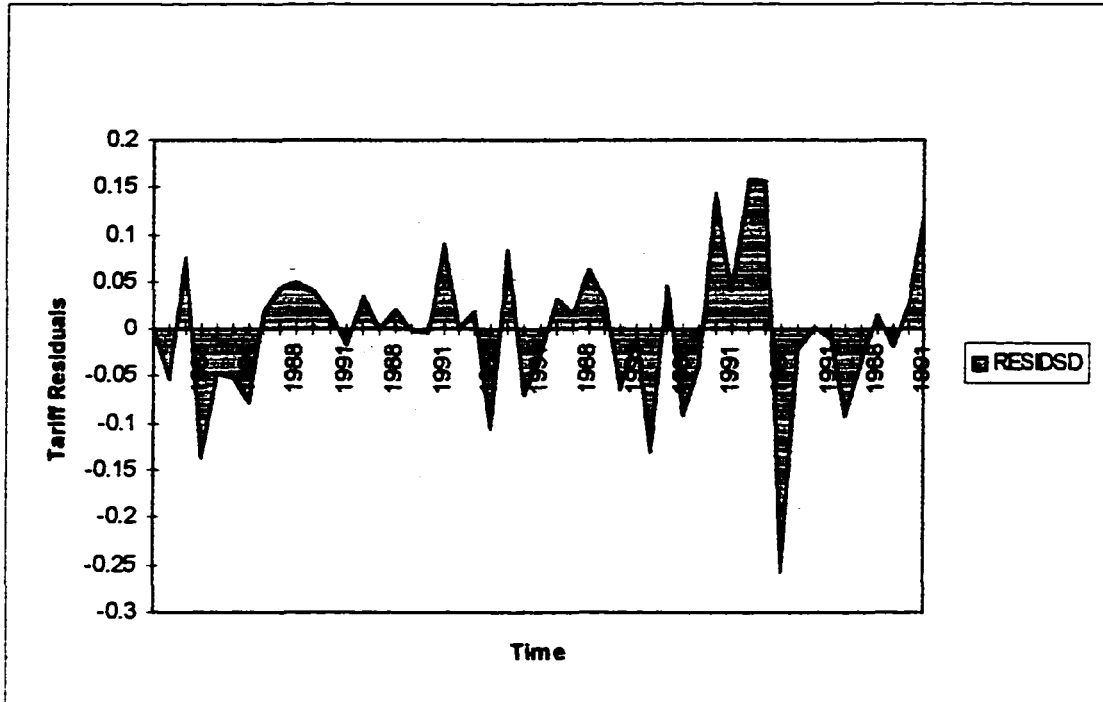


Figure 38. Graph of the residuals of the post-agreement tariff model.

of Nigeria, where there seems to be a bit more volatility in the residual series than in the countries. We deduce from the plot that the selected post-agreement tariff model is valid.

For the pooled regression, the R^2 and \bar{R}^2 are 0.95 and 0.70, respectively. The variables EXR and EXDTG still have very low t-statistics: -0.48 and 0.25, respectively. The constant remains significant, with a t-statistics of 3.77, and a significance level of 1%, and the lagged-tariff remains highly significant, with a

t-statistics of 14.90, which is significant at the 1% level (see Table 4). To carry out our test for structural stability, we use the following equation also known as the Chow test (ref. RATS User's Manual):

$$F = \frac{((rsspool - rssunr) / 4)}{(rsspool / ndfunr)} \quad (58)$$

where *rsspool* is the sum of squared residuals from the pooled regression (which does not include the pre-commitment tariff variable), *rssunr* (the sum of the sum of squared residuals from the two sub-sample models) is the unrestricted sum of squared residuals, and *ndfunr* the degree of freedom of the unrestricted model. This is simply the sum of the degrees of freedom from the sub-sample models. The F-statistics, $F_{(4, 90)}$, is 3.83, with a significance level of 0.0065. We therefore reject our null hypothesis, and conclude that *Model TRFPR2* is not stable over the two sample periods.

Table 4. The pooled tariff regression

Dep. Var: TRF				
Variables	Coeff.	Stand. Error	t-stats	Signif.
Constant	0.076	0.020	3.775	0.000
TRF{1}	0.788	0.053	14.897	0.000
EXR	-0.00001	-0.00002	-0.486	0.628
EXDTG	0.001	0.004	0.255	0.799

DOF: 94
SSE: 0.58
 $R^2 = 0.95$
 $\bar{R}^2 = 0.70$

The interpretation of the results of our test is that, in general, there seemed to have occurred a change in government tariff policy from the pre-agreement period to the post-agreement period. In our data the only difference between the two sub-periods is the pre-commitment tariffs that governments agreed to as part of SAP. Thus, we investigated whether including the pre-commitment tariff variable (TRFPC) in the post-agreement model affects the results obtained above. We call this new model, *Model TRFPST2*. We now present the results of its estimation (see Table 3). The R^2 and \bar{R}^2 are 0.96 and 0.50, respectively. The constant term has a t-statistics of 0.44, which is not significant; the EXR and EXDTG variables have t-statistics of 0.34 and 0.40 respectively, and are also not significant. The lagged tariff have a t-statistics of 5.68 and is significant at the 1% level, and the t-statistics of the pre-commitment variable (TRFPC) is 1.71, which is significant at the 10% level.

Excluding those variables with low significance level from the model, results in a remarkable improvement in the pre-commitment variables, and a slight increase in the \bar{R}^2 . Indeed, with this change, i.e., regressing tariff on the lagged tariff and the pre-commitment tariff only, the t-statistic of the lagged tariff becomes 5.93 which is significant at the 1% level, and the t-statistics of the pre-commitment tariff increases to 4.36, also significant at the 1%. Our results indicate that government tariff policy rule in the pre-agreement period breaks down in the post-agreement period. Further, changes in tariff in the post-agreement can be explained, mainly by the one-period lag of tariff and the pre-commitment tariff. One possible interpretation of our results is

that African governments that signed agreements with the Bretton Woods institutions between the periods of 1980-1991, generally, but not perfectly, respected the portion of the agreements which related to tariff reforms.

Now, given that the one-period lagged tariff seem to explain a significant portion of the tariff series, we decided to investigate the possibility of a unit root in the tariff series. This is an important exercise since, despite the above results, we do not know precisely the structure of tariff policy rule in African countries. For this exercise, we used the well-known Dickey-Fuller test. Following Enders (1995), we offer an explanation for this test. In general, assume a model of the form: $y_t = a_1 y_{t-1} + \varepsilon_t$. This model will be said to contain a unit root, if a_1 is equal to 1. To test this, we first subtract y_{t-1} to obtain: $\Delta y_t = (a_1 - 1)y_{t-1} + \varepsilon_t$, where, $\Delta y_t = (y_t - y_{t-1})$. Let $(a_1 - 1) = \gamma$. Then the model becomes: $\Delta y_t = \gamma y_{t-1} + \varepsilon_t$. To test the possibility of a model of random walk with a *drift*, we can add a constant term to obtain: $\Delta y_t = a_0 + \gamma y_{t-1} + \varepsilon_t$. Finally, the presence of a unit root can be tested by proposing the null hypothesis that $\gamma=0$. The critical t-values are found in the tables developed by Dickey and Fuller (1979). The inclusion of a *drift* term can also be tested using a simple t-statistic. We first estimated the random walk model over the pre-agreement period. The results are presented in Table 5. The t-statistic on the lagged tariff is -1.30, with a significant level of 0.198. The critical values for the t-statistic at the 10%, 5%, and 1% levels are -1.61, -1.95, and -2.60 respectively.

We therefore cannot, at conventional significance levels, reject the null hypothesis of the presence of a unit root in the tariff series during the pre-agreement period. The constant has a t-statistic of 2.08, significant at the 5% level. Thus, the tariff series, in the pre-agreement period, can be modeled as a unit root model with a *drift*.

In the post-agreement period, the t-statistic on the one-period lagged tariff is -4.43, significant at the 1% level. This leads us to reject the hypothesis of the presence of a unit root in the tariff series in the post-agreement period. One explanation for the behavior of the tariff series as a random walk in the pre-agreement period may relate to the possibility that there does not exist a systematic rule for setting tariff policy common to the African countries under study. We do in fact test for this hypothesis (below) and find that there exists a significant difference in tariff policy depending on whether a country is member of the CFA (French-speaking) currency zone or not. Incidentally, when the same model is estimated over the pooled sample (Table 5), we

Table 5. Testing Unit Roots in the Tariff Series

<i>Depd. Var: TRFD</i>												
<i>Variables</i>	<i>Pre-agrmt.</i>				<i>Post-agrmt.</i>				<i>Pooled Reg.</i>			
	<i>Coeff.</i>	<i>Stand. Error</i>	<i>t-stats</i>	<i>2-tail signif.</i>	<i>Coeff.</i>	<i>Stand. Error</i>	<i>t-stats</i>	<i>2-tail signif.</i>	<i>Coeff.</i>	<i>Stand. Error</i>	<i>t-stats</i>	<i>2-tail signif.</i>
Constant	0.03	0.01	2.08	0.04	0.12	0.03	3.87	0.00	0.06	0.01	3.84	0.00
TRF{1}	-0.07	0.05	-1.30	0.19	-0.40	0.08	-4.43	0.00	-0.19	0.04	-3.91	0.00

also reject the null hypothesis of a unit root.

Note that these results confirm our earlier conclusions. Once again, we estimated a model that can be used as a possible explanation for tariff setting policy in the pre-agreement period. However, as before, this model fails to hold in the post-agreement period, and the results of the test on the real effect of the announced pre-commitment tariff remain valid.

3.4.2.2 The Results of the Trade Model Assuming Common Effects

Across Countries.

The second portion of our empirical investigation consisted in estimating equation (55). The choice of the right hand side variables was based on past studies,¹⁵ as well as our own economic intuition. We view trade flows as reflecting production, and therefore investment in the trade sector of nations. Thus, as empirical studies have shown for the case of investment (see IFC, 1995), we believe that, in making their production and trade decisions, private agents take into consideration factors such as the existing capital stock (FXKG), credit availability, economic and currency stability, a country's general performance in its balance of payments accounts, performance in the public sector, country's income, and, if necessary, commercial policies. In our

15. See for example, Ingco and Boko (1995), and Balassa (1990). In addition a macroeconomic model was developed by Quarcoo (1991) for the Ghanaian trade sector. Although the hypotheses tested in that model consisted in determining the role of export as an engine of growth, and the link between domestic credit expansion and external balances, we found some of the elements of the model to be useful for our study. Further, Joe Umo (1991) developed a trade model for Nigeria which focuses on import demand. Alechi M'Bet (1991) presents a model on non-traditional exports in Côte d'Ivoire, and Nehemiah N'geno's (1991) model focuses on the Kenyan export sector. Edward Leamer (1994) presents a survey of empirical testing for trade theory. See the bibliography for complete references.

model, we use the money supply (LMS) as a proxy for credit availability; currency stability is measured by the change in the exchange rate; the macroeconomic stability is captured by the inflation rate, proxied here by the change in the consumer price index (CPIC); we use the following to measure performance in the international sector: the country foreign exchange reserve as a ratio of GDP (FREXCG), the current account balance, as a ratio of GDP (CACG), the external debt, as a ratio of GDP (EXDTG). We also use the gross domestic product (LGDP) to measure the country's income, and government deficit (expressed a ratio of GDP), as a measure of public sector performance. This variable is called GVDFG.

But, more germane to this study, the objective is to determine how the announcement of trade reforms impacted private sector behavior. First, we estimate model (55), where we regressed the log trade flows on explanatory variables, including the ones cited above, the predicted tariff from the earlier estimated tariff model (TRFPDPR), as well as the tariff equation residuals (RESIDSC), calculated as the difference between the predicted tariff and the actual tariff. The latter are included in order to determine whether the private sector finds the uncertain portion of government tariff policy to be more important to their decision than the tariffs themselves. Table 6 reports the results of the full model, and the corresponding residuals are graphed in Figure 39.

The residual plot in Figure 39, as well as the R^2 of 0.99 and the \bar{R}^2 of 0.97, together indicate that the regression is a very good fit. However, there remains

potential problems of multicollinearity among the explanatory variables, since several of the variables have low t-statistics while the F-statistic of the regression is a high 162.43.

Exclusion of variables are made on both the basis of economic intuition, and examination of the correlation matrix for the all the explanatory variables. Table 7 regresses the log of trade flows on the lagged trade flows, the predicted tariff, the tariff regression residuals, the change in consumer price, the foreign exchange reserve,

Table 6. Estimation of trade models in the pre-agreement period

<i>Depd. Var: LTRDFL</i>								
<i>Model 1</i>				<i>Model 2</i>				
<i>Variables</i>	<i>Coeff.</i>	<i>Stand. Error</i>	<i>t-stats</i>	<i>2-tail signif.</i>	<i>Coeff.</i>	<i>Stand. Error</i>	<i>t-stats</i>	<i>2-tail signif.</i>
Constant	0.170	0.520	0.330	0.740	0.240	0.370	0.650	0.530
LTRDFL{1}	0.880	0.090	9.680	0.000	0.900	0.069	13.260	0.000
RESIDSC	0.020	0.410	0.050	0.960	-0.055	0.410	-0.144	0.900
TRDPDPR	0.100	0.200	0.500	0.620	0.055	0.210	0.270	0.790
CPIC	-0.001	0.001	-0.400	0.700	-0.001	0.001	-0.270	0.790
FREXCG	3.083	2.170	1.770	0.080	3.260	1.700	1.940	0.060
EXDTG	-0.046	0.027	-1.710	0.098	-0.050	0.025	-1.930	0.063
EXR	0.0004	0.0003	1.390	0.180	0.0004	0.0002	1.980	0.056
LGDP	-0.034	0.190	-0.190	0.860	-0.062	0.123	-0.510	0.620
CACG	-0.860	0.740	-1.150	0.260				
FXKG	-0.550	0.810	-0.680	0.500				
DVDFG	0.140	0.290	0.470	0.640				
LMS	0.120	0.140	0.870	0.400	0.123	0.104	1.190	0.250
$R^2 = 0.99$				$R^2 = 0.99$				
$\bar{R}^2 = 0.97$				$\bar{R}^2 = 0.98$				

Table 7. The trade flows regression with tariff volatility and moving average

Depd. Var: LTRDFL

Model 1 (With tariff volatility and MAV)

Variables	Coeff.	Stand. Error	t-stats	2-tail signif.
Constant	0.360	0.390	0.920	0.370
LTRDFL{1}	0.820	0.080	9.550	0.000
TRFVOLAT	-2.590	5.660	-0.460	0.650
TRFMAV	0.034	0.210	0.150	0.880
TRF				
TRF{1}				
CPIC	-0.007	0.004	-1.880	0.060
FREXCG	2.720	2.120	1.280	0.210
EXDTG	-0.030	0.030	-0.990	0.330
EXR	0.001	0.0002	2.150	0.040
LGDP	0.006	0.140	0.040	0.960
LMS	0.140	0.110	1.310	0.190

$$R^2 = 0.99$$

$$\bar{R}^2 = 0.98$$

exchange rate, the log of GDP, the log of the money supply, and external debt. In this, as in the first regression, neither the predicted tariff, nor the tariff regression error seem to have any effect on the trade flows. Thus, before eliminating more variables, we explored the relationship between various measures of tariff effects [tariff volatility (TRFVOLAT), moving means of tariff (TRFMAV), the tariff in levels (TRF), lagged tariff (TRF{1})] and trade flows.

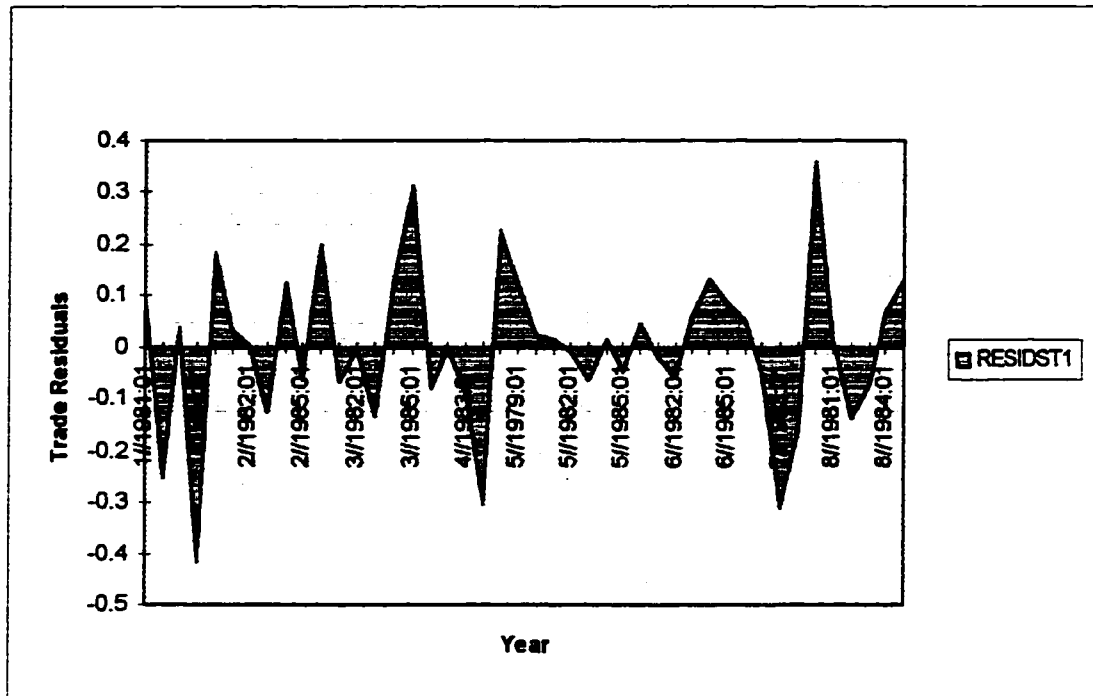


Figure 39. Graph of the Residuals of the Full Pre-agreement Trade Model

The choice of volatility of tariff was partly based on earlier studies, such as Lutz (1990), which investigated the relationship between output supply and price volatility. As Tables 7 and 8 show, none of the different measures of tariff effects seemed to impact private agents' behavior in the trade sector. One possible explanation for this result may concern the fact that, in addition to tariffs, many African government also maintain quotas, as well as other non-tariff barriers (NTB's) as a means to regulate the trade sector. This may explain why tariffs do not appear to affect private agents' decisions in the period before countries were required by international agreements to tariffy their NTB's.

accounted for about 40% of imports.” (p 44). For Kenya it states: “quantity restrictions in the form of quotas and an extensive licensing system have been the major constraints on Kenya’s trade throughout the 1980s.” (p 42) For Cote d’Ivoire we have: “the first stage of the program was implemented in 1985. [Quantity restrictions] and the reference prices were removed, the tariff structure was rationalized...” (p 40). For Senegal, “the objective of import liberalization was to abolish NTBs, eliminate special tariff regimes, and rationalize the tariff structure.” (p 46) There is strong evidence therefore both from our case studies and other reports that non-tariff barriers, instead of tariffs themselves, remained the main trade revenue generating instruments for the countries we are studying in the pre-agreement period.

Table 8 (above) presents the regression which includes tariffs in levels as an explanatory variable. After exclusion of all measures of tariffs, and exploration of various models, we selected one that regresses trade flows on a constant, the lagged trade flows, the one-period lag of inflation, the foreign exchange reserves (as a ratio of GDP), the log of money supply, the log of GDP, and external debt (as a ratio of GDP) as the best model to explain private behavior in the trade sector in the pre-agreement period. All parameters have the expected signs, and are significant, at least at the 10% level (see Table 9). The residual plot in Figure 40 indicates no pattern in the residuals series implying that the model fits very well.

As Table 9 shows, the lagged trade, with a coefficient of 0.71, and a t-statistics

Table 9. The selected trade model in the pre-agreement period

Depd. Var: LTRDFL									
Model 1					Model 2 (with lagged inflation)				
(with inflation in level form)									
Variables	Coeff.	Stand. Error	t-stats	2-tail signif.	Coeff.	Stand. Error	t-stats	2-tail signif.	
Constant	0.100	0.150	0.670	0.500	0.022	0.140	0.160	0.880	
LTRDFL{1}	0.770	0.050	15.670	0.000	0.720	0.044	16.240	0.000	
CPIC	-0.003	0.001	-2.710	0.007					
CPIC{1}					-0.005	0.001	-5.890	0.000	
FREXCG	2.660	0.570	4.680	0.000	2.580	0.510	5.050	0.000	
EXDTG	-0.070	0.022	-3.190	0.002	-0.065	0.020	-3.370	0.001	
EXR	0.001	0.0002	2.790	0.006	0.180	0.058	3.060	0.002	
LGDP	0.127	0.063	2.020	0.040	0.180	0.060	3.110	0.002	
LMS	0.088	0.060	1.480	0.144	0.099	0.055	1.790	0.070	
$R^2 = 0.99$					$R^2 = 0.99$				
$R^2 = 0.98$					$R^2 = 0.98$				
					SSE=2.8				
					DOF=106				

of 16.23, appears to be a strong predictor of aggregate trade. Economic stability, (change in the CPI) negatively affects aggregate trade. The coefficient for this variable is -0.005, and the t-statistics is -5.88. Access to foreign exchange reserves, national income (GDP), and credit availability (money supply) are significant, positive predictors of aggregate trade, as we would expect. The foreign exchange coefficient is 2.58, with a t-statistic of 5.05; the log of GDP has a coefficient of 0.17, with a t-statistic of 3.11, and the log of money supply has a coefficient of 0.09, with a t-

statistic of 1.79. High external debt discourages trade, because it might force governments to increase trade revenues generating measures to service the debt. Thus, again we would expect a negative relationship between external debt and the level of aggregate trade. Indeed, in our estimation, the external debt coefficient is -0.065, with a t-statistic of -3.37. We kept the constant in the regression, even though it is not significant, to capture any other effects not explained by the other right hand side variables. The regression has an excellent fit, with an R^2 of 0.99, and an \bar{R}^2 of 0.98. Once again, due to the strong explanatory power of the lagged trade variable, we test for the unit root in the trade series. The procedure is similar to the one employed for

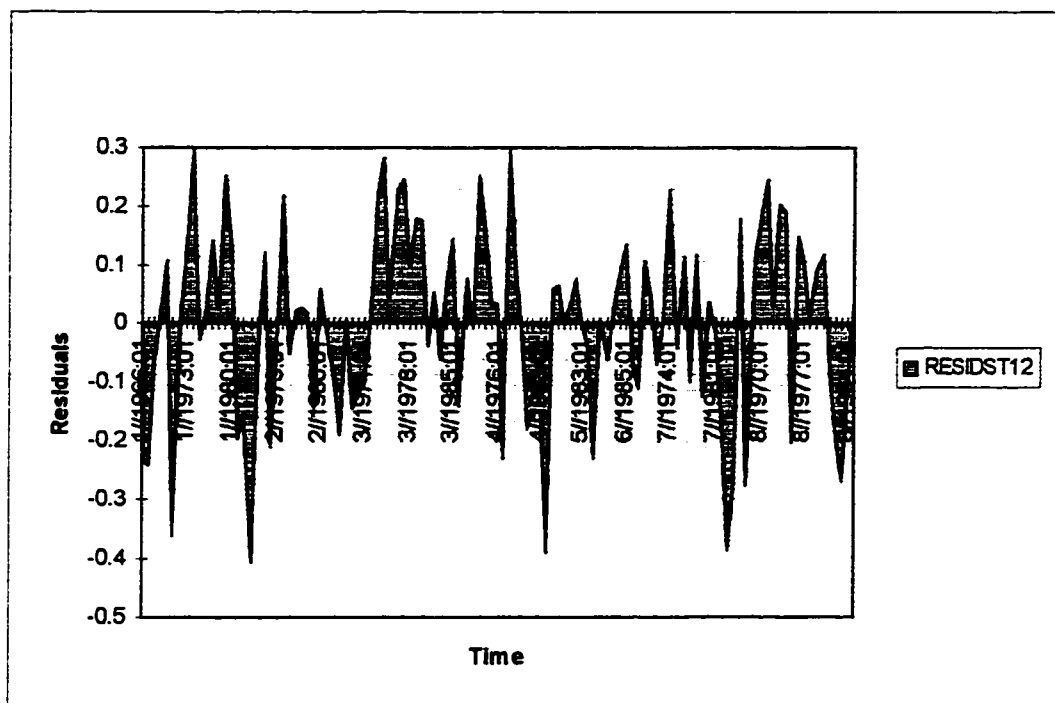


Figure 40. The Residuals Plot of the Selected Pre-agreement Trade Model

the tariff series above. The unit root test is based on regressing the differenced trade series on the lagged trade variable.

The null hypothesis (presence of unit roots) is that the coefficient on the lagged trade variables is zero. When we include a constant, then we test for the presence of unit root with *drift*. Our results indicate that, in the pre-agreement period the coefficient on the lagged trade variable is -0.01, with a significance level of 0.46 (see Table 10).

Thus, we cannot reject the null hypothesis of the presence of a unit root in the trade series. The *drift* (constant) term is also not significant. The results lead us to conclude that in the pre-agreement period the trade flows series seem to follow a random walk pattern. In the post-agreement period, the lagged trade variable has coefficient of -0.13, which is significant at 10% level, leading us to conclude that there is some statistical evidence (not strong) to reject the hypothesis of unit root in the trade series in the post-agreement period. For the pooled regression, we were not able to reject the hypothesis of the presence of unit root in the trade series. As in the case of the tariff model, we also tested, using the Chow procedure again, for structural break in the trade flow model over both the pre- and post-agreement periods.

Table 11 reports the results of the pooled, and post-agreement regressions. The null hypothesis in this case is that there is no structural break over the two periods. A F-statistic which is higher than the critical F-statistic indicates that we

Table 10. Unit root tests in the trade series

<i>Depd. Var: TRFLD</i>				
<i>Pre-Agreement Model</i>				
<i>Variable</i>	<i>Coeff</i>	<i>Std Error</i>	<i>T-Stat</i>	<i>Signif</i>
Constant	193.913	126.641	1.531	0.127
TRDFL{1}	-0.014	0.020	-0.737	0.462
<i>Post-Agreement Model</i>				
<i>Variable</i>	<i>Coeff</i>	<i>Std Error</i>	<i>T-Stat</i>	<i>Signif</i>
Constant	557.674	426.228	1.308	0.197
TRDFL{1}	-0.133	0.076	-1.746	0.088

cannot accept the null hypothesis.

For this study, the critical F-statistic, at the 5% significance level is 1.94, and the calculated F-statistics is 4.69, which is higher than the critical F. Therefore, we reject the null hypothesis at the 5% level, and conclude that we cannot statistically maintain that the model that explains the behavior of private agents in the trade sector in the pre-agreement period, remains the same in the post-agreement period.

Next, we test whether the pre-commitment tariff had any real effect on the econometric model that we used to explain private agents' behavior in the post-agreement period. First, given the failure of the pre-agreement model to hold in the post-agreement period, we estimated several alternative models, to determine one that best explains trade flows in the post-agreement period. The model we selected

regresses the log of trade flows on a constant, the one-period lag of trade, the log of money supply, and foreign exchange reserves (see Figure 41 for the graph of the residuals).

The residual plot of the trade model in the post-agreement period (Figure 41) contrasts sharply with the same plot in the pre-agreement period. Indeed, in Figure 40, we observe large volatility in the trade residuals in almost all countries. In contrast, in Figure 41, the volatility in residuals is drastically reduced

Table 11. The trade model: pooled and post-agreement regressions

<i>Depd. Var: LTRDFL</i>									
<i>Variables</i>	<i>The trade model in the post-agreement period</i>				<i>The pooled trade model</i>				
	<i>Coeff.</i>	<i>Stand. Error</i>	<i>t-stats</i>	<i>2-tail signif.</i>	<i>Coeff.</i>	<i>Stand. Error</i>	<i>t-stats</i>	<i>2-tail signif.</i>	
Constant	-0.470	0.430	-1.100	0.280	0.100	0.136	0.770	0.440	
LTRDFL{1}	0.410	0.120	3.490	0.001	0.730	0.044	16.840	0.000	
CPIC{1}	-0.001	0.002	-0.030	0.760	-0.005	0.001	-5.310	0.000	
FREXCG	0.600	1.020	0.590	0.570	2.090	0.450	4.700	0.000	
EXDTG	0.020	0.017	1.170	0.250	0.004	0.009	0.470	0.640	
EXR	-0.0002	0.0001	-3.000	0.004	-0.0001	0.0001	-1.920	0.050	
LGDP	0.650	0.170	3.820	0.000	0.190	0.060	3.200	0.001	
LMS	-0.080	0.140	-0.560	0.580	0.063	0.054	1.170	0.244	
$R^2 = 0.99$				$R^2 = 0.99$					
$\bar{R}^2 = 0.96$				$\bar{R}^2 = 0.97$					
SSE = 1.5 DOF=40				SSE = 5.4 DOF=154					

for all countries except Nigeria and Senegal. We believe that this result lends support to the Chow and unit root tests which we have performed above, implying again that there is a structural break in the trade model from the pre-agreement period to the post-agreement period.

In Table 12, we present the results of the selected post-agreement model. The lagged trade has a coefficient of 0.75, and a t-statistic of 7.31, the log of money supply has a coefficient of 0.22, and a t-statistic of 1.96, and the coefficient of the foreign exchange is 1.98, with a t-statistic of 2.09. The model has an R^2 of 0.99 and an \bar{R}^2 of 0.95. Here as in the case of the pre-agreement model, we included the predicted tariff

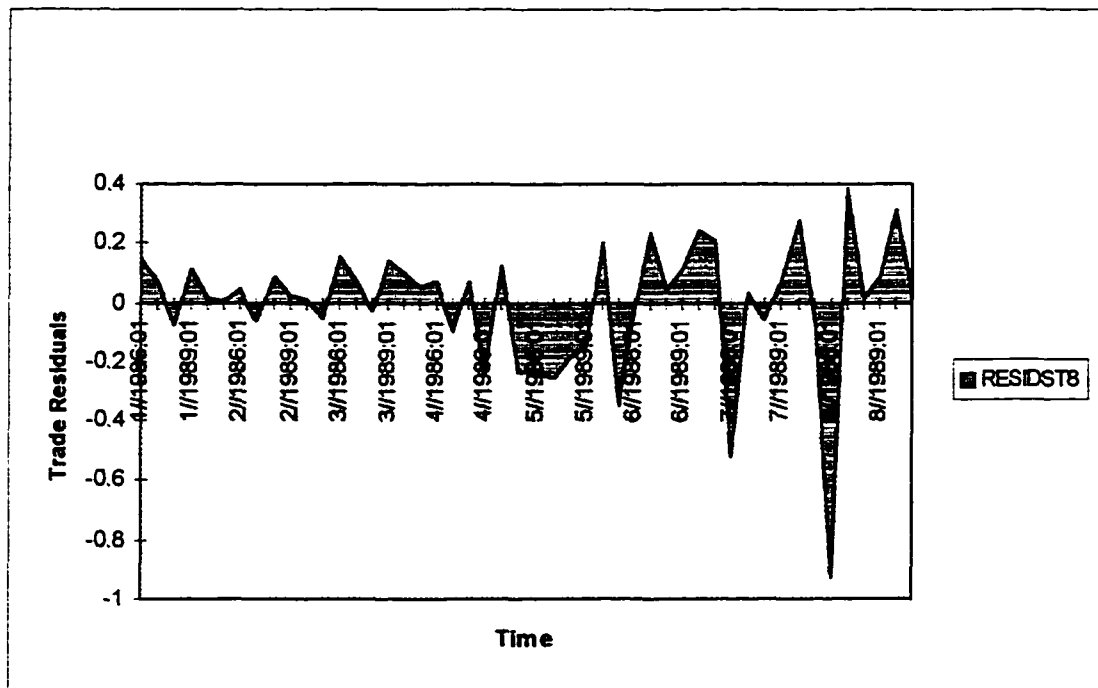


Figure 41. Graph of the residuals of the selected post-agreement trade model

and the residuals from the announced-tariff-included-tariff model. The assumption again is that trade must be more responsive to anticipated as opposed to unanticipated changes in tariffs. All previous variables remain significant, and maintain the same sign. The coefficient of the predicted tariff is -0.69, with a t-statistics of 1.76, significant at the 10% level. But, the residual tariff (which captures the uncertainty in tariff policy) was not significant, as its coefficient is 0.04, t-statistic, only 0.09. Excluding the residual tariffs did not produce any significant impact on the regression results. Finally, the R^2 of the last model is 0.99, and \bar{R}^2 , 0.95. Thus, the pre-commitment tariffs do have real effect of private agents' behavior in the trade sector, as explained by our model.

Table 12. Testing the effect of the pre-commitment tariff

Variables	Model 1: The selected Post-agreement model				Model 2: Effect of PC tariff With Errors included				Model 3: Effects of PC Tariff w/o Errors			
	Coeff.	Stand. Error	t-stats	2-tail signif.	Coeff.	Stand. Error	t-stats	2-tail signif.	Coeff.	Stand. Error	t-stats	2-tail signif.
Constant	0.344	0.250	1.390	0.180	0.680	0.310	2.190	0.030	0.680	0.310	2.220	0.033
LTRDFL{1}	0.760	0.110	7.320	0.000	0.720	0.100	6.830	0.000	0.720	0.110	6.900	0.000
LMS	0.220	0.120	1.970	0.050	0.250	0.120	2.250	0.030	0.260	0.120	2.280	0.030
FREXCG	1.980	0.950	2.090	0.040	1.910	0.940	2.040	0.048	1.910	0.930	2.070	0.045
TRFPDPS					-0.700	0.400	-1.760	0.087	-0.700	0.390	-1.790	0.082
RESIDSH					0.042	0.440	0.096	0.930				
	$R^2 = 0.99$				$R^2 = 0.99$				$R^2 = 0.99$			
	$\bar{R}^2 = 0.95$				$\bar{R}^2 = 0.95$				$\bar{R}^2 = 0.95$			

We find that in contrast to their behavior in the pre-agreement period, private agents included government tariff policy as a factor in their production and trade decisions in the post-agreement period. This may be an indication that the private sector lent some credence to government announcements of reforms in the 1980s (a formal pre-commitment test for announced policies is conducted below). Next, we reports the results of the fixed effects models for tariffs and trade flows.

3.4.2.3 The Results of the Fixed Effects Tariff Model

The first model incorporates the same variables as the full model estimated above, with the following changes added. Since the countries we selected are different from each other in terms of size (for example Nigeria has a population of over 100 million, versus 6 million in Mali), we decided to form indices of those variables which had taken only the logarithmic values before. These include the trade flows, the GDP, and the money supply. In so doing the results become comparable across countries. For our indices we use 1985 (the year before adjustment programs took hold) as the base year. Further, we use the real exchange rate (REXR) instead of the nominal exchange in this and subsequent estimations. In addition, as per our discussion on fixed effects models, we incorporated dummy variables to capture specific country effects. With eight countries, we used seven dummy variables, taking Ghana as the baseline country whose effects are captured by the original constant term. Finally, we incorporated the terms of trade for each country in order to test the response of the tariff equation to changes in the terms of trade. Table 13 reports the results of the full

fixed effects tariff model. The R^2 for this model is 0.97, and the \bar{R}^2 is 0.79. The results obtained in this first run indicate that three countries have tariff setting policies that are significantly different from the situation in Ghana. Those countries include Kenya (5% significance level), Mali (10%), and Malawi (5%).

Once again, using the t-statistics of variables and the correlation matrix, we eliminated several economic variables. We keep the dummy variables even if their t-statistics are not significant, because this allows us to determine country-specific effects. The resulting model regresses tariff on a constant, the lagged tariff, the real exchange rate, the index of GDP and country dummies. As Table 14 shows, the strongest response comes from the lagged tariff, (coefficient of 0.63, t-statistics 4.41), and very high significance level. Both the exchange rate and the GDP are significant at the 10% level. For this model, the countries whose effects are significantly different from Ghana are Tanzania (5%), and Malawi(5%).

Considering the geographical location of the countries included in the model, this result is not surprising. Of the eight countries considered in the present study, five (Ghana, Cote d'Ivoire, Mali, Nigeria and Senegal) are located in West Africa, while the remaining three (Kenya, Tanzania, and Malawi) are located in East Africa. Because of geographical proximity, and inter-country alliances, there is more likely to be correlation among countries if they are located in the same region than otherwise. This argument does not however explain why Kenya was not significantly different from

Ghana in the above model, although the fact that both countries have the same British colonial legacy may be a factor.

Next, we estimated the pre-agreement model in the post-agreement period to test whether there exists any changes in the results. Table 15 reports the results of this model. The above table provides some insightful results. First, the coefficient of the exchange rate has become negative in the post-agreement period, and is statically significant at the 5% level. This result concurs well with the provisions of the

**Table 13. The full fixed effects tariff model
in the pre-agreement period**

<i>Depd. Var: TRF</i>				
<i>Variable</i>	<i>Coeff</i>	<i>Stand Error</i>	<i>T-Stat</i>	<i>Signif</i>
Constant	-0.029	0.310	-0.094	0.926
TRF{1}	0.561	0.186	3.015	0.005
TRDFLI{1}	-0.001	0.001	-1.400	0.172
TOTRD	-0.001	0.001	-0.529	0.601
GDP1	0.001	0.000	1.763	0.089
GVEXPG	-0.498	0.312	-1.596	0.121
REXR	0.002	0.001	1.631	0.114
KCHG	-0.227	0.512	-0.442	0.662
EXDTG	0.003	0.100	0.034	0.973
CACG	-0.071	0.327	-0.216	0.831
DUMMY(2)	0.280	0.132	2.116	0.043
DUMMY(3)	0.198	0.122	1.626	0.115
DUMMY(4)	0.194	0.111	1.740	0.093
DUMMY(5)	0.316	0.138	2.293	0.029
DUMMY(6)	0.526	0.388	1.355	0.186
DUMMY(7)	0.282	0.184	1.530	0.137
DUMMY(8)	0.132	0.109	1.202	0.239

$$R^2 = 0.97$$

$$\bar{R}^2 = 0.79$$

Table 14. The selected fixed effects tariff model in the pre-agreement period.

<i>Depd. Var. : TRF</i>				
<i>Stand.</i>				
<i>Variable</i>	<i>Coeff</i>	<i>Error</i>	<i>T-Stat</i>	<i>Signif</i>
Constant	-0.170	0.167	-1.014	0.317
TRF{1}	0.636	0.144	4.416	8E-05
REXR	0.001	8E-04	1.781	0.083
GDPi	6E-04	3E-04	1.704	0.097
DUMMY(2)	0.121	0.082	1.474	0.149
DUMMY(3)	0.056	0.066	0.844	0.404
DUMMY(4)	0.086	0.073	1.186	0.243
DUMMY(5)	0.161	0.082	1.973	0.056
DUMMY(6)	0.221	0.090	2.441	0.019
DUMMY(7)	0.102	0.075	1.373	0.178
DUMMY(8)	0.049	0.080	0.609	0.546

$$R^2 = 0.97$$

$$\bar{R}^2 = 0.80$$

adjustment programs signed by African countries in the 1980s.

Indeed, in an attempt to restore internal and external balance, a real devaluation of countries' exchange rate was required of most countries.¹⁷ Since in this study, exchange rate is expressed as the number of national currency units per one dollar, devaluation implies an increase in the exchange rate, while tariff reforms require a decrease in tariff rates. Thus, while in the pre-agreement the two variables may have changed in the same direction in many countries, they are forced to change in opposite

17. The CFA zone countries maintained a fixed exchange rate, pegged to the French franc until 1994 [see Clement (1995)]. Thus, devaluation did not apply to the three French-speaking countries (Cote d'Ivoire, Mali, and Senegal) in our studies.

Table 15. The post-agreement fixed effects tariff model

<i>Depd. Var. TRF</i>				
<i>Variable</i>	<i>Coeff</i>	<i>Std Error</i>	<i>T-Stat</i>	<i>Signif</i>
Constant	0.397	0.160	2.482	0.018
TRF{1}	0.372	0.130	2.855	0.007
REXR	-0.001	0.0004	-2.574	0.014
GDPI	0.001	0.001	1.081	0.287
DUMMY(2)	-0.137	0.089	-1.543	0.131
DUMMY(3)	-0.128	0.084	-1.530	0.135
DUMMY(4)	-0.207	0.090	-2.310	0.027
DUMMY(5)	-0.191	0.095	-2.019	0.051
DUMMY(6)	0.184	0.063	2.935	0.006
DUMMY(7)	0.129	0.052	2.471	0.018
DUMMY(8)	-0.209	0.095	-2.199	0.034

$R^2 = 0.96$

$\bar{R}^2 = 0.56$

direction as per the agreements. That the real exchange rate should be significantly negatively related to tariff in the post-agreement period is indeed an indication that countries did attempt to follow through on their promises.

Also, we find that the changes in Kenya and Cote d'Ivoire were not significantly different from the Ghanaian effect. Mali, and Malawi had tariff rates statistically significantly lower than Ghanaian tariffs, whereas tariff rates in Tanzania and Nigeria are statistically significantly higher than tariffs in Ghana. In order to test the effect of the precommitment tariff on actual tariffs we estimated the same model,

but with interaction terms replacing the simple country dummies. These interaction terms are called $DUMPC_i$ (for $i = 2 \dots 8$) and are found as:

$$DUMPC_i = DUMMY(i) * TRFPC, \text{ for } i=2 \dots 8 \quad (59)$$

where, TRFPC is the pre-committed tariff. In addition to the interaction variables, we include the full vector of pre-commitment tariffs in the model. Thus, the null hypothesis that all countries are the same will hold true if the coefficients on the dummy variables are all zero. The results of this model are reported in Table 16.

Given the t-statistics obtained in Table 16, we reject the null hypothesis that all countries behaved in the same manner in the post-agreement period. In fact, while the results for Kenya and Cote d'Ivoire were not significantly different from those of Ghana, we believe there is indication of significant policy reversal or late implementations Mali (implementation of tariff agreement did not begin until 1988. t-statistics=-2.30), Malawi (t-statistics=-1.95), and Senegal (t-statistics=-2.01). Parallel to model TRFPST4 in Table 3, we examine the effect of excluding the constant and GDPI from the fixed effect model. The results are reported in Table 17.

The results that we obtained in Table 17 are parallel to those of model TRFPST4 in Table 3. The exclusion of the constant and the GDP variable greatly improves the significance of the pre-commitment tariff. Indeed, the coefficient of TRFPC went from 0.65 to 1.23, and the t-statistic rose from 1.067 to 2.59. This is another indication that the pre-commitment tariff had an impact on tariff setting policy. Continuing our attempt to test for any significant change in tariff policy between the

Table 16. The fixed effects model with interaction variables

<i>Depd. Var: TRF</i>				
<i>Variable</i>	<i>Coeff</i>	<i>Std Error</i>	<i>T-Stat</i>	<i>Signif</i>
Constant	0.197	0.196	1.003	0.322
TRF{1}	0.420	0.127	3.299	0.002
REXR	-0.001	0.000	-2.332	0.025
GDPi	0.001	0.001	1.174	0.248
TRFPC	0.649	0.608	1.067	0.293
DUMPC2	-0.593	0.366	-1.621	0.114
DUMPC3	-0.531	0.369	-1.439	0.159
DUMPC4	-0.857	0.372	-2.306	0.027
DUMPC5	-0.807	0.413	-1.951	0.059
DUMPC6	0.401	0.279	1.436	0.160
DUMPC7	0.476	0.241	1.976	0.056
DUMPC8	-0.799	0.395	-2.020	0.051

$R^2 = 0.96$

$\bar{R}^2 = 0.55$

pre- and post-agreement periods, we divided our sample up into two groups according to whether they belong to the CFA currency zone or have their own currency. In the African context, this amounts to a test of whether tariffs in French-speaking countries are generally different from those in English-speaking countries. The variable used to perform this test is CFADUM, which is 1 for countries in the CFA zone and zero otherwise. We present the results in Table 18.

In the pre-agreement period, the variable CFADUM has a coefficient of -0.05 and a t-statistics of -2.24, indicating that on average, tariff rates in French-speaking

Table 17. The fixed effects model with the exclusion of the constant and the GDP.

<i>Depd. Var: TRF</i>				
<i>Variable</i>	<i>Coeff</i>	<i>Std Error</i>	<i>T-Stat</i>	<i>Signif</i>
TRF{1}	0.494	0.113	4.361	0.000
REXR	-0.0005	0.0003	-1.709	0.096
TRFPC	1.234	0.477	2.589	0.014
DUMPC2	-0.473	0.366	-1.293	0.204
DUMPC3	-0.110	0.319	-0.344	0.733
DUMPC4	-0.486	0.335	-1.452	0.155
DUMPC5	-0.332	0.357	-0.930	0.358
DUMPC6	-0.004	0.197	-0.020	0.984
DUMPC7	0.184	0.196	0.937	0.355
DUMPC8	-0.697	0.373	-1.866	0.070

$R^2 = 0.96$

$\bar{R}^2 = 0.52$

countries are lower than the rates in English-speaking countries, in the pre-reform period. This finding is supported by our stylized facts. For instance, the World Bank reports that in the pre-agreement period the average tariff rate was 26% in Cote d'Ivoire, and 25% in Mali (both French-speaking), whereas in the English-speaking countries of Ghana, Kenya, Nigeria and Tanzania, average tariffs stood at 30%, 30%, 35%, and 30%, respectively (Dean, Desai and Riedel, 1994). However, in the post-reform period, Table 18 indicates that with a coefficient of -0.0039 and a t-statistics of 0.90, we cannot reject the null hypothesis that the coefficient on CFADUM is zero.

Table 18. The tariff model with currency zone differentiation

<i>Depd Var.: TRF</i>								
<i>Model in Pre-agreemt Period</i>					<i>Model in Post-agreemt Period</i>			
<i>Variable</i>	<i>Coeff</i>	<i>Std Error</i>	<i>T-Stat</i>	<i>Signif</i>	<i>Coeff</i>	<i>Std Error</i>	<i>T-Stat</i>	<i>Signif</i>
Constant	0.037	0.068	0.539	0.592	0.210	0.105	1.991	0.053
TRF{1}	0.835	0.073	11.501	0.000	0.580	0.104	5.589	0.000
REXR	0.0004	0.001	0.717	0.477	-0.0002	0.0002	-1.141	0.260
GDP1	0.0001	0.0002	0.641	0.525	-0.0003	0.0005	-0.704	0.485
CFADUM	-0.052	0.023	-2.236	0.030	-0.004	0.030	-0.132	0.896
$R^2 = 0.96$					$R^2 = 0.95$			
$\bar{R}^2 = 0.79$					$\bar{R}^2 = 0.50$			

This means that statistically, we cannot maintain the hypothesis that membership in the CFA zone makes an important difference in tariff policy in the post-reform period.

This is not a surprising result since the agreements signed by countries during the early phase of structural adjustment programs contain more or less the same requirements.

In the next section, we propose a methodology, based on the bootstrap approach, to test for the effect of pre-commitment tariff announcements on government policy.

3.4.2.4 Testing for Pre-commitment Policies

This test is based on the hypothesis that if policy announcements were adhered to, then we would predict that the government is less likely to alter its tariff policy in response to exogenous shocks in the post-announcement period than in the pre-

announcement period. More specifically, the null hypothesis is that under pre-commitment, the absolute value of the response coefficient in the post-agreement period must be no larger than the absolute value of the response coefficient in the pre-agreement period. The necessity of using absolute values in our calculation presented us with difficulties in applying the usual asymptotic assumptions made in normal hypothesis testing. We therefore opted to use the bootstrap method to test our hypothesis for the cases of the real exchange rate and the GDP. Below is a sketch of the bootstrap technique utilized.

3.4.2.5 The Bootstrap Technique

Assume a general model of the form:

$$Y_t = \beta_0 + \beta_1 X_t + \varepsilon_t \quad (60)$$

where, Y_t is the dependent variable, X_t is the exogenous variable, and ε_t is the vector of residuals which may exhibit autocorrelation. The first part of the procedure is to fit model (60) saving the regression coefficients, the autocorrelation function (ACF) and the residuals. Using these results we construct a vector of residuals as:

$$\hat{\varepsilon}_t = Y_t - \hat{Y}_t, \text{ where}^{18}, \hat{Y}_t = \hat{\beta}_0 + \hat{\beta}_1 X_t + \hat{\rho}_j \varepsilon_{t-j} \quad (61)$$

18 The correlation coefficient $\hat{\rho}_j$ is calculated as: $\hat{\rho}_j = \frac{\sum_{t=j+1}^n \varepsilon_t \varepsilon_{t-j}}{\sum_{t=1}^n \varepsilon_t^2}$ for $j=1 \dots P$, where P is the

maximum lag order, and n =sample size.

The second step is to draw, *with replacement*, a random sample (of size n) of residuals, called ε^* , from the $\hat{\varepsilon}$ series. Armed with ε^* , the regression coefficients, and the model from above, we then generate a bootstrap data, called Y^* as:

$$Y_t^* = \hat{Y}_t + \varepsilon_t^* + \hat{\rho}_1 \varepsilon_{t-1}^* \quad (62)$$

The third step is to use Y_t^* from (62) to fit our original model, obtaining the bootstrap coefficients, say β^* . We repeated steps two and three 2000 times. Moreover, we applied the same methodology to both of our subsamples: the pre-announcement sample and the post-announcement sample. And, for each run we calculate a parameter Δ^* as: $\Delta^* = |\beta_2^*| - |\beta_1^*|$ where, β_2^* is the estimated bootstrap coefficient from the post-announcement sample, and β_1^* is the estimated bootstrap coefficient from the pre-announcement sample. The histogram of Δ^* will be used for the hypothesis testing in the next section.

3.4.2.6 Testing the Null Hypothesis Based on the Percentile Interval

The theoretical prediction is that, under pre-commitment, the response of the government policy to exogenous variations in economic conditions should be smaller in the post-announcement period than in the pre-announcement period. The null hypothesis to be tested then is:

$$H_0: |\beta_2^*| \leq |\beta_1^*|, \text{ or equivalently, } H_0: \Delta^* = |\beta_2^*| - |\beta_1^*| \leq 0 \quad (63)$$

And, the alternative hypothesis is: $H_2: \Delta^* > 0$. (64)

To test the null hypothesis, we used the percentile approach to confidence interval calculation as proposed by Efron and Tibshirani (1993). The procedure consists of the following. Given a selected significance level α , the $100*(1-\alpha)\%$ confidence interval for the bootstrap parameter Δ^* (calculated from some finite number B of bootstrap replications) is found by determining the lower bound of the interval, say $\Delta_B^{*(\alpha)}$, as the $100*\alpha$ th empirical percentile of the Δ_b^* ($b=1\dots B$) values, and the upper bound of the interval, say $\Delta_B^{*(1-\alpha)}$, as $100*(1-\alpha)$ th empirical percentile of the Δ_b^* values. Thus, with 2000 replications, and $\alpha=0.05$, the lower bound of the 95% confidence interval is the 100th [(2000*0.05)th] ordered value of the replications, and the upper bound of the interval is the 1900th ordered value of the replications. For our purpose, we are only interested in the lower bound of the 95% confidence interval. Indeed, if the lower bound, $\Delta_B^{*(\alpha)}>0$, meaning that the 95% confidence interval is to the right of zero, then we would reject the null hypothesis. Otherwise, we cannot reject the null hypothesis. Next, we present the test results. Table 19 shows different statistics on 2000 replications of our bootstrap statistics.

We applied the bootstrap procedure to the fixed effects model using both the pre-announcement and post-announcement samples. The two exogenous economic variables in the model are the real exchange rate and the GDP. The variable DEXR is the calculated Δ^* for the real exchange rate, and DGDP is the calculated Δ^* for the GDP. In Figures 42-43 we plot the histograms of DEXR and DGDP.

We are now ready to test the null hypothesis. Following the procedure outlined above, we find the 5%th empirical percentile of the DEXR values to be -0.00710, and the 5%th empirical percentile of the DGDP values is -0.00860. Thus, the lower bound

Table 19. Statistics for 2000 bootstrap replications of DEXR and DGDP

<i>NAME</i>	<i>N</i>	<i>MEAN</i>	<i>ST. DEV</i>	<i>VARIANCE</i>	<i>MINIMUM</i>	<i>MAXIMUM</i>	<i>COEF.OF.VARIATION</i>
DEXR	2000	-0.0048337	0.0053781	0.0000289	-0.040364	0.0062451	-1.1126
DGDP	2000	-0.0029451	0.0040343	0.0000162	-0.016119	0.012741	-1.3699

value of the 95% confidence interval for both the DEXR and DGDP is less than zero, and we fail to reject the null hypothesis in each case.

The above test results constitute rigorous evidence that the tariff and exchange rate reforms contained in the agreements signed by African governments were (at least partially) adhered to in the period following the announcement. Note that, of the two variables tested, the exchange rate is the more interesting case. It is not directly related to tariffs, but it enters into the expectations formation of agents. Thus, it is important for governments to follow the exchange rate policies that they have announced. However, the GDP is partially determined by the tariff policy itself in African countries, and thus, does not constitute an external (to the economy or to government instruments) economic factor to which government policies must respond.

Our next task is to test whether the models that we have used in our analysis are well specified. First, we test the tariff model. Later, we present the test results for the trade model.

3.4.2.7 Tests of Specification of the Tariff Model: the Hausman Approach

In this section we test for the validity of our model specification. As should be clear from our discussion on panel data, there are two modeling approaches that we can use in a panel data study: a fixed effect model and an error components or random effect model. The fixed effect model is extensively discussed in section 3.4.2.1. Here we present the alternative modeling approach: the random effect model. The model is: $y_{it} = \alpha + \beta' x_{it} + \xi_{it}$, where, ξ_{it} consists of three components (this is why the random effect model is also called the error component model): a variable η_i which reflects individual differences, a variable λ_t representing time specific differences, and a variable ε_{it} reflecting factors affecting both individual units and time periods. Thus, ξ_{it} can be modeled as: $\xi_{it} = \eta_i + \lambda_t + \varepsilon_{it}$. The specification test becomes important when one considers the assumptions being made in these two approaches.

The random effect model assumes that there is no correlation between the individual effects and the other regressors in the model; the fixed effect model assumes the opposite. We believe that due their geographical proximity, and the regional political, economic and cultural alliances¹⁹ that exist between African countries, the

19. Examples include: the OAU, the ECOWAS, EAC, the ADB. See Mazzeo (1984).

HISTOGRAM - DEXR

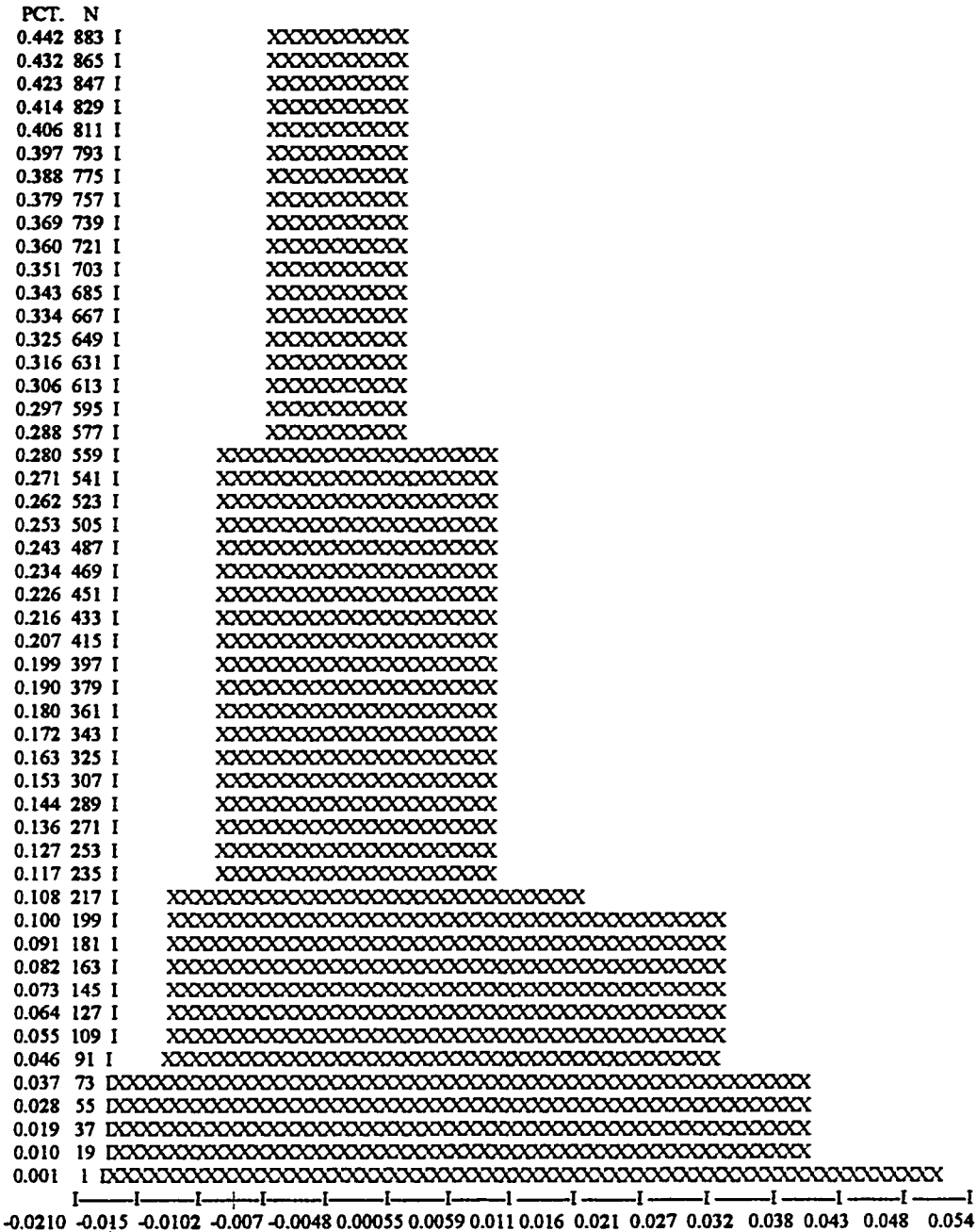


Figure 42. Histogram of 2000 bootstrap replications of the difference in the absolute value of the real exchange rate coefficients from the pre- and post-announcement periods.

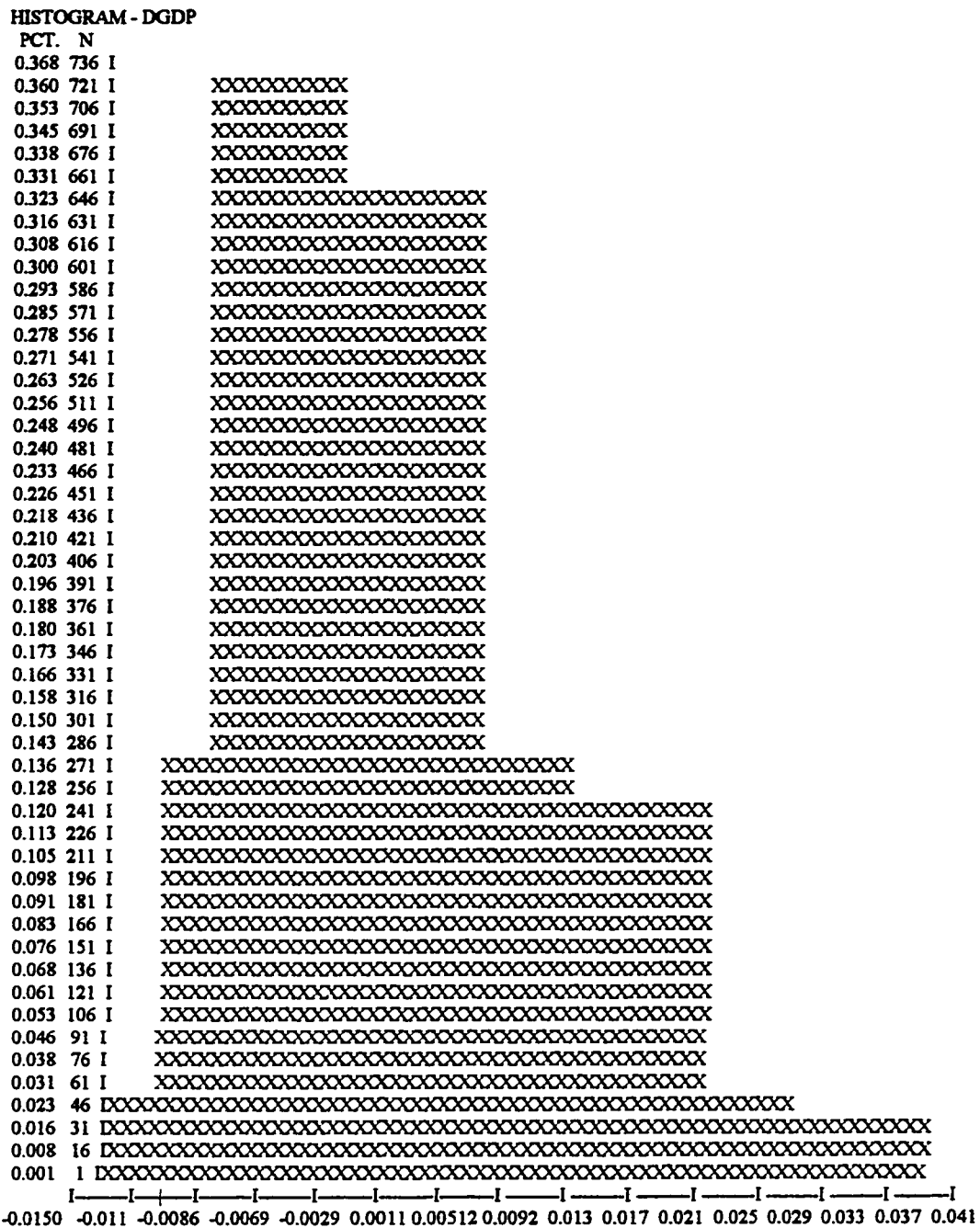


Figure 43. Histogram of 2000 bootstrap replications of the difference in the absolute value of the GDP coefficients from the pre- and post-announcement periods.

fixed effects model is the more appropriate approach.

To test for the orthogonality assumption made in the random effect model, Hausman (1978) devised a test based on the difference in the coefficient vectors of the two models and the estimated covariance matrices. Assume that the error components (random effect) model is the true model. Then the coefficients of the fixed effects would be inefficient. Let $\hat{\beta}_1$ be the less efficient (fixed effect) estimator, and $\hat{\beta}_2$ be the random effect estimator (where both estimators are single coefficients.) According to Hausman, if we assume that the random effect model is the true model, then the difference $\hat{\beta}_1 - \hat{\beta}_2$ should be close to zero. The test statistic (based on the Wald criterion) is calculated as:

$$W = \frac{(\hat{\beta}_1 - \hat{\beta}_2)^2}{\text{var}[\hat{\beta}_1 - \hat{\beta}_2]} \quad (65)$$

The covariance matrix in the denominator is found as:

$$\text{var}(\hat{\beta}_1 - \hat{\beta}_2) = \text{var}(\hat{\beta}_1) + \text{var}(\hat{\beta}_2) + 2\text{Cov}(\hat{\beta}_1, \hat{\beta}_2) \quad (66)$$

This is a difficult matrix to compute, but according to Hausman “the covariance of an efficient estimator with its difference from an inefficient estimator, is zero” (Greene, p 479). Thus, the above matrix can be approximated as:

$$\text{var}(\hat{\beta}_1 - \hat{\beta}_2) = \text{var}(\hat{\beta}_1) + \text{var}(\hat{\beta}_2) \quad (67)$$

and the test statistic is then found as:

$$W = \frac{(\hat{\beta}_1 - \hat{\beta}_2)^2}{\text{var}[\hat{\beta}_1] + \text{var}[\hat{\beta}_2]} \sim \chi^2_{(k)} \quad (68)$$

where k represents appropriate degrees of freedom.

Applying this test to the tariff model, with the null hypothesis that the random effects model is the true model, our calculated W -statistic is: 13.002, with significance level equal to 0.0046. Therefore, we reject, even at the 1% level, the null hypothesis that individual effects are uncorrelated with other regressors, and maintain the fixed effect model as the more appropriate one for our study.

3.4.2.8 Partial Conclusion on Tariff Policy in Africa

With respect to tariff policy in African countries, the first part of this research produced results indicating that in general, there occurred a structural shift in tariff policy making in the eight African countries that we selected. Furthermore, we discovered that incorporating the pre-commitment tariff variables into the tariff equation had a statistically significant impact on tariff policy in Africa. Later, we conduct more detailed study to capture differences across countries. Using this fixed effects approach in panel data modeling, we were able to determine, distinctly what the policy effects of adjustment programs were in each country. We found out for example, that Ghana, Tanzania, Nigeria, Cote d'Ivoire and Kenya, tended to follow the tariff policy requirements of the adjustment programs, with the strongest effects occurring in Ghana, Nigeria and Tanzania. Further, we discovered that there were significant reversals in Senegal, and Malawi, and late implementation in Mali. In

addition, our results indicate that there exists a significant difference in reform policies according to the country grouping based on colonial legacy. Incidentally, using the real exchange rate, our results confirm that the real devaluation of nations' currencies, which was a major part of the adjustment programs in Africa, did in fact take place. Our results are confirmed by the stylized facts reported on each country. We now turn to the study of trade flows using the fixed effects model.

3.4.3. The Fixed Effects Trade Model

The second part of our inquiry is to determine private reactions to changes in nations' tariff policies. Once again, to account for differences in the sizes of economies, we used indices (the base year is 1985) of the following variables: the trade flows (TRDFLI), foreign exchange reserves (FREXCI), GDP (GDPI), and the money supply (MSI). In addition, here we used the real exchange rate instead of the nominal exchange rate, and we included the terms of trade to determine how trade flows respond to this variable. Similar to the estimation in Tables 9 and 11, we first present the full model Table 20, then Table 21 will report the selected model.

The results of this first estimation indicate that with an \bar{R}^2 of 0.64, and several insignificant variables, the model could be improved upon. After several trials, the best fixed effects trade model that we selected to predict trade flows is reported in Table 21.

With the exclusion of insignificant variables, we did not observe a significant change in the R^2 which had a slight drop from 0.97 to 0.96. In contrast there was a

significant increase in the \bar{R}^2 which increased from 0.64 to 0.88 indicating an improvement in the model. The model regresses the trade flows on a constant, the lag of trade flows, the one-period lag of inflation, and the foreign exchange reserves plus country dummy variables.²⁰ All economic variables have the expected signs. Trade flows are negatively related to inflation instability, but respond positively to the level of available foreign exchange reserves, and their one-period lag. All economic variables are significant at least at the 10% level. Two variables, the lagged trade flows and inflation are significant at the 5% level. In addition, we note that while all countries' trade sector seemed to have performed worse than the Ghanaian trade sector, the differences are not significant, except in Cote d'Ivoire.

As before, we test the trade model in the post-agreement period. First, we run the model with the country dummies only, then we test the model with interaction terms between country dummies and the precommitment tariff. The results of this estimation are reported in Table 22.

The results show that the trade sectors in Tanzania and Nigeria performed significantly worse than the Ghanaian sector in the post-agreement period, although the significance of the Tanzanian dummy is only 10%. When, the interaction terms are included, Nigeria becomes the only country whose trade sector performs statistically significantly worse than the Ghanaian trade sector.

20. Note that the terms of trade did not significantly affect the trade flows in our study.

As we did for the case of the tariff model, we test whether location in the CFA currency zone is a significant predictor of trade flows in African nations. Table 23 shows, that the coefficient of CFADUM is negative in both periods, however, we fail to reject the hypothesis that this variable is zero in both periods. We would infer from the results in Table 23 that (CFA) currency zone location is not a statistically important predictor of private trade decisions in African nations. This result lends support to the expectation that, regardless of their respective countries, private agents,

**Table 20. The full fixed effects trade model
in the pre-agreement period**

<i>Depd Var: TRDFLI</i>				
<i>Variable</i>	<i>Coeff</i>	<i>Std Error</i>	<i>T-Stat</i>	<i>Signif</i>
Constant	57.106	39.621	1.441	0.156
TRDFLI{1}	0.551	0.129	4.254	0.000
CPIC{1}	-0.575	0.177	-3.244	0.002
TOTRD	-0.033	0.197	-0.169	0.867
FREXCI	0.002	0.003	0.629	0.533
REXR	0.120	0.165	0.727	0.471
GDPI	-0.203	0.178	-1.140	0.260
MSI	0.270	0.148	1.825	0.075
EXDTG	-0.358	12.010	-0.030	0.976
DUMMY(2)	-17.589	25.159	-0.699	0.488
DUMMY(3)	-26.006	22.152	-1.174	0.247
DUMMY(4)	-22.867	22.239	-1.028	0.309
DUMMY(5)	-24.896	23.135	-1.076	0.288
DUMMY(6)	-18.247	18.514	-0.986	0.330
DUMMY(7)	-0.375	35.120	-0.011	0.992
DUMMY(8)	-27.622	21.627	-1.277	0.208

$$\bar{R}^2 = 0.97$$

$$\bar{R}^2 = 0.64$$

**Table 21. The selected fixed effects trade model
in the pre-agreement period.**

<i>Depd. Var: TRDFLI</i>				
<i>Variable</i>	<i>Coeff</i>	<i>Std Error</i>	<i>T-Stat</i>	<i>Signif</i>
Constant	14.802	4.939	2.997	0.003
TRDFLI{1}	0.950	0.034	28.221	0.000
CPIC{1}	-0.203	0.088	-2.311	0.022
FREXCI	0.004	0.002	1.919	0.057
DUMMY(2)	-6.079	5.410	-1.124	0.263
DUMMY(3)	-12.456	6.133	-2.031	0.044
DUMMY(4)	-4.913	5.635	-0.872	0.385
DUMMY(5)	-11.147	8.793	-1.268	0.207
DUMMY(6)	-4.116	5.302	-0.776	0.439
DUMMY(7)	-6.164	5.141	-1.199	0.233
DUMMY(8)	-6.163	5.669	-1.087	0.279

$$R^2 = 0.96$$

$$\bar{R}^2 = 0.88$$

Table 22. The Fixed Effects Trade Model in the Post-agreement Period with and without interaction terms

<i>Depd. Var: TRDFLI</i>					<i>Dpd. Var.: TRDFLI</i>				
<i>Variable</i>	<i>Coeff</i>	<i>Std Error</i>	<i>T-Stat</i>	<i>Signif</i>	<i>Variable</i>	<i>Coeff</i>	<i>Std Error</i>	<i>T-Stat</i>	<i>Signif</i>
Constant	61.873	25.085	2.467	0.018	Constant	56.90	25.06	2.27	0.03
TRDFLI{1}	0.595	0.160	3.726	0.001	TRDFLI{1}	0.62	0.16	3.87	0.00
CPIC{1}	0.115	0.310	0.370	0.713	CPIC{1}	0.13	0.32	0.41	0.68
FREXCI	0.014	0.009	1.485	0.146	FREXCI	0.01	0.01	1.43	0.16
DUMMY(2)	-11.834	13.134	-0.901	0.373	DUMPC2	-29.39	42.22	-0.70	0.49
DUMMY(3)	-21.806	14.847	-1.469	0.150	DUMPC3	-87.52	68.84	-1.27	0.21
DUMMY(4)	-6.846	16.085	-0.426	0.673	DUMPC4	-17.69	65.09	-0.27	0.79
DUMMY(5)	3.514	12.404	0.283	0.779	DUMPC5	25.32	56.54	0.45	0.66
DUMMY(6)	-24.693	13.946	-1.771	0.085	DUMPC6	-75.42	48.33	-1.56	0.13
DUMMY(7)	-39.216	16.683	-2.351	0.024	DUMPC7	-156.45	72.28	-2.16	0.04
DUMMY(8)	-14.797	14.756	-1.003	0.322	DUMPC8	-32.49	40.13	-0.81	0.42
					TRFPC	198.63	175.85	1.12	0.266

$$R^2 = 0.97$$

$$R^2 = 0.97$$

$$\bar{R}^2 = 0.69$$

$$\bar{R}^2 = 0.68$$

faced with the same circumstances (we forced the model to be the same for all countries in our study), will tend to make decision based on the same rational considerations. Thus, we would not expect differences in private behavior for agents facing the same set of variables.

To determine whether there has occurred an increase in trade between the two periods, we estimate the pooled model with a time dummy variable called TIMEDUM included. This variable takes on the value of 1 for the period 1986-1991, and zero otherwise. The results of this model are reported in Table 24. The variable TIMEDUM is important because it helps to test the following hypothesis. Trade reforms (tariff reductions and elimination or reduction of non-tariff trade barriers), when credible, are

Table 23. Testing the Effect of CFA Zone Location in both Pre- and Post Agreement Periods

<i>Depd. Var: TRDFLI</i>					<i>Depd. Var.: TRDFLI</i>				
<i>Testing the Effect of CFA Zone Location in Pre-agreement Period</i>					<i>Testing the Effect of CFA Zone Location in Post-agreement Period</i>				
<i>Variable</i>	<i>Coeff</i>	<i>Std Error</i>	<i>T-Stat</i>	<i>Signif</i>	<i>Variable</i>	<i>Coeff</i>	<i>Std Error</i>	<i>T-Stat</i>	<i>Signif</i>
Constant	9.373	2.738	3.424	0.001	Constant	13.68	14.21	0.96	0.34
TRDFLI{1}	0.950	0.033	29.005	0.000	TRDFLI{1}	0.92	0.11	8.39	0.00
CPIC{1}	-0.149	0.078	-1.922	0.057	CPIC{1}	0.08	0.28	0.28	0.78
FREXCI	0.002	0.002	1.343	0.181	FREXCI	0.01	0.01	1.27	0.21
CFADUM	-2.253	2.906	-0.775	0.440	CFADUM	-3.17	8.37	-0.38	0.71
$R^2 = 0.96$					$R^2 = 0.97$				
$R^2 = 0.87$					$R^2 = 0.66$				

Table 24. Testing for Inter-period Differences in the Volume of Trade

<i>Depd. Var.: TRDFLI</i>				
<i>Variable</i>	<i>Coeff</i>	<i>Std Error</i>	<i>T-Stat</i>	<i>Signif</i>
Constant	15.984	4.884	3.273	0.001
TRDFLI{1}	0.925	0.032	28.707	0.000
CPIC{1}	-0.154	0.083	-1.853	0.066
FREXCI	0.004	0.002	2.221	0.028
DUMMY(2)	-6.554	5.081	-1.290	0.199
DUMMY(3)	-13.475	5.600	-2.406	0.017
DUMMY(4)	-4.324	5.343	-0.809	0.419
DUMMY(5)	1.101	6.543	0.168	0.867
DUMMY(6)	-4.408	4.879	-0.904	0.367
DUMMY(7)	-7.916	4.873	-1.624	0.106
DUMMY(8)	-7.454	5.342	-1.395	0.165
TIMEDUM	6.287	3.124	2.012	0.046

$$R^2 = 0.97$$

$$R^2 = 0.87$$

supposed to spur the volume of trade in the periods following the announcement of the reforms, i.e., the trade sector of a country that is engaged credible trade reforms would be predicted to become more open. If this hypothesis holds, then the time dummy should be positive and statistically significantly different from zero. Indeed, as Table 24 shows, we can reject the hypothesis that TIMEDUM is equal to zero at the 5% significance level. Thus, it appears that overall, for the time periods and countries under study, private agents responded positively to reforms in African countries. We now present the results of the specification test for the trade model.

3.4.3.1 Specification Test for the Trade Model

The same Hausman specification test that we utilized in the case of the tariff model was applied to the trade model. The issue once again, is to determine whether our specification of a fixed effects model for trade in Africa was valid in the context of our panel data approach as opposed to a random effects model. The same W-statistic that we derived above applies here. Our calculated W-statistic is 9.605, with significance level equal 0.022. Thus, we can, based on strong statistical evidence (2.5% significance level), reject the null hypothesis that trade flows in this study should be modeled as a random effects model. Put differently, we reject the hypothesis that there exists no correlation between country specific effects and other regressors in the trade model. As we have explained before, this results is well expected in the context of Africa due to the many trade and other economic ties that exist among the countries in the different regions of the continent.

4. CONCLUSION AND SUGGESTIONS FOR FURTHER RESEARCH

Overall, from an econometric standpoint, we have found the following results: the best models that we can use to predict both government tariff setting policy and private agents' behavior in African countries in the pre-adjustment period, fail to hold in the post-adjustment period. Holding everything else constant, the main difference (of interest to this study) between the two periods is the policy commitments made by governments as part of their international agreements. Our results indicate that, with respect to tariff policy, African governments, in general, respected their commitments. Further, private agents appear to have found the international agreements to be credible, and seemed to have modified their production and trade decisions to include tariff policy as an element of their planning. We could therefore state that the Structural Adjustment Programs, with regard to their provision for tariff reduction, served their purpose as a precommitment mechanism in African countries.

The "real world" applications of these results must be conducted with care. First, structural adjustment programs became prevalent only in the 1980s, and with our data available only up to 1991, we did not have a long period to study the effects of policy changes in Africa. We remedied this problem somewhat by adopting a panel data approach in our study. Further, our data on tariffs, for the most part, were calculated by us, from data on tariff revenues in African countries. And, in the absence of a tariff reduction schedule for the pre-commitment tariff, we assumed that from a base year, tariffs would be reduced in equal proportion up to their new level agreed to

by governments. Thus, one area of possible improvement on this study is to obtain better data on tariff policy and policy changes in Africa.

Another area of improvement regards broadening the scope of this study to include countries from other regions, and to countries which did not sign agreements to determine how those countries performed during the same time period we considered, and compare the results to the ones obtained in this study. This is difficult to apply in the African context, because virtually every country in Africa has undertaken some type of structural adjustment program. Indeed, a 1992 World Bank report indicates that during the 1980-89 period, there were only eight African countries (out of fifty one) which did not receive adjustment loans. Those countries include: Algeria, Benin, Botswana, Cameroon, Egypt, Ethiopia, Liberia, and Rwanda. However, Benin, Botswana, Cameroon, and Egypt have since joined the group of adjusting countries. Algeria, Ethiopia, Liberia, and Rwanda are either in the midst of civil strife, or have been ravaged by one so that it is not possible to obtain meaningful data from those countries.

With respect to our theoretical presentation, further areas of interest include studying the effects of the introduction of real uncertainty into the model, and the investigation of other kinds of pre-commitment mechanisms, especially as they relate to the political economy of countries.

Finally, ours was not a study of the welfare effects or the failure or success of structural adjustment programs in Africa. Many studies, including several World

Bank's own assessments have found adjustment policies to have mixed results in Africa (e.g., World Bank, 1989). And, in a recent article in the magazine, *The Economist*, Jeffrey Sachs pronounced the Bretton Woods institutions' policies in Africa to be a failure, although salvageable (*The Economist*, June 1995). But, the questions posed in our thesis are much narrower than the success and failure of adjustment programs in Africa. We sought to find out whether international agreements, and more specifically, the provisions for tariff policy changes in those agreements, could serve as a pre-commitment mechanism in the relationship between the private sector and the government in African countries.

The statistical evidence suggests that in the presence of an international "arbiter" the private sector seems to hold some credibility towards the government in Africa. However, the stylized evidence shows that it is difficult for governments to implement reforms which may change the status quo for sectors which hold powerful political influence in the concerned country. Nevertheless, based on our theoretical discussion, and our empirical results, we recommend that, for those African governments which are concerned about their relationships with the private sector, an adoption of some kind of mechanism (international agreements, constitutional laws, etc....) that would irrevocably commit governments to their policy announcements could serve to raise the private sector's confidence in government policies. However, any such mechanism must have its foundation in the political, social and cultural realities of each country.

APPENDIX A. PROOF OF $\frac{\partial Q_x}{\partial \tau} < 0$

Consider the utility function (3):

$$U = U(C_m; G) \quad (\text{A.1})$$

where;

$$C_m = g(Q_x; E) = Q_m + Q_x(1 - \tau)P^w \quad (\text{A.2})$$

and,

$$G = \sum_1^H \tau P^w Q_x^h = H\tau P^w Q_x \quad (\text{A.3})$$

Then, under pre-commitment, the first order condition to the maximization of (A.1)

subject to (A.2) and (A.3) is:

$$\frac{\partial U}{\partial Q_x} = U_1 [g'(Q_x; E) + (1 - \tau)P^w] + U_G P^w \tau = 0 \quad (\text{A.4})$$

Total differentiation of (A.4) gives rise to:

$$(U_1 g') dQ_x + P^w (U_G - U_1) d\tau + \tau P^w [A dC_m + B dG] = 0 \quad (\text{A.5})$$

where,

$$dC_m = \left[-\tau P^w \frac{U_G}{U_1} dQ_x - P^w Q_x d\tau \right] \quad (\text{A.6})$$

$$dG = [H\tau P^w dQ_x + HP^w Q_x d\tau] \quad (\text{A.7})$$

$$A \equiv U_{G1} - \frac{U_G}{U_1} U_{11} > 0, \text{ if } G \text{ is a normal good} \quad (\text{A.8})$$

and,

$$B \equiv \left[U_{GG} - \frac{U_G}{U_I} U_{IG} \right] < 0, \text{ if } C_m \text{ is a normal good.} \quad (\text{A.9})$$

Using (A.5)-(A.9) we obtain:

$$\begin{aligned} & \left[U_I \dot{g} + (\tau P^*)^2 \left\{ -A \frac{U_G}{U_I} + HB \right\} \right] dQ_x \\ & = \left[P^* (-U_G + U_I) + \tau (P^*)^2 \{ A Q_x - BH Q_x \} \right] d\tau \end{aligned} \quad (\text{A.10})$$

Define:

$$Z \equiv \left[U_I \dot{g} + (\tau P^*)^2 \left\{ -A \frac{U_G}{U_I} + HB \right\} \right] \quad (\text{A.11})$$

Under our assumptions, (including normality), we have $Z < 0$.

Thus,

$$\frac{dQ_x}{d\tau} = \frac{\left[P^* (U_I - U_G) + \tau (P^*)^2 Q_x (A - BH) \right]}{Z} \quad (\text{A.12})$$

Now, define $Q_\tau \equiv \frac{dQ_x}{d\tau}$. Then we make use of the first order conditions for the

government welfare maximization in equation (23) and obtain:

$$HU_G - U_I + P^* U_G (H-1) Q_\tau \frac{\tau}{Q} = 0 \quad (\text{A.13})$$

which implies that,

$$U_I - U_G = (H-1) \left[U_G + P^* U_G Q_\tau \frac{\tau}{Q} \right] \quad (\text{A.14})$$

Substituting (A.14) into (A.12) we obtain:

$$Q_r = \frac{[P^w(H-1)U_G] + [(H-1)(P^w)^2 U_G \frac{\tau}{Q}] + [\tau(P^w)^2(A-BH)]Q_x}{Z} \quad \text{A.15}$$

Define:

$$S \equiv P^w(H-1)U_G + \tau(P^w)^2(A-BH)Q_x \quad \text{(A.16)}$$

and,

$$K \equiv (H-1)(P^w)^2 U_G \frac{\tau}{Q}. \quad \text{(A.17)}$$

Thus, (A.15) can be rewritten as:

$$Q_r = \frac{S + KQ_x}{Z} \quad \text{(A.18)}$$

which implies that:

$$Q_r \left[1 - \frac{K}{Z} \right] = \frac{S}{Z} \quad \text{(A.19)}$$

Finally, we can solve for the variable of interest as:

$$Q_r = \frac{S}{Z - K} \quad \text{(A.20)}$$

Under our assumptions, $K > 0$, $S > 0$ and $Z < 0$. Therefore we obtain the desired result

that: $\frac{dQ_x}{d\tau} < 0$. QED.

APPENDIX B: LIST OF VARIABLES

TRF	Annualized aggregate tariff rate
TRFPC	Precommitment tariff announced
LTRDFL	Log of trade flows (Imports + Exports)
TRDFLI	Index of trade flows (1985 base year)
GVEXPG	Government expenditures, expressed as a ratio of GDP
EXR	Nominal exchange rate
REXR	Real exchange rate
LGDP	Log of GDP
GDPI	Index of GDP (1985 base year)
KCHG	Change in the Capital Stock (Investment) as a ratio of GDP
EXDTG	Total External Debt as a ratio of GDP
CACG	The Current Account Balance, as a ratio of GDP
CPIC	Change in Consumer Price Index
FREXCG	Foreign Exchange Reserves as a ratio of GDP
FREXCI	Index of foreign exchange (1985 base year)
FXKG	Fixed Capital Stock as a ratio of GDP
GVDFG	Government budget deficit as a ratio of GDP
LMS	Log of money supply
MSI	Index of the money supply (1985 base year)
TRFPDPR	Predicted Tariff in pre-agreement period
RESIDSC	Residuals of Tariff Model in pre-agreement period
TRFPDPS	Predicted tariff in post-agreement period
RESIDSH	Residuals of Tariff Model in Post-agreement period
TRFVOLAT	Volatility in tariff series
TRFMAV	Moving average in tariff series
TOTRD	Terms of trade
TIMDUM	Time dummy
CFADUM	CFA zone dummy
DUMPCi	Interaction dummy variable for country i

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