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As of August 1998, financial support towards the ERF Working Papers Series from the Commission of the European Communities (through the FEMISE Program) is gratefully acknowledged. The views expressed in the Working Papers are those of the authors and do not necessarily reflect the views of the European Commission.



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1. Introduction

One thorny problem in public finance analysis is to address issues concerning relationships between fiscal deficits and the external sector. Especially, an unresolved problem in many developing countries is whether fiscal policy affects external balance. How do fiscal disequilibria feed into external deficits? As Rodrigùez (1994) argued, one should expect a strong link between fiscal and current account deficits in financially open economies when consumers are not Ricardian. It is widely recognized that fiscal imbalances played a major role in the overborrowing by developing countries that led to the 1982 debt crisis (see for example, Dornbush, 1985; Sachs, 1989). But, as Rodrigùez (1994) argued, "more systematic evidence linking public deficits with external deficits is still lacking."

The present paper is dealing with this issue. Our starting point is the observation that Morocco, as many other developing countries, accumulated fiscal as well as external deficits during the 1970s and the 1980s. Are these deficits linked in the Moroccan case? If the answer is affirmative, what is the direction of causality between them? What are the public spending variables that affect external deficits? In other words, what is the kind of public absorption that affects external surpluses more substantially? What is the relative contribution of public consumption and investment in driving external imbalances?

If all these main questions are well known among policy makers and the community of economic research, no serious empirical examination has been undertaken to answer them, especially in the particular case of Morocco. The paper deals with this issue, using advanced analytical and empirical approaches. The paper seems to be innovative because of the following reasons:

- we derive relevant mathematical relationships between fiscal policy variables and external surpluses from national accounts identities, using levels as well as ratios to GDP of the dependant and explanatory variables;
- unlike previous studies, we disintegrate public spending and divide them into public consumption and investment to allow for their respective effects on external deficits;
- unlike some previous studies, the research project uses advanced econometric techniques (especially, stationarity tests, cointegration tests, error correction models, causality tests) to estimate linkages between fiscal and external deficits;
- these advanced empirical tools will allow us, not only to determine effects of fiscal policy on external deficits, but also to empirically study the interaction and causality direction between variables.

The remainder of this paper is organized as follows. Section I summarizes and discusses the existing theoretical and empirical literature on linkages between fiscal and external deficits. Section II describes our conceptual framework and presents models to be estimated. Section III concerns the empirical methodology and estimation results. Section IV summarizes preliminary main findings, policy implications and concluding remarks.

2. The Theoretical and Empirical Literature Review

2.1 The Theoretical Framework

On the theoretical level, economists have tried to apprehend why the balance of payments current account surplus changes over time. There are generally three main approaches that deal with this issue, namely fiscal, monetary and elasticities approaches. Although these three approaches are convergent, certain studies focused mainly on the fiscal approach according to which current account surpluses are affected by fiscal deficits.

Theoretically speaking, two fiscal approaches are known to explore links between external and fiscal deficits: the Ricardian explanation and the Keynesian proposition.

The Ricardian equivalence theorem predicts that external and fiscal deficits are not linked. The theorem is based on the idea that fiscal deficits that result from a tax cut have no impact on national savings (see Barro, 1974, 1989). Decreasing public savings due to large fiscal deficits will be matched by an equal increase in private savings. The reason behind this Ricardian equivalence theorem is simple: because consumers expect that a tax cut which results in fiscal deficits will lead to future increases in taxes to serve public debt, they will save money today to pay for the future tax increases.

As Barro (1989) argued, "the Ricardian modification to the standard analysis begins with the observation that, for a given path of government spending, a deficit-financed cut in current taxes leads to higher future taxes that have the same present value as the initial cut." "Therefore, the substitution of a budget deficit for current taxes (or any other rearrangement of the timing of taxes) has no impact on the aggregate demand for goods. In this sense, budget deficits and taxation have equivalent effects on the economy - hence, the term, Ricardian equivalence theorem. To put the equivalence result another way, a decrease in the government's savings (that is, a current budget deficit) leads to an offsetting increase in desired private savings, and hence to no change in desired national savings" (Barro, 1989). Assuming that this idea is true, fiscal deficits will have no effect on anything because they will not change national savings and then, aggregate national saving will not change at all. Therefore, fiscal deficits are expected to have no impact on external surpluses.

The Keynesian proposition against the Ricardian equivalence is a strong one. The Keynesian view claims that there is a positive relationship between the two deficits and that the causality goes from fiscal deficits to external deficits.

This proposition, known as the twin deficits hypothesis, is based on the idea that if the public sector is negatively saving, then aggregate national savings will fall. Falling national savings will lead to increasing interest rates and then, to appreciating exchange rates which will make exports less attractive and imports more attractive. Consequently, fiscal deficits will lead to a deterioration in trade balance and then to a declining current account surplus because the former is a major part of the latter.

2.2 Previous Empirical Studies

In empirical literature, certain economists have recently studied the relationship between trade and fiscal deficits. Mixed empirical results have been provided by recent empirical investigation.

Among recent studies, one can mention those supporting the Ricardian equivalence which claim that fiscal and external deficits are uncorrelated (see for example, Evans (1988), Miller and Russek (1989), Dewald and Ulan (1990), Enders and Lee (1990), and Kim (1995)). By contrast, Darrat (1988), Abell (1990), Zietz and Pemberton (1990), Bauchman (1992), Rosenzweig and Tallman (1993), Bahmani-Oskooee (1992, 1995), Vamvoukas (1999) support the conventional view, that the two deficits are closely linked and that external deficits are caused by fiscal deficits.

Lany (1984), Bernheim (1988), Vamvoukas (1997) and Islam (1998) are rare economists among those who have questioned the validity of the twin deficits proposition in developing countries. For example, Lany (1984) studied empirically the relationship between the two deficits in some developing as well as developed countries and argued that fiscal deficits have stronger effects on external surpluses in developing countries than in the developed world. Bernheim (1988) tested effects of fiscal deficits on external surpluses in Mexico and five OECD countries. He concluded that, except in Japan, the two deficits are closely linked. Using annual data for Greece, Vamvoukas (1997) tested causality relationships between fiscal deficits and current account deficits. His empirical results, using cointegration, error correction models and Granger causality test, showed a unidirectional relationship going from fiscal to current account deficits, justifying the conventional view in the short as well as long run. In the particular case of Brazil, Islam (1998) has estimated the relationship, using Granger causality test. Over the period 1973-1991, his empirical results have shown a bidirectional relationship between the two deficits, contradicting the conventional twin-deficit thesis.

In the particular case of Morocco, our current bibliographical research reveals that no serious empirical analysis has been devoted to estimate effects of fiscal policy on external deficits. For instance, Boussetta (1992, 1995) has used very simplistic graphical observations to show that the twin deficits hypothesis is confirmed in the Moroccan case. In Boussetta's work, nothing may demonstrate that the twin deficits phenomenon exists in the short and long run and that no bidirectional causality exists between the two deficits. Thus, such studies cannot be plausible, and no strong policy implications can be derived from them.

All the mentioned previous studies have some shortcomings. First, they use either trade deficits or current account deficits even though these two variables may be very different in a particular country. Second, they use either the two deficits in levels or in proportions to GDP even though econometric results may differ in the two cases. Third, if the twin deficits hypothesis is confirmed by the empirical study, no further analysis has been devoted to determine the impact of public absorption components – which are major parts of fiscal deficits –on external deficits. Fourth, some of the mentioned studies still use conventional econometric tools which are particularly unable to account for the complexity of relationships between fiscal policy and external sector variables.

In the subsequent sections, we will show how we will contribute to improve the analysis of linkages between fiscal policy and external variables in the particular case of Morocco.

3. The Conceptual Framework: Specification of Relationships

3.1 Specified Relationships between External and Fiscal Deficits

The relationship between fiscal and trade deficits can be derived from the following National Account identity:

$$Sp_t - PI_t = (G_t - R_t) + (X_t - M_t)$$
(1)

where Sp, PI, G, R, X and M refer to private savings, private investment, public expenditures, public revenue, exports and imports respectively.

If Ricardian equivalence doesn't hold, a decrease in public saving leads to a decrease in national savings. This leads to a disequilibrium between *Sp* and *PI*. This imbalance implies that: if $Sp < PI \Rightarrow (G > R) \Rightarrow (X < M)$. Thus, fiscal deficits result from a decline in the capacity of saving devoted to the financing of domestic investment.

To study effects of fiscal variables on external surpluses, one can use the trade surplus or the current account surplus as the relevant dependent variable. Moreover, one can use these variables in levels or as ratios to GDP. Unlike previous studies, we will use all possible alternative measures of the dependent variable: Using the levels of exports of goods and services (X) divided by the levels of imports of goods and services (M) as an approximation of the trade surplus, TS (on goods and services) and the ratio of the level of public expenditures (G) to public revenue (R) as a measure of the overall budget surplus (OBS) as the relevant explanatory variable, we can express the behavior of the trade deficit as follows:

$$\frac{X_t}{M_t} = a_0 \cdot \left(\frac{R_t}{G_t}\right)^{a_1} \cdot \varepsilon_t \tag{2}$$

Taking natural logarithms of the variables, we derive the following linearized model:

$$Log\left(\frac{X_t}{M_t}\right) = \alpha_0 + \alpha_1 Log\left(\frac{R_t}{G_t}\right) + \mu_t$$
(3)

where $\alpha_0 = e^{a_1}$; $\alpha_1 = a_1$, and $\mu_t = \varepsilon_t$

According to the discussed theoretical controversies between Keynesians and Ricardians, the expected sign of *OBS* is ambiguous.

Using trade and fiscal surpluses as ratios to GDP, we propose the following alternative model to estimate the relationship between the two deficits:

$$\frac{TRS_{t}}{GDP_{t}} = a_{0} + a_{1} \cdot \frac{OBS_{t}}{GDP_{t}} + \varepsilon_{t}$$

$$\tag{4}$$

3.2 Specified Relationships between External Deficits and Public Absorption Components

After an appropriate estimation of equation (3), we propose to determine respective effects of public absorption components on the trade deficit. If the parameter α_1 is found to be positive according to the Keynesian view, one can be interested in determining what kind of public absorption is the main determinant of trade deficits: is it public consumption (*PUBC*) or public investment (*PUBI*) or both? This question is very interesting and empirically answering it may determine what is the major public spending component that drives accumulation of trade deficits in the case of Morocco. Many existing previous studies have neglected this very important aspect.

Using the levels of exports of goods and services (X) divided by the levels of imports of goods and services (M) as an approximation of the trade surplus, the following two regressions will be estimated using modern time-series analysis:

$$Log\left(\frac{X_t}{M_t}\right) = a_0 + a_1 . Log\left(PUBC_t\right) + \varepsilon_t$$
(5)
(7)

$$Log\left(\frac{X_t}{M_t}\right) = a'_0 + a'_1 \cdot Log\left(P \cup BI_t\right) + \varepsilon'_t$$
(6)

Using trade and fiscal surpluses as ratios to GDP, the two regressions become:

$$\frac{TRS_t}{GDP_t} = a_0 + a_1 \cdot \frac{PUBC_t}{GDP_t} + \varepsilon_t$$
(7)

$$\frac{TRS_t}{GDP_t} = a_0 + a_1 \cdot \frac{PUBI_t}{GDP_t} + \varepsilon_t$$
(8)

Using balance of payments current account surplus as the relevant dependent variable, equations (4), (7) and (8) may be modified accordingly.

To highlight the importance of this modification, we propose to provide refinements to the National Accounting identity represented by equation (1). Indeed, in equilibrium, aggregate supply equals aggregate demand. More precisely, in equilibrium, the sum of private consumption, private savings, public revenue, imports and paid factor income transfers (*PFI*) must equal the sum of private consumption, private investment, public expenditures, exports and received factor income transfers (*RFI*). Formally, equation (1) becomes:

$$Cp_t + Sp_t + R_t + M_t + PFI_t = Cp_t + Ip_t + G_t + X_t + RFI_t$$
(9)

That is :

$$(Sp_t - Ip_t) + (R_t - G)_t + (M_t - X_t + PFI_t - RFI_t) = 0$$
(10)

where the term $(M_t - X_t + PFI_t - RFI_t)$ in equation (10) is the balance of payments current account surplus (*CAS*).

According to this modification, the behavior of external surplus can be expressed as follows:

$$Log\left(\frac{X_t + RFI_t}{M_t + PFI_t}\right) = \alpha_0 + \alpha_1 \cdot Log\left(\frac{G_t}{R_t}\right) + \mu_t$$
(11)
(?)

When variables are expressed in proportions to GDP, the model becomes:

$$\left(\frac{\left(X_{t} + RFI_{t}\right) - \left(M_{t} + PFI_{t}\right)}{GDP_{t}}\right) = \alpha_{0} + \alpha_{1} \cdot \frac{OBS}{GDP_{t}} + \mu_{t}$$
(12)

Using modern time series analysis (especially unit root tests, cointegration tests, error correction models and Granger causality tests) to estimate linkages between fiscal policy variables and external surpluses will allow us to better understand those linkages, notably to explore empirically the direction of causality between them: in some cases, fiscal surpluses may be results rather than determinants of external surpluses (see for example, the Saudi Arabian case studied by Alkswani, 2000). In other cases, the relationship between the two surpluses may be bidirectional, etc.

4. The Empirical Framework, Data Collection and Estimation Results

4.1 The Methodological Framework

One can be interested in exploring causality between fiscal policy variables and external deficits. The concept of causality, due to Granger (1969), can be used here to test for a long run relationship between the mentioned variables. In what follows, we describe how we will use the Granger causality approach to empirically analyze the relationships between variables, taking equation (4) as an example (the same methodology will be applied to estimate all the derived relationships). According to Granger's causality approach, $\frac{TS_t}{Y_t}$ is caused by $\frac{OBS_t}{Y_t}$ if the first variable is better predicted from past values of the first and second

variables together rather than from past values of the first variable alone. Four patterns of causality can be distinguished: i) unidirectional causality from the second to the first variable; ii) bi-directional causality; iii) no causality. By using the following model, causality between the two variables can be tested:

$$\frac{TRS_t}{GDP_t} = \alpha_0 + \sum_{i=0}^k \alpha_i \left(\frac{OBS_{t-i}}{GDP_{t-i}}\right) + \sum_{j=1}^k \beta_j \left(\frac{TRS_{t-j}}{GDP_{t-j}}\right) + u_t \quad (13)$$

$$\frac{OBS_t}{GDP_t} = \alpha_0 + \sum_{i=1}^k \omega_i \left(\frac{OBS_{t-i}}{GDP_{t-i}} \right) + \sum_{j=0}^k \psi_j \left(\frac{TRS_{t-j}}{GDP_{t-j}} \right) + \upsilon_t \quad (14)$$

The existence of a relationship between the two variables is tested through the null hypothesis that $\alpha_i = 0$ in equation (13) and $\psi_j = 0$ in equation (14) for all *i* and *j*, using standard *F* or Wald tests. If the coefficients α_i are statistically different from zero, then, fiscal deficits cause trade deficits; if the coefficients ψ_j are statistically different from zero, then, fiscal deficits are caused by trade deficits. If both α_i and ψ_j are statistically different from zero, then, there is bi-

directional causality and both variables are related to past effects of other variables.

However, before conducting causality tests, the two variables must be found to be stationary individually or, if not, they should be cointegrated. To test for stationarity, we will use a unit root test developed by Fuller (1976) and Dickey and Fuller (1981). The difference between Dickey-Fuller (DF) and augmented Dickey-Fuller (ADF) tests is that the latter accounts for autocorrelation in residuals if it exists.

If the null hypothesis of a unit root (non-stationarity) is rejected, a time series can be considered as integrated of order zero, i.e. I(0), in levels; if not, the time series is not stationary in levels, but can be stationary in the first difference, etc.

If the two variables are integrated of the same order, I(1) for example, there is a possibility that they will be cointegrated. Then, a cointegration test will be conducted. The original Engle and Granger approach to cointegration can be used here by running equation (6), for example, and seeing if the residuals from that equation are stationary. If the residuals are stationary in levels, differences between the two series ultimately die out and the variables will be thought to exist in a long run balance, i.e. they are cointegrated. An alternative approach to cointegration was developed by Johanson (1988, 1990, 1991). This new approach, based on a Maximum likelihood procedure, is particularly preferable when the number of variables exceeds two, due to the possibility of the existence of multiple cointegration vectors (see below). However, as Gonzalo (1994) argued, the advantage of this approach to cointegration is not only limited to multivariate cases, but it is also preferable to the Engle-Granger approach even in the case of a bivariate model.

The starting point for a Johanson's cointegration test is a VAR of order p involving k endogenous variables (two variables in our case). This VAR can be expressed as follows:

$$y_t = B_1 . y_{t-1} + B_2 . y_{t-2} + ... + B_p . y_{t-p} + k . x_t + \varepsilon_t$$
(15)

where y is the vector of our two endogenous variables, x is a vector of deterministic variables and ε is a vector of innovations.

The VAR can be rewritten as:

$$\Delta y_t = \Gamma . y_{t-1} + \sum_{i=1}^{p-1} \Upsilon_i \Delta y_{t-i} + K . x_t + \varepsilon_t$$
(16)

where
$$\Gamma = \sum_{i=1}^{p} B_i - I$$
 et $\Upsilon = -\sum_{j=i+1}^{p} B_j$

According to Granger's representation theorem, if the coefficient matrix Γ has reduced rank r < k (r < 2 in our case), then there exist $k \ x \ r$ ($2 \ x \ l$ in our case) matrixes α and β each with rank r such that $\Gamma = \alpha . \beta'$ and $\beta' . y_t$ is stationary. r is called the number of cointegrating relations (or the cointegrating rank) and each column β is the cointegration vector. As for elements of α , they are known as adjustment parameters in the error correction model. Johansen's method is to estimate thematrix Γ in an unrestricted form, and then test whether we can reject the restrictions implied by the reduced rank of Γ . More precisely, to determine the number of cointegrating vectors, Johanson (1988, 1990, 1991) and Johanson and Juselius (1990) suggested two statistic tests: the trace and the maximal Eigenvalue tests. In what follows, we describe how we will carry out these two tests taking equation (4) as an example.

The starting point in testing the cointegratedness of the four variables included in the equation is to run ADF unit root tests on each of these variables. If the four variables are not stationary and are integrated of the same order (say I(1)), then we will run Johanson's cointegration test. To determine the number of cointegration vectors, we will run trace and maximal Eigenvalue tests.

The trace test will allow us to test the null hypothesis that the number of distinct cointegarting vectors is less than or equal to k (k = 2 in our example of equation 4), against the general unrestricted alternative (k = r). The trace test is computed according to the following formula:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{p} Log\left(1 - \hat{\lambda}_{i}\right)$$
(17)

where $\hat{\lambda}_{r+1}, \dots, \hat{\lambda}_n$ are the smallest value eigenvectors (p-r). The null hypothesis stated that the number of cointegration vectors equals at most (r). In other words, it states that the cointegrating vectors equals or is less than (r) (where, in our case in equation 4, r = 0, 1, 2).

The maximal Eigenvalue test is computed as follows:

$$\lambda_{\max}(r, r+1) = -TLog\left(1 - \hat{\lambda}_{r+1}\right) \tag{18}$$

Formula (18) permits to test the null hypothesis that there is (r) of cointegrating vectors against the alternative that there is (r+1) cointegrating vectors.

For each Eigenvalue, we will compare the calculated likelihood ratio with the critical value at the 5 percent level of significance. If a calculated likelihood ratio is seen to exceed the critical value at the 5 percent level of significance, it will be possible to reject the null hypothesis that there is no cointegration vector. By contrast, if a calculated likelihood ratio is seen to be less than the critical value at

the 5 percent level of significance, the null hypothesis that there is no cointegration vector will not be rejected.

If the two variables included in equation (4), for example, all have unit roots, there can be from zero to 2 linearly independent, cointegrating relations. If there are no cointegrating relations, a standard Granger causality test will be run using the first differences of the two variables (like in equations 13 and 14). Conversely, if there is one cointegrating equation in the system, we will specify an error correction model. More precisely, if there is cointegration, the long run relationships between two variables, like in equation (4), will be:

$$\frac{TRS_t}{GDP_t} = a_0 + a_1.t + a_2.\frac{OBS_t}{GDP_t} + \varepsilon_t$$
(19)

$$\frac{OBS_t}{GDP_t} = a_0 + a_1 t + a_2 \cdot \frac{TRS_t}{GDP_t} + \mu_t$$
(20)

Thus, the error correction model is represented by the following equations:

$$\Delta \left(\frac{TRS_{t}}{GDP_{t}}\right) = \beta_{0} + \beta_{1}t + \sum_{i=0}^{k} \left(\alpha_{i}\Delta \left(\frac{OBS_{t-i}}{GDP_{t-i}}\right)\right) + \sum_{j=1}^{k} \left(\delta_{j}\Delta \left(\frac{TRS_{t-j}}{GDP_{t-j}}\right)\right) + \lambda_{1}ECT_{t-1} + \eta_{t} \quad (21)$$

$$\Delta \left(\frac{OBS_{t}}{GDP_{t}}\right) = \gamma_{0} + \gamma_{1}t + \sum_{i=1}^{k} \left(\omega_{i}\Delta \left(\frac{OBS_{t-i}}{GDP_{t-i}}\right)\right) + \sum_{j=0}^{k} \psi_{j}\Delta \left(\frac{TRS_{t-j}}{GDP_{t-j}}\right) + \lambda_{2}ECT_{t-1}' + \upsilon_{t} \quad (22)$$

where ECT and ECT' are the error correction terms represented by the residuals of equations (19) and (20) respectively.

If the two series are found to be cointegrated, then Granger causality tests are based on equations (21) and (22). While causality tests were originally formulated for stationary variables, Granger has extended the idea to be used with cointegration models (see Engle and Granger, 1991). Indeed, he argues that there must be at least a unidirectional causality if there is cointegration. Causality analysis with cointegrated variables is more extensive and centers on the speed of adjustment coefficients which are the $\frac{RR_{H}}{dR_{H}}$ in equations (21) and (22).

For applying causality tests using equations (21) and (22), we will follow three steps. First, the null hypotheses that $\alpha_i = \lambda_1 = 0$ and $\omega_j = \lambda_2 = 0$ for all *i* and *j* is tested. If the null hypothesis is accepted, further testing is useless, and there is no causality in any direction. In contrast, if the null hypothesis is rejected, one can be interested in knowing whether the causality is due to short-term stationary variation or to long-run variation. Thus, the second step is to test just the α_i and β_{max} in equations (21) and (22) to see whether the source of causality is short term. The third step is the analysis of the λ_s to see if they infer a long-run equilibrium

relationship. If λ_1 is negative and statistically different from zero, fiscal deficits will be thought to cause trade deficits in the long run; if λ_2 is negative and statistically different from zero, trade deficits will be thought to cause fiscal deficits in the long run. If both coefficients are negative and statistically different from zero, there is a long-run bi-directional relationship between the two deficits.

4.2 Data Collection and Estimation Results

Several sources are available for data. In particular, we have data from the Moroccan National Accounts, World Development Indicators on CD-ROM (World Bank, 1999), International Financial Statistics Yearbook (IMF, various issues). Our data have been collected from *The Statistical Yearbook of Morocco (Annuaire Statistique du Maroc), International Financial Statistics* (IMF, CD-ROM, 1999) and *World Development Indicators* (World Bank, CD-ROM, 1999). The period covered by these data sources generally starts from 1967 to 1997. In what follows, we present and interpret our estimation results.

4.3 Stationarity Test

Table 1 summarizes ADF test results for all variables included in our equations above. The number of lags is chosen so as the *Akaike information criterion* is minimum. In all cases, the t-statistic of the coefficient associated with the lagged - one period - variable is more than the critical value (CV) at 5 percent, suggesting that all variables are non-stationary in level. In first differences, however, all variables are stationary, that is integrated of order 1. Thus, variables can be co-integrated.

Effectively, Engle-Granger and Johanson cointegration tests show that couples of variables are cointegrated, suggesting that there is a long run equilibrium relationship between them. Table 2 summarizes the Engle-Granger cointegration test results and table 3 presents the Johanson cointegration test results. All the test results indicate that all couples of variables are cointegrated as shown by the statistical significance of the coefficient associated with the lagged residual of the cointegration equations (table 2) as well as by the likelihood ratio which always exceeds critical values at 5 percent level of significance (table 3). Moreover, in all cases (table 3), the likelihood ratio exceeds the critical value only in one case in relationship with Eigen values. This suggests that in all cases, the cointegrating vector is unique.

Given theses test results, we specify error correction models where the error correction term is estimated by the lagged residuals of cointegrating equations. In what follows, we present our estimated cointegrating equations as well as error correction models.

4.4 External and Fiscal Deficits in Morocco: Cointegrating Equations and Error Correction Models

As we have argued above, we use fiscal and external sector variables in levels as well as in proportions to GDP. Since all couples of variables are seen to be cointegrated, the relationship between two cointegrated variables is considered as a cointegrating equation, that is a long-run equilibrium relationship. Residuals (lagged one period) from those cointegrating equations are estimates for error correction terms in our error correction models which will determine short and long run causality as well as causality direction between variables. First, we present and interpret our cointegrating equations and error correction models when variables are expressed in levels. Second, we present and interpret our cointegrating and error correction models when variables are expressed in ratios to GDP.

Fiscal and external surpluses: cointegrating equations and error correction models when variables are expressed in levels:

Table 4 presents our estimates for cointegrating equations. Equations (23) and (23.1) in table 4 show that trade and fiscal surpluses exhibit a positive relationship, in conformity with the fiscal approach to trade balance. When the ratio to public expenditure of public revenues decreases by 1 percent, the ratio of Exports to imports of goods and services fall by 1.76 percent. When the ratio to public expenditure of public revenues decreases by 1 percent, the ratio to public expenditure of public revenues decreases by 1 percent, the ratio to public expenditure of public revenues decreases by 1 percent, the ratio to public expenditure of public revenues decreases by 0.47 percent.

Nevertheless, if one relies only on cointegrating equations, results may be misleading. As we argued in previous sections, when variables are cointegrated, Granger causality tests should be conducted on the basis of error correction models. Table 5 presents our estimated error correction models when variables are expressed in levels. Equations (24) and (24.1) in table 5 reveal that there is a positive bidirectional causality between external and fiscal deficits. As shown by the high t-statistic of the coefficients associated with the first differences of Log(R/G) in equation (24) as well as of Log(X/M) in equation (24.1) and the high t-statistic of the coefficient associated with the error correction term, there is a bi-directional short and long run causality between the two deficits. This suggests, contrary to the views of certain economists (see Boussetta, 1992, for example), that trade surplus affects and is affected by fiscal surplus. Trade deficits are affected by fiscal deficits especially through the public sector's demand of imported goods and fiscal surpluses are affected by trade surpluses through decreasing contributions of exporting public (in forms of dividends and taxes on exports) and private (in forms of taxation) enterprises to the government budget. Moreover, restrictions on imports during the greater part of the period which leads to an improvement of the trade surplus may induce a decreasing trade deficit, especially when some consumption and investment goods are to be

imported by the public sector. It is important, however, to note that decreasing imports may also partly deteriorate the fiscal surplus, especially when a substantial part of public revenues comes from taxes on international transactions. Nevertheless, it seems that the net effect of all these factors is to deteriorate the trade surplus.

Fiscal and external surpluses: cointegrating equations and error correction models when variables are expressed in ratios to GDP:

Table 6 presents our estimates for cointegrating equations when fiscal and external variables are expressed in proportion to GDP. Equations (25), (25.1), (26) and (26.1) reveal that the relationship between fiscal and external variables is positive and statistically very significant, suggesting, in contrast to the widespread idea, that external surpluses affect and are affected by fiscal balances, independently of the methodology adopted to measure variables.

When the external surplus is expressed as the *trade surplus* in proportion to GDP and the fiscal surplus is measured by the ratio to GDP of (revenues minus expenditures), a 1 percentage point increase of the ratio to GDP of fiscal deficit would deteriorate the trade balance by 1.29 percentage points of GDP. Trade surpluses in proportion to GDP also still have a positive and statistically significant impact on fiscal surpluses. When the trade surplus rises by 1 percentage points of GDP, the fiscal surplus will improve by 0.67 percentage points of GDP.

When the external surplus is estimated by the current account surplus and the fiscal surplus is approximated by (revenues minus expenditures plus lending minus repayment), in conformity with the IMF's measurement methodology, the fiscal surplus as a ratio to GDP still has a positive and statistically significant effect on the external surplus: when the fiscal deficit increases by 1 percentage point of GDP, the current account surplus deteriorates by a proportion around 1.13 percentage points of GDP. The current account surplus also still has a positive and statistically significant impact on the fiscal surplus: when the current account surplus rises by 1 percentage point of GDP, the fiscal deficit would fall by a proportion around 0.73 percentage points of GDP.

Nevertheless, since couples of variables are seen to be cointegrated, causality tests must be conducted on the basis of error correction models. Table 7 presents our estimated error correction models when variables are expressed in ratios to GDP. Since the coefficients associated with first differences of the explanatory variables and coefficients of error correction terms in equations (27) through (28.1) are all statistically very significant, one can understand that there is a bidirectional causality between external and fiscal surpluses. As shown by the high t-statistics of all the coefficients of explanatory variables, including the error correction terms, there is a bidirectional *short and long run* causality between

external and fiscal surpluses independently of the methodology adopted to measure variables. Effectively, all Wald standard tests allow us to reject the null hypothesis that coefficients on first differences of explanatory variables and on error correction terms are zero, suggesting that there is effectively a positive bidirectional causality between external surpluses and fiscal balances. Moreover, standard Wald tests on the coefficients associated with the first differences of explanatory variables reveal that we can reject the null hypothesis that these coefficients are zero, suggesting that a *short run* causality exists between external surpluses and fiscal balances. Since the coefficients on error correction terms in equations (27) through (28.1) are statistically very significant, it seems also that a long run positive bidirectional causality exists between external surpluses and fiscal balances, independent of the methodology adopted to measure external and fiscal surpluses as ratios to GDP. Therefore, our empirical results contradict those found by other studies, especially those using conventional and simplistic statistical analyses, mainly Boussetta's statistical work (see Boussetta, 1992; 1995), whereby simplistic graphs show only an ambiguous unidirectional causality going from fiscal to external surpluses.

5. Public Absorption Components and External Imbalances: Cointegrating Equations and Error Correction Terms

Since our empirical results reveal that bidirectional positive causality exists between external and fiscal deficits in the particular case of Morocco, it is important to know what kind of public absorption determines external surpluses and how external surpluses affect public absorption components themselves. In spite of the interest of this decomposition, many previous studies have neglected it.

As we have argued above, we use public absorption components and external sector variables in levels as well as in proportions to GDP. Since all couples of variables are seen to be cointegrated, the relationship between two cointegrated variables is considered as a cointegrating equation, that is a long-run equilibrium relationship. Residuals (lagged one period) from those cointegrating equations are estimates for error correction terms in our error correction models. Estimating those error correction models will determine *short and long run causality* as well as *causality direction* between variables. First, we present and interpret our cointegrating equations and error correction models when all variables are expressed in levels. Second, we present and interpret our cointegrating and error correction models when variables are expressed in ratios to GDP.

5.1 Public Absorption Components and External Surpluses : A Modern Time-Series Analysis When Variables are Expressed in Levels

Table 8 presents our estimated cointegrating equations expressing long run equilibrium relationships between public absorption components (public consumption and public investment) and external surpluses when all these

variables are expressed in levels. Equations (29), (29.1), (30) and (30.1) in table 7 reveal, as expected, that there is a negative relationship between public absorption components and external surpluses. Equation (29) in table 8 shows that when nominal public consumption rises by 1 percent, the ratio of exports to imports of goods and services, which is our estimate of the level of trade surplus, would fall by a proportion around 0.90 percent. Equation (29.1) in table 8 shows that external surpluses also have a negative impact on public consumption. When the ratio of exports to imports of goods and services rises by 1 percent, public consumption would fall by 0.85 percent. This impact probably

captures the negative effect of import restrictions on public consumption. During the major part of the period, the government had imposed restrictions on imports forcing public consumption to fall.

The same holds for public investment. As shown in equation (30) in table 8, public investment negatively affects trade surpluses. When public investment rises by 1 percent, the ratio of exports to imports of goods and services fall by a proportion around 0.43 percent, suggesting that public spending on investment goods would deteriorate trade surpluses. However, the magnitude of the impact of public investment on trade surpluses is clearly less than that of public consumption: the impact of public consumption is roughly two times the impact of public investment. This suggests that public consumption is the major public absorption component that deteriorates trade surpluses in the particular case of Morocco. This is not surprising since the ratio to GDP of general government consumption in Morocco is one of the highest ones in developing countries and a major part of that consumption relies on imports: World Bank statistical data show that general government consumption in Morocco approached 18 percent of GDP in 1997 and 16 percent of GDP was the annual average during the period 1967-1997 (in 1997, public salaries were around 12 percent of GDP).

By contrast, trade surpluses affect more heavily public investment than public consumption. Effectively, equation (30.1) in table 8 shows that a rise of the ratio of exports to imports of goods and services by 1 percent would reduce public investment by 1.58 percent, that is, about 1.86 times the impact on public consumption. This is a real paradox: while public consumption continues to deteriorate foreign saving, the impact of reducing imports falls more heavily on investment goods.

Since couples of variables in cointegrating equations in table 8 are seen to be cointegrated, Granger causality tests must be conducted on the basis of error correction models. Table 9 presents our estimated error correction models when variables are expressed in levels and the error correction terms are estimated by the residuals (lagged one period) of cointegrating equations. Equations (31), (31.1), (32) and (32.1) in table 9 reveal that coefficients associated with first differences of explanatory variables are statistically significant. Since the

coefficients associated with error correction terms are also negative and statistically very significant, in conformity with cointegration implications, there is a bidirectional causality between public absorption components and trade surpluses. Effectively, standard Wald tests show that we can reject the null hypothesis that coefficients of first differences of explanatory variables and error correction terms in equations (31), (31.1), (32) and (32.1) in table 9 are zero. This means that the bidirectional causality exists. Because standard Wald tests reveal that we can reject the null hypothesis that all the coefficients associated with the first differences of explanatory variables are zero, short run bidirectional causality exists between public absorption components and trade surpluses. Since the coefficients associated with error correction terms are everywhere *negative* and statistically very *significant*, long run causality also exists between public absorption components and trade surpluses.

5.2 Public Absorption Components And External Surpluses: A Modern Time-Series Analysis When Variables are Expressed in Ratios to GDP

Our estimated cointegrating equations in table 10 do not change our main conclusions concerning interactions between fiscal and external surpluses. Equation (33) in table 9 shows that when public consumption rises by 1 percentage point of GDP, trade surplus on goods and services would fall by 1.64 percentage points of GDP. By contrast, equation (34) in table 9 reveals that an increase in public investment by 1 percentage point of GDP would deteriorate trade surpluses on goods and services by only 1.15 percentage points of GDP, suggesting that public consumption deteriorates trade surpluses more substantially than does public investment.

The paradox is still there: while public consumption as a ratio to GDP deteriorates more substantially trade surpluses as a ratio to GDP, improvement of trade surpluses, especially through restrictions on imports, falls more heavily on public investment. According to our estimates in equations (33.1) and (34.1) in table 10, a 1 percentage point increase in the ratio to GDP of the trade surplus would reduce public consumption by a proportion around 0.42 percentage points of GDP against 0.52 percentage points of GDP for public investment.

Our empirical results do not change much when we measure the external surplus by the balance of payments current account surplus. As shown in equation (35), a 1 percent increase in the ratio to GDP

of public consumption would deteriorate the current account surplus by a proportion around 1.64 percentage points of GDP against only 1.12 percentage points of GDP for public investment (equation 36 in table 10). Even in this case, the mentioned paradox still holds. While public consumption is seen to deteriorate more heavily the current account surplus, an improvement of the latter affects public investment negatively and more substantially than it does public consumption. As shown in equation (36.1), a 1 percentage point

improvement in the ratio to GDP of current account surplus would reduce public investment by a proportion around 0.67 percentage points of GDP against only 0.46 percentage points for public consumption (equation 35.1 in table 10). This empirical result reveals that import restrictions fall more heavily on the public sector imports of investment goods than on the public sector imports of consumption goods.

Our cointegrating equations have shown interesting results in relationship to interactions between public absorption components and external surpluses. However, since all couples of variables (in proportion to GDP) introduced in the cointegrating equations (table 10) are seen to be cointegrated, Granger causality tests must be conducted on the basis of error correction models. Table 11 presents our estimated error correction models when external surpluses and public absorption components are expressed as ratios to GDP and the error correction terms are estimated by the residuals (lagged one period) of cointegrating equations presented in table 10. Equations (37) through 40.1 in table 11 reveal that the coefficients associated with first differences of explanatory variables are statistically significant. Since the coefficients associated with error correction terms are also *negative* and statistically very significant, in conformity with cointegration implications, there is a bidirectional causality between public absorption components and trade surpluses as ratios to GDP, independent of the methodology adopted to measure external surpluses. Effectively, standard Wald tests show that we can reject the null hypothesis that coefficients of first differences of explanatory variables and error correction terms in equations (37) through 40.1 in table 11 are zero. This means that the bidirectional causality exists. Because standard Wald tests reveal that we can reject the null hypothesis that all the coefficients associated with the first differences of explanatory variables are zero, short run bidirectional causality exists between public absorption components and trade surpluses as ratios to GDP. Since the coefficients associated with error correction terms are everywhere *negative* and statistically very *significant*, long run causality also exists between public absorption components and trade surpluses as ratios to GDP.

6. Main Findings, Policy Implications and Concluding Remarks

Our tests indicate that all variables are seen to be nonstationary in levels and stationary in first differences. Single cointegration equations have been found for couples of variables included in our equations. All our cointegrating equations reveal that there are positive relationships between external and fiscal surpluses and that there are negative relationships between external balances and public absorption components. However, it seems that the magnitude of the impact of fiscal surpluses on external balances is stronger. Moreover, estimated cointegrating equations show that public consumption affects external balances, more powerfully than does public investment, suggesting that external imbalances in the case of Morocco are more substantially affected by general government consumption. Our estimates also show that there is a real paradox in the process of external and fiscal adjustment in the case of Morocco. Effectively, while public consumption is seen to drive more significantly the external deficit, fiscal adjustment seems to fall more heavily on public investment as shown by the estimated effect of the external surplus improvement on public investment. Since public investment is seen to have a crowding-in effect on private investment and growth (see Mansouri; 2000; Mansouri, 2001; Mansouri, forthcoming), we think that the strategy of fiscal and external adjustment in Morocco would be bad for long run economic growth.

Since couples of variables are seen to be cointegrated, we have estimated error correction models. Our estimates indicate, contrarily to the widespread idea, that there is a bi-directional short and long run causality between fiscal and external surpluses. Theoretically speaking, our empirical results obviously contradict the twin deficit hypothesis which claims that there is a unidirectional causality going from fiscal to external surpluses. Our empirical results also contradict the Ricardian proposition that fiscal and external deficits are not linked at all. As we have shown in our estimated models, our conclusions hold independently of the methodology used to measure fiscal and external sector variables.

More interesting are the preliminary empirical results concerning causality between public absorption components and external deficits. A negative causality between public absorption and external surpluses is found to hold in the short as well as long run and to be bi-directional. It seems however that public consumption affects negatively and more substantially foreign saving. In spite of this reality, fiscal adjustment in Morocco has always fallen heavily on public investment which is usually easy to cut. In terms of public spending effects on the economy, it seems that the process of fiscal and external adjustment in Morocco would be probably detrimental for growth.

The policy implications to be drawn from these findings seems to be very important. The relationships between fiscal and external deficits are found to be mutual in the short as well as long run. In this case, if the Moroccan policy makers want to improve the external balance, a fiscal adjustment would be necessary through public spending reduction and public revenue optimization. On the other hand, fiscal adjustment itself needs an adjustment of the current account balance. This would be possible through diversification of external revenue as well as a good strategy of public spending reduction. On the revenue front, actions should focus on diversification of exports, a sustainable development of tourism, struggling against capital flight, encouragement of work remittances, etc. All these factors may have direct and indirect effects on the government budget. On the public spending front, actions should focus on public spending fort, actions should focus on public spending fort, actions should focus on the public spending front, actions should focus on public spending front, ac

above, the impact of public consumption on the external balance is more powerful than the corresponding impact of public investment. Moreover, cutting public investment on social and physical infrastructure may inhibit long-run economic growth (see Mansouri, 2000, Mansouri, 2001; Mansouri, forthcoming). Therefore, a prudent fiscal adjustment should be undertaken. In particular, fiscal adjustment must fall mainly on public consumption and other wasting public spending as well as on public revenue optimization through good governance and struggling against tax evasion and fraud.

Stronger inferences from time series data can be drawn if data are available for a longer time. Indeed, Unit root and cointegration tests are particularly sensitive to the number of observations. Moreover, results of these tests may also change because of structural changes in the Moroccan economy. The present paper project uses available statistical data over about thirty years, a period which is not quite long enough to run stronger tests and to account for structural changes.

References

- Abell, J.D. 1990. "Twin Deficits During the 1980s: An Empirical Investigation." *Journal* of Macroeconomics, 12.
- Alkswani, M. A. 2000. "The Twin Deficits Phenomenon in petroleum Economy: Evidence from Saudi Arabia." Paper presented at the 7th ERF Annual Conference, Amman, Jordan.
- Bachman, D.D. 1992. "Why is the US Current Account Deficit so Large? Evidence From Vector Autoregressions." *Southern Economic Journal*, 59.
- Bahmani-Oskooee, M. 1995. "The Long-Run Determinations of the US Trade Balance revisited?" Journal of Post Keynesian economics, 17.
- Barro, R. J. 1974. "Are Government Bonds Net Wealth?" *Journal of Political Economy*, 81, December.
- Barro, R. J. 1989. "The Ricardian Approach to Budget Deficits." *Journal of Economic Perspectives*, 3(2), spring.
- Boussetta, M. 1992. "Financement Public et Soldes Budgétaires: Cas du Maroc." *Thèse de Doctorat*, Faculté de Droit, Rabat.
- Boussetta, M. 1995. "Deficit budgétaire et Déficit Extérieur: Cas du Maroc." *Revue de la Faculté de Droit de Fez*, printems.
- Corbo, V. and K. Schmidt-Hebbell. 1991. "Public Policies and Saving in Developing Countries." *Journal of Development Economics*, 36(1).
- Darrat, A.F. 1988. "Have Large Budget Deficits Caused Rising Trade Deficits?" Southern Economic Journal, 54.
- Dewald, W.G. and M. Ulan. 1990. "The Twin Deficit Illusion." Cato Journal, 10.
- Dickey, D.A. and W.A. Fuller. 1981. "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root." *Econometrica*, 49.
- Dornbush, R. 1985. "Overborrowing: Three Case Studies" in S.W. Gordon and J.T. Cuddington (eds.), *International Debt and the Developing Countries*. World Bank, Washington, D.C.
- Easterly, W., C.A. Rodrigùez and K. Schmidt Hubbell. 1994c. "Public Sector Deficits and Macroeconomic Performance: A Synthesis." In William Easterly, Carlos Alfredo Rodrigùez and Schmidt Hebbell (eds.), Public Sector Deficits and Macroeconomic Performance. Oxford University Press.
- Enders, W. and B.S. Lee. 1990. "Current Account and Budget Deficits: Twins or Distant Cousins?" *The Review of Economics and Statistics*, 72.
- Evans, P. 1988. "Is the Dollar High Because of Large Budget Deficits?" *Journal of Monetary Economics*, 18.
- Fuller, W.A. 1976. Introduction to Statistical Time Series. New York: Wiley.
- Gonzalo, C. 1994. "Five Alternative Methods of Estimating Long-Run Equilibrium Relationship." *Journal of Econometrics*, 60.
- Granger, C.W.J. and P. Newbold. 1974. "Spurious Regression in Econometrics." *Journal* of Econometrics, 2.
- Grilli, V. 1989. "Seigniorage in EUROPE3?" in M. De Cecco and A. Giovannini (eds.), A European Central Bank? Perspectives on Monetary Unification after Ten Years of the EMSs. Cambridge: Cambridge University Press.

- Islam, M.F. 1998. "Brazil's Twin Deficits: An Empirical Examination." *Atlantic Economic Journal*, June.
- Johansen, S. 1988. "Statistical Analysis of Cointegration Vectors." *Journal of Economics, Dynamics and Control*, 12.
- Johansen, S. and K. Juselius. 1990. "Maximum Likelihood Estimation and Interference on Cointegration with Application to the Demand for Money." *Oxford Bulletin of Economics and Statistics*, 52.
- Kim, K.H. 1995. "On the Long-Run determinants of the US Trade Balance: A Comment." Journal of Post keynesian Economics, 17.
- Lany, L.O. 1984. "The Strong Dollar, the Current Account and Federal Deficits: Cause and Effect." *Federal Reserve Bank of Dallas Economics Review*, January.
- Mansouri, B. 2000. "Fiscal Policy, Price Stability and Private Spending: The Case of Morocco." Paper presented at 7th ERF Annual Conference held, Amman, Jordan.
- Mansouri, B. 2001. "Austement Budgétaire en Afrique: Quelques Eléments d'Economie Politique des Réformes. "*Revue Marocaine d'Economie et de Droit Comparé*, printemps.
- Mansouri, B. (forthcoming), "Vers une Economie Politique de l'Ajustement Budgétaire au Maroc: Rationalisation des Dépenses Publiques et Optimisation des Recettes Fiscales" in *Etat et Fiscazité en Afrique*, proceedings of the Summer University on Governance, Summer, 1999; The Council for the Development of Economic and Social Research in Africa (CODESRIA), Dakar, Senegal.
- Miller, S.M. and F.S. Russik. 1989. "Are the Twin Deficits Really Related?" *Contemporary Policy issues*, October.
- Rosenweing, J.A. and E.W. Tallman. 1993. "Fiscal Policy and Trade Adjustment: Are the deficits Really Twins?" *Economic Inquiry*, 31.
- Sachs, J. (ed.) 1989. *Developing Country Debt and the World economy*. Chicago: University of Chicago Press.
- Vamvoukas, G.A. 1997. "A Note on Budget Deficits and Interest Rates: Evidence from A Small Open economy." *Southern Economic Journal*, 63.
- Vamvoukas, G.A. 1999. "The Twin Deficit Phenomenon: Evidence from Greece." *Applied Economics*, 31.
- Zietz, J. and D.K. Pemberton. 1990. "The US Budget and Trade Deficits: A Simultaneous Equation Model." *Southern Economic Journal*, 57.

Table1: Unit Root Tests

Variable	ADF equation	CV	CV	Stationarity	Stationarity
		(1%)	(5%)	level?	1 st diff.?
$Log\left(rac{X_t}{M_t} ight)$	$\Delta Log\left(\frac{X_t}{M_t}\right) = -0.06 - 0,19Log\left(\frac{X_{t-1}}{M_{t-1}}\right)$ (-1.53) (-1.79)	-3,66	-2,96	No	Yes
$Log\left(\frac{R_t}{G_t}\right)$	$\Delta Log\left(\frac{R_t}{G_t}\right) = -0.05 - 0,23Log\left(\frac{R_{t-1}}{G_{t-1}}\right)$	-3.66	-2,96	No	Yes
	(-1,47) (-1,79)				
$\frac{TRS_t}{GDP_t}$	$\Delta\left(\frac{TRS_t}{GDP_t}\right) = -0.02 - 0,22 \frac{TRS_{t-1}}{GDP_{t-1}}$	"	"	No	Yes
ł	(-1,66) $(-1,95)$				
$R_t - G_t$	$\Delta((R_t - G_t)/GDP_t) = -0.02 - 0.28(R_{t-1} - G_{t-1})/GDP_{t-1}$	"	"	No	Yes
GDP_t	(-1.92) (-2.71)				
	$+0,15\Delta((R_{t-1}-G_{t-1})/GDP_{t-1})$				
	(1.50)				
$\frac{CAS_t}{GDP_t}$	$\Delta \left(\frac{CAS_t}{GDP_t}\right) = -0.014 - 0,33\frac{CAS_{t-1}}{GDP_{t-1}} + 0.23\Delta \left(\frac{CAS_{t-1}}{GDP_{t-1}}\right)$	"	"	No	Yes
i	(-1.72) (-2.50) (1.25)				
OBS_t	$\Delta (OBS_t / GDP_t) = -0.02 - 0.26 OBS_{t-1} / GDP_{t-1}$	"	"	No	Yes
GDP_t	(-1.75) (-2.13)				
t	$+0,32\Delta (OBS_{t-1}/GDP_{t-1})$				
	(1.68)				

Table 1: Contd.

Variable	ADF equation	CV (1%)	CV (5%)	Stationarity	Stationarity 1 st diff 2
$Log(PUBC_t)$	$\Delta Log(PUBC_{t}) = 1.13 + 0.016t - 0.14Log(PUBC_{t-1})$	"	(370)	No	Yes
- ()	(2.00) (1,68) (-1,86)				
	$+0,54\Delta Log(PUBC_{t-1})$				
	(3.26)				
$Log(PUBI_t)$	$\Delta Log(PUBI_t) = 0.60 - 0,06Log(PUBI_{t-1})$	"	"	No	Yes
	(1.72) (-1,50)				
	$+0,17\Delta Log(PUBI_{t-1})$				
	(0.95)				
$PUBC_t$	$\Delta(PUBC_t/GDP_t) = 0.03 - 0, 20 PUBC_{t-1}/GDP_{t-1}$	"	"	No	Yes
GDP_t	(2.01) (-1,94)				
	$+0,21\Delta(PUBC_{t-1}/GDP_{t-1})$				
	(1.18)				
$PUBI_t$	$\Delta (PUBC_t / GDP_t) = 0.03 - 0,20 PUBC_{t-1} / GDP_{t-1}$	"	"	No	Yes
GDP_t	(2.01) (-1,94)				
	$+0,21\Delta(PUBC_{t-1}/GDP_{t-1})$				
	(1.18)				

Variables	t-statistic of the coefficient associated with the residual (lagged one period) of				
	the cointegrating equation				
$Log\left(\frac{X_t}{M_t}\right)$ and $Log\left(\frac{R_t}{G_t}\right)$	\rightarrow \leftarrow	5.22 (**) -5.57 (**)			
$\frac{TRS_t}{GDP}$ and $\frac{R_t - G_t}{GDP}$	\rightarrow	-4.92 (**)			
CAS_t and OBS_t	\rightarrow	-4.92 (**)			
$\overline{GDP_t}$ and $\overline{GDP_t}$	\leftarrow	-3.67 (**)			
$Log\left(\frac{X_t}{M_t}\right)$ and $Log\left(PUBC_t\right)$	\rightarrow \leftarrow	-3.59 -3.10(**)			
$Log\left(\frac{X_t}{M_t}\right)$ and $Log\left(PUBI_t\right)$	\rightarrow \leftarrow	-3.12(**) -2.95(**)			
$\frac{TRS_t}{GDP_t}$ and $\frac{PUBC_t}{GDP_t}$	\rightarrow \leftarrow	-2.84(**) -2.96(**)			
$\frac{TRS_t}{GDP_t}$ and $\frac{PUBI_t}{GDP_t}$	\rightarrow	-2.55(**) -2 56(**)			
$\frac{CAS_t}{GDP}$ and $\frac{PUBC_t}{GDP}$	\rightarrow	-3.82(**) 2.55(**)			
$\frac{CAS_t}{CDR}$ and $\frac{PUBI_t}{CDR}$	\leftarrow	-2.94			
GDP_t GDP_t	\leftarrow	-2./ð			

 Table 2: Engle Granger Cointegration Tests (ADF tests on the residuals of cointegrating equations)

Notes : \rightarrow and \leftarrow indicate that the first (*second*) variable is regressed on the second (*first*) respectively. The symbol (**) indicates that the constant and the linear trend are statistically significant. In the cointegrating equation, residuals of all cointegrating equations are *strongly* stationary in level, that is neither the constant nor the linear trends are statistically significant. In the ADF equations, the number of lags is chosen so that the Akaike information criterion is minimum.

Variables	Eigen values	Likelihood ratio	CV (5%)	CV (1%)
$Log\left(\frac{X_t}{M_t}\right)$ and $Log\left(\frac{R_t}{G_t}\right)$	0.56(*)	2595	18.17	23.46
	0.09	2.74	3.74	6.40
$\frac{TRS_t}{GDP_t}$ and $\frac{R_t - G_t}{GDP_t}$	0.50(**)	22.84	18.17	23.46
	0.10	3.13	3.74	6.40
$\frac{CAS_t}{GDP_t}$ and $\frac{OBS_t}{GDP_t}$	0.37(***)	16.63	15.41	20.04
	0.10	3.15	3.76	6.65
$Log\left(\frac{X_t}{M_t}\right)$ and $Log(PUBC_t)$	0.65(***)	33.60	19.96	24.60
	0.11	3.38	9.24	12.97
$Log\left(\frac{X_t}{M_t}\right)$ and $Log(PUBI_t)$	0.71(***)	31.20	19.96	24.60
	0.12	2.83	9.24	12.97
$\frac{TRS_t}{GDP_t}$ and $\frac{PUBC_t}{GDP_t}$	0.49(**)	20.07	18.17	23.46
	0.12	3.12	3.74	6.40
$\frac{TRS_t}{GDP_t}$ and $\frac{PUBI_t}{GDP_t}$	0,49(***)	16.52	12.53	16.31
	0.04	0.83	3.84	6.51
$\frac{CAS_t}{GDP_t}$ and $\frac{PUBC_t}{GDP_t}$	0.40(**)	18.81	18.17	23.46
	0.10	3.23	3.74	6.40
$\frac{CAS_t}{GDP_t}$ and $\frac{PUBI_t}{GDP_t}$	0.37(***)	20.66	19.96	24.60
	0.20	6.70	9.24	12.97

 Table 3: Johanson Cointegration Tests

Notes: in cases 1, 2, 3, 4 and 8, the number of lags equals 1 while it equals : i) 2 in the case 9; ii) 3 in the case 6; iii) 5 in the cases 5 and 7. (*) with linear deterministic trend in the data; (**): with quadratic deterministic trend in the data; (***): with a constant in the cointegrating equation as well as in the VAR; (***): with a constant in the cointegrating equation.

 Table 4: Relationships between Trade Surpluses (balance of goods and services) and Fiscal Deficits (cointegrating equations): Variables Expressed in Levels

$$Log\left(\frac{X_t}{M_t}\right) = 0.39 - 0.014t + 1.76 Log\left(\frac{R_t}{G_t}\right)$$
(5.34) (-5.95) (10.88)
(23)
$$R^2 = 0.83; \quad R^2 \text{ ajust} = 0.82; \text{ F-statistic} = 62.10; \quad \text{D-W} = 1.92$$

$$Log\left(\frac{R_t}{G_t}\right) = -0.24 - 0.008t + 0.47 Log\left(\frac{X_t}{M_t}\right)$$
(23.1)
(-8.87) (6.38) (10.88)
$$R^2 = 0.84; \quad R^2 \text{ ajust} = 0.83; \text{ F-statistic} = 68.52; \quad \text{D-W} = 2.09$$

Table 5: Relationships between Trade Surpluses (balance of goods and services) and Fiscal Deficits: Variables Expressed in Levels (error correction models)

$$\Delta Log\left(\frac{X_t}{M_t}\right) = 0.98 \Delta Log\left(\frac{R_t}{G_t}\right) - 0.43 \Delta Log\left(\frac{R_{t-2}}{G_{t-2}}\right) + 0.21 \Delta Log\left(\frac{X_{t-1}}{M_{t-1}}\right) - 0.86 ECT1_{t-1}$$

$$(4.57) \quad (-1.91) \quad (1.60) \quad (-4,77)$$

$$R^2 = 0.71; \quad R^2 \text{ ajust} = 0.67; \text{ F-statistic} = 17.95; \quad D-W = 1.87$$

$$\Delta Log\left(\frac{R_t}{G_t}\right) = 0.46 \Delta Log\left(\frac{X_t}{M_t}\right) - 1.06 ECT1_{t-1}'$$

$$(6.20) \quad (-5.09) \quad (-5.09)$$

$$R^2 = 0.66; \quad R^2 \text{ ajust} = 0.65; \text{ F-statistic} = 49.70; \quad D-W = 1.93$$

$$(24.1)$$

 Table 6: Relationships between External and Fiscal Surpluses (cointegrating equations): Variables Expressed in Ratios to GDP

1. External Surplus = Trade Surplus (TRS); Fiscal Surplus = Public				
Revenues (R) - Public Expenditures (G)				
$\frac{TRS_t}{TRS_t} = 0.06 - 0.003t + 1.29 \frac{R_t - G_t}{TRS_t}$				
GDP_t GDP_t	(25)			
(4.54) (-5.33) (12.74)				
$R^2 = 0.87; R^2 \text{ ajust} = 0.86; \text{ F-statistic} = 86.05;$	D-W = 1.88			
$\frac{R_t - G_t}{R_t} = -0.05 + 0.002t + 0.67 \frac{TRS_t}{R_t}$				
GDP_t GDP_t	(25.1)			
(-6.41) (5.24) (12.74)				
$R^2 = 0.87; R^2 \text{ ajust} = 0.86; \text{ F-statistic} = 84.24;$	D-W = 1.90			
$R^2 = 0.82;$ R^2 ajusté = 0.81; F-statistic = 62.27;	D-W = 1.38			
2. External Surplus = Current Account Surplus (CAS	5); Fiscal Surplus =			
Overall Budget Surplus (OBS) = Public Revenues (R)	- Public Expenditures			
(G) + Lending - Repayment				
$\frac{CAS_t}{GDP_t} = 0.044 - 0.0008t + 1.13\frac{OBS_t}{GDP_t}$	(26)			
$\frac{OBS_t}{GDP_t} = -0.05 + 0.0008t + 0.73 \frac{CAS_t}{GDP_t}$	(26.1)			
(-4.94) (1.97) (11.12)				
$R^2 = 0.83; R^2 \text{ ajust} = 0.82; \text{ F-statistic} = 65.78;$	D-W = 1.28			

Table 7: Relationships between External and Fiscal Surpluses: Error Correction Models (variables expressed in ratios to GDP)

1. External Surplus = Trade Surplus (TRS); Fiscal Surplus = Public Revenues (R)	-
Public Expenditures (G)	
$\Delta \left(\frac{TRS_{t}}{GDP_{t}}\right) = 0.97\Delta \left(\frac{R_{t} - G_{t}}{GDP_{t}}\right) - 0.67\Delta \left(\frac{R_{t-1} - G_{t-1}}{GDP_{t-1}}\right) - 0.96\Delta \left(\frac{R_{t-2} - G_{t-2}}{GDP_{t-2}}\right) - 0.42\Delta \left(\frac{R_{t-3} - G_{t-1}}{GDP_{t-3}}\right) $	<u>3</u>)
(5.98) (-1.65) (-2.95) (-1.47)	(27)
$+0.61\Delta \left(\frac{TRS_{t-1}}{GDP_{t-1}}\right) + 0.59\Delta \left(\frac{TRS_{t-2}}{GDP_{t-2}}\right) + 0.39\Delta \left(\frac{TRS_{t-3}}{GDP_{t-3}}\right) - 1.49ECT2_{t-1}$	
(2.18) (2.34) (2.14) (-4.13)	
$R^2 = 0.84; R^2 \text{ ajust} = 0.77; F-\text{statistic} = 12.18; D-W = 1.93$	
$ = \Delta \left(\frac{R_{t} - G_{t}}{GDP_{t}}\right) = 0.49\Delta \left(\frac{R_{t-1} - G_{t-1}}{GDP_{t-1}}\right) + 0.54\Delta \left(\frac{R_{t-2} - G_{t-2}}{GDP_{t-2}}\right) + 0.35\Delta \left(\frac{R_{t-3} - G_{t-3}}{GDP_{t-3}}\right) + 0.64\Delta \left(\frac{RRS}{GDP_{t-3}}\right) + 0.64\Delta \left(\frac{RRS}{$	$\left(\frac{t}{2}\right)$
(1.48) (1.91) (1.50) (6.17)	(27.1)
$-0.27\Delta \left(\frac{\mathit{TRS}_{t-1}}{\mathit{GDP}_{t-1}}\right) - 0.35\Delta \left(\frac{\mathit{TRS}_{t-2}}{\mathit{GDP}_{t-2}}\right) - 0.30\Delta \left(\frac{\mathit{TRS}_{t-3}}{\mathit{GDP}_{t-3}}\right) - 1.44\mathit{ECT2}_{t-1}'$	
(-1.27) (-1.82) (-2.20) (-3.45)	
$R^2 = 0.79; R^2 \text{ ajust} = 0.71; F-\text{statistic} = 9.22; D-W = 1.98$	
2. External Surplus = Current Account Surplus (CAS); Fiscal Surplus = Overall B	udget
Surplus (OBS) = Public Revenues (R) - Public Expenditures (G) + Lending - Renay	vment
$\Delta\left(\frac{CAS_t}{GDP_t}\right) = 0.20\Delta\left(\frac{CAS_{t-1}}{GDP_{t-1}}\right) + 0.26\Delta\left(\frac{CAS_{t-2}}{GDP_{t-2}}\right) + 0.25\Delta\left(\frac{CAS_{t-3}}{GDP_{t-3}}\right)$ (1.60) (1.60) (2.02)	(28)
(1.00) (1.01) (2.02)	
$+1.02\Delta \left(\frac{OBS_t}{GDP_t}\right) - 0.39\Delta \left(\frac{OBS_{t-2}}{GDP_{t-2}}\right) - 0.90ECT3_{t-1}$	
(6.00) (-1.63) (-4.72)	
$R^2 = 0.78; R^2 \text{ ajust} = 0.73; F-\text{statistic} = 15.20; D-W = 1.78$	
$\Delta \left(\frac{OBS_t}{GDP_t}\right) = 0.58\Delta \left(\frac{CAS_t}{GDP_t}\right) - 0.21\Delta \left(\frac{OBS_{t-3}}{GDP_{t-3}}\right) - 0.57ECT3_{t-1}'$	(28.1)
(6.96) (-2.77) (-3.31)	
$R^2 = 0.73; R^2 \text{ ajust} = 0.71; \text{ F-statistic} = 33.96; D-W = 1.72$	

Table 8: Relationships between Trade Surpluses (balance of goods &services) & Public Absorption Components (public consumption (PUBC) &Public Investment (PUBI)): cointegrating equations (variables expressed inlevels)

$$Log\left(\frac{X_t}{M_t}\right) = 5.91 + 0.10t - 0.90Log\left(PUBC_t\right)$$
(29)
(9.07) (8.88) (-9.43)

$$R^2 = 0.77; \quad R^2 \text{ ajust} = 0.76; \quad \text{F-statistic} = 45.85; \quad \text{D-W} = 1.21$$

$$Log\left(PUBC_t\right) = 6.63 + 0.12t - 0.85Log\left(\frac{X_t}{M_t}\right)$$
(29.1)
(115.04) (49.52) (-9.43)

$$R^2 = 0.99; \quad R^2 \text{ ajust} = 0.99; \quad \text{F-statistic} = 1376; \quad \text{D-W} = 1.06$$

$$Log\left(\frac{X_t}{M_t}\right) = 2.50 + 0.04t - 0.43Log\left(PUBI_t\right)$$
(30)
(6.87) (6.32) (-7.56)

$$R^2 = 0.69; \quad R^2 \text{ ajust} = 0.66; \quad \text{F-statistic} = 29.64; \quad \text{D-W} = 1.03$$

$$Log\left(PUBI_t\right) = 6.00 + 0.10t - 1.58Log\left(\frac{X_t}{M_t}\right)$$
(30.1)
(45.00) (19.08) (-7.56)

$$R^2 = 0.95; \quad R^2 \text{ ajust} = 0.94; \quad \text{F-statistic} = 238.65; \quad \text{D-W} = 0.98$$

Table 9: Relationships between Trade Surpluses (balance of goods &services) & Public Absorption Components (public consumption (PUBC) &Public Investment (PUBI)): Error Correction Models (variables expressedin levels)

$$\begin{split} \mathcal{M}_{\mathcal{A}_{\mathcal{B}}} & \left(\frac{X_{t}}{M_{t}}\right) = 0.08 - 0.53 \mathcal{M}_{\mathcal{B}}(PBC_{t}) - 0.42 \mathcal{M}_{\mathcal{B}}(PBC_{t-1}) - 0.25 \mathcal{M}_{\mathcal{B}}(PBC_{t-3}) - 0.55 BCT4_{t-1}_{(31)} \\ & (219)(-252) \quad (-2004) \quad (-1.40) \quad (-3.18) \\ R^{2} &= 0.58; \quad R^{2} \text{ ajust} \acute{e} = 0.50; \quad \text{F-statistic} = 8.005; \quad \text{D-W} = 1.88 \\ & \Delta \log \left(PUBC_{t}\right) = 0.47 \Delta \log \left(PUBC_{t-1}\right) + 0.53 \Delta \log \left(PUBC_{t-3}\right) - 0.34 \log \left(\frac{X_{t}}{M_{t}}\right) + 0.30 \log \left(\frac{X_{t-2}}{M_{t-2}}\right)_{(31.1)} \\ & (-3.09) \quad (-3.42) \quad (-2.37) \quad (2.57) \\ & + 0.21 Log \left(\frac{X_{t-3}}{M_{t-3}}\right) - 0.56 ECT4'_{t-1} \\ & (1.74) \quad (-3.47) \\ R^{2} &= 0.56; \quad R^{2} \text{ ajust} \acute{e} = 0.46; \quad \text{F-statistic} = 5.11; \quad \text{D-W} = 2.30 \\ & \Delta \log \left(\frac{X_{t}}{M_{t}}\right) = 0.24 \Delta \log \left(\frac{X_{t-1}}{M_{t-1}}\right) - 0.22 \Delta \log \left(PUBI_{t}\right) + 0.15 \Delta \log \left(PUBI_{t-2}\right) - 0.63 ECT5_{t-1}(32) \\ & (1.56) \quad (-2.98) \quad (1.90) \quad (-4.20) \\ R^{2} &= 0.55; \quad R^{2} \text{ ajust} \acute{e} = 0.50; \quad \text{F-statistic} = 9.75; \quad \text{D-W} = 2.03 \\ & \Delta \log \left(PUBI_{t}\right) = 0.07 + 0.32 \Delta \log \left(PUBI_{t-2}\right) - 1.22 \Delta \log \left(\frac{X_{t}}{M_{t}}\right) - 0.49 ECT5'_{t-1}(_{32.1}) \\ & (1.59) \left(1.83\right) \quad (-3.71) \quad (-2.52) \\ R^{2} &= 0.38; \quad R^{2} \text{ ajust} \acute{e} = 0.30; \quad \text{F-statistic} = 5.01; \quad \text{D-W} = 1.73 \\ \end{split}$$

Table 10: Relationships between External Surpluses & Public AbsorptionComponents (public consumption (PUBC) & Public Investment (PUBI)):Cointegrating Equations (variables expressed in Ratios to GDP)

1- External Surplus = Trac	le Surplus (TR	S):		
$\frac{TRS_t}{GDP_t} = 0.19 - 1.61 \frac{PU}{G}$	$\frac{UBC_t}{DP_t}$			(33)
(5.79) (-8.16)				
$R^2 = 0.75; R^2 \text{ ajust}\acute{e} =$	0.73; F-statis	tic = 40.77;	D-W = 0.96	5
$\frac{PUBC_t}{GDP_t} = 0.11 + 0.000$	$0.42 \frac{TR}{GD}$	$\frac{S_t}{P_t}$		(33.1)
(14.62) (2.27)	(-8.17)			
$R^2 = 0.75; R^2 \text{ ajust}\acute{e} =$	0.73; F-statist	tic = 40.77;	D-W = 0.96	5
$\frac{TRS_t}{GDP_t} = 0.06 - 0.002t$	$-1.15 \frac{PUBI_t}{GDP_t}$: 		(34)
(2.86) (-2.38)	(-7.41)			
$R^2 = 0.68; R^2 \text{ ajust}\acute{e} =$	0.66; F-statis	tic = 28.90;	D-W = 0.76	5
$\frac{PUBI_t}{GDP_t} = 0.07 - 0.00$	$1t - 0.58 \frac{TR}{GD}$	$\frac{S_t}{P_t}$		(34.1)
(5.59) (-2.20)	(-7.41)			
$\Delta Log\left(\frac{X_t}{M_t}\right) = 0.24 \Delta Log\left(\frac{X_{t-1}}{M_{t-1}}\right)$	$\left(\frac{1}{1}\right) - 0.22\Delta Log(F)$	$PUBI_t$) + 0.15 Δ	$Log(PUBI_{t-2})$	$) - 0.63ECT5_{t-1}$
(1.56)	(-2.98)	(1.90)		(-4.20)

Table 10: Contd.

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2- External Surplus = Current Account Surplus (CAS)	
$\frac{CAS_t}{GDP_t} = 0.16 + 0.003t - 1.64 \frac{PUBC_t}{GDP_t}$	(35)
(6.25) (4.79) (-9.44)	
$R^2 = 0.76; R^2 \text{ ajust} = 0.75; \text{ F-statistic} = 45.31; \text{D-W} = 1.37$	
$\frac{PUBC_t}{GDP_t} = 0.11 + 0.002t - 0.46 \frac{CAS_t}{GDP_t}$	(35.1)
(15.32) (15.58) (-9.44)	
$\alpha_i = 0$	
$\frac{CAS_t}{GDP_t} = 0.05 - 1.12 \frac{PUBI_t}{GDP_t}$	(36)
(4.58) (-9.04)	
$R^2 = 0.75; R^2 \text{ ajust} = 0.74; \text{ F-statistic} = 81.67; \text{D-W} = 0.94$	
$\frac{P U B I_t}{G D P_t} = 0.06 - 0.67 \frac{C A S_t}{G D P_t}$	(36.1)
(11.79) (-9.04)	
$R^2 = 0.75; R^2 \text{ ajust} = 0.74; \text{ F-statistic} = 81.67; \text{D-W} = 0.83$	

 Table 11: Relationships between External Surpluses & Public Absorption

 Components (public consumption (*PUBC*) & Public INvestment (*PUBI*)):

 Error Correction Models (variables expressed in Ratios to GDP)

$$\begin{split} \textbf{I-External Surplus} &= \textbf{Trade Surplus (TRS) :} \\ \Delta \left(\frac{TRS_t}{GDP_t} \right) = -0.21 \Delta \left(\frac{TRS_{t-3}}{GDP_{t-3}} \right) -1.35 \Delta \left(\frac{PUBC_t}{GDP_t} \right) -0.44ECT6_{t-1} \\ (37) \\ (-1.51) \\ (-1.51) \\ (-1.51) \\ (-1.51) \\ (-1.51) \\ (-1.51) \\ (-1.51) \\ (-1.51) \\ (-1.51) \\ (-1.51) \\ (-1.51) \\ (-1.51) \\ (-1.51) \\ (-1.51) \\ (-1.52) \\$$

Table 11: Contd

$$\begin{aligned} \frac{2 - \text{External Surplus} = \text{Current Account Surplus (CAS) :}}{\Delta\left(\frac{CAS_t}{GDP_t}\right) = -1.25\Delta\left(\frac{PUBC_t}{GDP_t}\right) - 0.72ECT8_{t-1} \\ (39) \\ (-4.80) \\ (-3.99) \\ R^2 = 0.60; R^2 \text{ ajusté} = 0.59; F-\text{statistic} = 41.73; D-W = 1.75 \\ \Delta\left(\frac{PUBC_t}{GDP_t}\right) = -0.35\Delta\left(\frac{CAS_t}{GDP_t}\right) - 0.50ECT8_{t-1}' \\ (-5.25) \\ (-2.71) \\ (39.1) \\ R^2 = 0.50; R^2 \text{ ajusté} = 0.548; F-\text{statistic} = 27.39; D-W = 1.76 \\ \Delta\left(\frac{CAS_t}{GDP_t}\right) = -0.92\Delta\left(\frac{PUBI_t}{GDP_t}\right) - 0.52ECT9_{t-1} \\ (-5.42) \\ (-3.15) \\ R^2 = 0.66; R^2 \text{ ajusté} = 0.65; F-\text{statistic} = 52.10; D-W = 1.82 \\ \Delta\left(\frac{PUBI_t}{GDP_t}\right) = -0.58\Delta\left(\frac{CAS_t}{GDP_t}\right) - 0.36ECT9_{t-1}' \\ (-6.34) \\ (-2.13) \\ (40.1) \\ R^2 = 0.60; R^2 \text{ ajusté} = 0.59; F-\text{statistic} = 40.57; D-W = 1.91 \end{aligned}$$