DOES THE CONSTRAINT IN THE MATRIX OF LONG RUN EFFECTS BIAS THE RICARDIAN EQUIVALENCE TEST?

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Abstract

The purpose of this paper is to test the Ricardian Equivalence Hypothesis REH by estimating a SVAR model. In this framework, we separate the co-movements of saving rate and budget deficit rate into two shocks, associated with structural parameters, as if we were looking for ''two needles in haystack''. We avoid imposing formal short and long run constraints, because these may overestimate the compensation rate and bias the estimation of structural multipliers. Our results suggest that REH is applicable to Moroccan economy, since private saving compensates a large fraction i.e. 90% of the shock in budget deficit, which may handicap the economic development.

Keywords: Budget deficit, Saving, Ricardian Equivalence, Structural shock, SVAR.
JEL classification: C5, H3, H6 and O23

1. Introduction

The rates of investment effort and saving in terms of GDP percentage knew important variations in the last three decades. We notice that the rates of public saving (i.e., ordinary budget balance) have increased in the same way as the rate of national saving, while the rate of saving has gone upward the rate of investment effort has gone downward. This is due among other factors to (a) the interest rates that keep going high as a result of the interactions of capital supply and demand, (b) the real effect relative to processes of rate of saving and investment and to (c) the financial policy mainly the fiscal policy of the government. Needless to say that the series in question consists of several economic and financial interactions which require an econometric approach to be proposed. During the last two decades, the public saving rate presents a quite similar increase to that of the national saving rate, whereas the investment rate tends to decrease with a higher variability compared to the saving rate. These evolutions, which directly influence the rhythm of the economic growth, are related to the capitals of bank costs and to the progressive reduction in the government investment effort. After the government failure in managing public economy which relied on foreign debts to some extent (Ghassan, 2003 and Naanaa, 2002), the government plays a role of organizer and bargainer and passes laws and charters which aim at encouraging foreign and local private sectors.

In this paper, we try to examine the Ricardian Equivalence Hypothesis REH and then we test it on the Moroccan economy as a case-study during the last three decades. The SVAR modelisation allows to decipher some interactions between national saving rate and budget deficit rate of government. This method makes it possible for us to separate the co-movements of the dynamics of saving and that of budget deficit into two typical components of shocks related to the structural parameters of this model. In Section 2, we specify the form of the VAR model which is the basis of the effect of

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budget deficit on national saving. In Section 3, we show the importance of the economic analysis in order to specify the SVAR model by using the estimation of the VAR model. As for Section 4, it illustrates the main interpretation. Section 5 shows the bootstrapping results and the last section summarizes the findings.

2. Specification of VAR model

The Moroccan government, among other developing countries, has known high public deficits stemming from an expanded financial policy mainly after the phosphate crisis in 1975 and the second world oil crisis. The financial and economic conjuncture led to a strong decrease in public saving at the beginning of the 1980's. Figure 1 shows the evolution of national saving rates and ordinary budget balance from 1970 to 2002. It seems that the two curves present "almost" similar tendencies, and it shows that the variability of national saving cannot be separated from that of public saving, and the decrease of the latter corresponds exactly to public deficits[1].

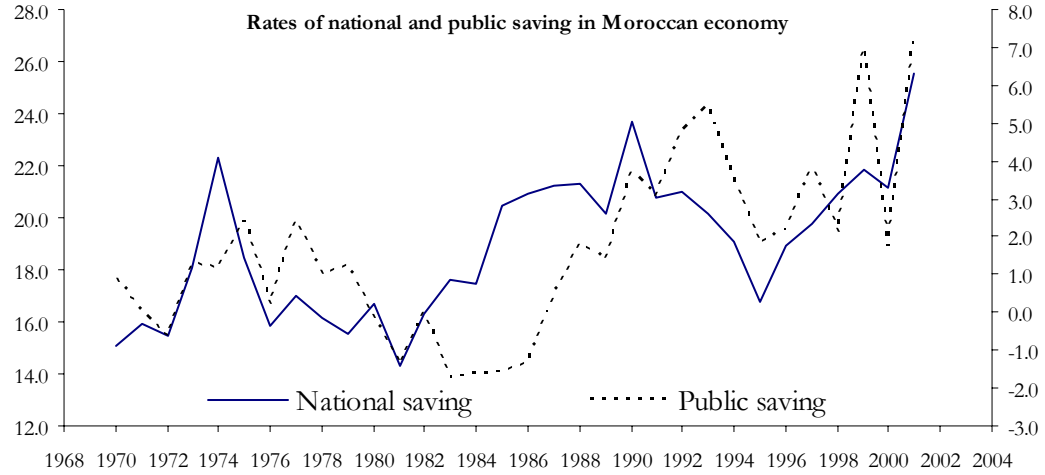

Figure 1. Evolution of saving rates

In the economic literature (Blanchard 1985, Barro 1989, Seater 1993), the problems out of the above correlation are discussed throughout the hypothesis of Ricardian Equivalence, which is always subject to controversies. In the literature, we notice the absence of consensus about the effects of debt and the state's budget deficit on real and monetary economy. This may be due to the contemporary correlation between saving and primary budget deficit. This correlation increases every time private agents' behaviours consider fiscal and budget measures for short and long terms. On the one hand, the households' behaviours and largely the private sector can lead the financial policy astray because whenever private agents are aware of what measures the government intends to take they can annihilate the effects of these measures. On the other hand, the government can provoke monetary and finance shocks by surprising the private agents and creating a balance in the reactions of private savers and strategies of budget deficit.

[1] In this paper we use annual series (private and public) saving and GDP from DS Direction of Statistics; whereas budget deficit data is taken from DEPF Direction of studies and financial expectations (Rabat).

Despite this statistical correlation, it is not sufficient to confirm or reject the compensation mechanism of public saving variation by private saving variation i.e. REH, because it is not reflected in the increase of the private saving, which is characterized during the economic cycle by inverse curves related to curves of public saving. So the deterioration of ordinary budget deficit cannot be compensated by an equivalent increase of private saving. This is so because the REH can be true in the long run and not in the short run, for the anticipations of private agents are influenced by the quantity of available information about the orientations and tendencies of economic and financial activities and notably those related to governmental decisions. Therefore, this complicates the distinction between cyclical variability and structural variability caused deliberately and directly by public authorities or by a constrained management of the budget.

Similarly, the contemporary correlation that is observed in Figure 1 is nothing but the start of the stated problem. Since the beginning of the 2000's it seems that the long-lasting changes have been dominating relative to the events of the first half of the eighties. On the one hand, it seems plausible that these changes stem from common level of awareness among public and private agents during the first half of 1980's which is the start of the acute finance crisis in Morocco. But on the other hand, savers can anticipate random changes such as the increase of public budget deficit, and this can lead to an increase in the private consumption or in the choice of their portfolios by adapting their preferences to monetary liquidity. This could make the government's expectation diminishes to zero.

However, following the analysis of Poterba and Summers (1987), this reciprocal sensitivity between the behaviour of the private and public sector is not sufficient to reject the REH, because it always seems possible to provoke influent shocks of different natures and carry out in fine financial authorities' expectations. This view requires the maintenance of the memory of each series without imposing long run constraints.

To discard these difficulties, we use the SVAR methodology to separate the dynamic of budget deficit from that of saving, and this is done by using two kinds of structural shocks. In the first step, we estimate the non-constraint bi-varied VAR model so as to describe the changes in national saving rate noted *s* and in public saving rate minus public investment effort rate which is the budget deficit rate noted *d* and defined by $d := s^p - i^g$ because $s^p < i^g$.

In the framework of VAR model, the first shock $\varepsilon_{\Delta s}$, linked to a permanent modification of national saving which considers the choice of consumers and the variations of their income can influence the budget deficit either transitorily or permanently: the modifications of private saving can have long run effects on budget constraints. These effects can decline in the long term according to the prevailing theoretical paradigm. As for the second shock $\varepsilon_{\Delta d}$, it expresses modifications of the rhythm of increase in the government expenditures at the level of both the fiscal situation, and other deliberate or unplanned variations related to the central government budget. Before estimating the VAR model, it is necessary to precise its representation mode by clarifying the long run proprieties of time series[2]. The augmented Dickey-Fuller ADF test of deficit rate and

[2] We have used the canonical form VAR*(p)* where the number of lags is determined according to Akaike criterion which reduces the serial correlation of residuals. Here, we find $p = 1$ regarding to

national saving rate exhibits that they are I(1). The non-stationary test and the cointegration test by Johansen procedure respectively show that the series are non-stationary and non-cointegrated[3]. Thus, the appropriate specification consists in considering the VAR model on first difference variables Δd_t and Δs_t. In other respect, we use the instantaneous causality test to exhibit the pertinence of VAR model, the estimation gives the following results:

$$\begin{cases} \Delta d_t = 9.336 - 0.866\Delta s_t + 0.666\Delta d_{t-1} + 0.499\Delta s_{t-1} + \hat{\varepsilon}_{\Delta d_t} \\ \quad\quad (1.593) \quad (\mathbf{-2.941}) \quad\quad (4.770) \quad\quad (1.662) \\ \Delta s_t = 9.348 - 0.288\Delta d_t + 0.574\Delta s_{t-1} + 0.113\Delta d_{t-1} + \hat{\varepsilon}_{\Delta s_t} \\ \quad\quad (3.085) \quad (\mathbf{-2.941}) \quad\quad (4.009) \quad\quad (1.049) \end{cases} \tag{1}$$

The explicatory value of two variables confirms their instantaneous determination. This does not necessarily mean the presence of an economic causality, because the insertion of Δs_t in equation Δd_t leads to the same result: the *T*-statistic is exactly the same in both equations; the causality is then reciprocal between the two variables. This result indicates the pertinence of VAR model, which sums up all correlations between the two variables on the one side, and corresponds to the reduced form of the unknown structural model that needs to be specified on the other side. The general form of the VAR in the first difference is as follows:

$$\begin{cases} \Delta d_t = c_1 + a_{11}\Delta d_{t-1} + a_{12}\Delta s_{t-1} + \varepsilon_{\Delta d_t} \\ \Delta s_t = c_2 + a_{21}\Delta s_{t-1} + a_{22}\Delta d_{t-1} + \varepsilon_{\Delta s_t} \end{cases} \tag{2}$$

the matrix of variance-covariance is:

$$V(\varepsilon_t) = \begin{bmatrix} \sigma^2_{\Delta d} & \sigma_{\Delta d,\Delta s} \\ \sigma_{\Delta d,\Delta s} & \sigma^2_{\Delta s} \end{bmatrix}$$

The estimation of (2) gives[4]:

$$\begin{cases} \Delta d_t = -0.0035 - 0.272\Delta d_{t-1} - 0.245\Delta s_{t-1} + \hat{\varepsilon}_{\Delta d_t} \\ \Delta s_t = 0.0034 - 0.1301\Delta s_{t-1} + 0.117\Delta d_{t-1} + \hat{\varepsilon}_{\Delta s_t} \end{cases}$$

$$V(\hat{\varepsilon}_t) = \begin{bmatrix} 0.03078^2 & \sigma_{\Delta d,\Delta s} \\ -0.46829\sigma_{\Delta d}\sigma_{\Delta s} & 0.01968^2 \end{bmatrix}$$

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annual series. It relativizes the efficiency of the model by singling out an optimal number *p*, but it does not fundamentally alter the influence of shocks in the long run, notably for annual series.

[3] Johansen procedure does not reject the null hypothesis H_0 i.e. there is an absence of any relation of cointegration between the budget deficit rate *d* and the national saving rate *s*. Actually, in H_0 i.e. *r=0* the statistical trace is 9.99 and the critical value is 15.41, at a significance level of 95%. This result goes with the economic theory which suggests the absence of any long run link between the variables at *d* and *s* levels.

[4] The statistical value does not follow an usual and standard distribution, but the estimated parameters are not biased.

The perturbations $\varepsilon_{\Delta d_t}$ and $\varepsilon_{\Delta s_t}$ in the equations of budget deficit and national saving contain supplementary information to time *t*. The innovation $\varepsilon_{\Delta d_t}$ can be considered as an unknown budget shock, and the random term $\varepsilon_{\Delta s_t}$ is a saving shock. Though these innovations have a statistical significance they cannot be associated directly to economic shocks.

The correlation between two calculated residuals is not zero; it measures the instantaneous causality between budget deficit and national saving. Its value can be obtained by covariance i.e. $k\sigma_{\Delta d}\sigma_{\Delta s}$, it is equal to -0.4683. By considering the estimated VAR model as a simulation model: when a shock occurs in one of the perturbations, it is compulsory to modify the other perturbation, otherwise the result is not valid and cannot be interpreted objectively.

3. Importance of economic analysis and SVAR specification

3.1 SVAR specification. To sort out the problem of the above correlation, it is necessary to model explicitly the correlation between the two innovations. The economic analysis contributes to the specification of the kind of link between *s* and *d* according to the following theoretical typology (and this is confirmed by the above analysis of instantaneous causality, see system (1) for reciprocal causality equations):

- Once there is a budget shock, the deficit increases and reduces saving: negative instantaneous correlation.
- Once there is a budget shock, the deficit increases and makes saving higher in the long run: positive dynamic correlation.
- When there is a supply shock by saving, it leads to the reduction of budget deficit under the effect of a growth in saving: negative correlation.

This interpretation of the structural model consists in separating these two effects and identifying the two independent shocks. In order to specify this model according to canonical VAR model, we assume that the perturbations of this model provide a linear combination of underlying budget and saving shocks, which gives $\varepsilon = S\ u$:

$$\begin{cases} \varepsilon_{\Delta d} = s_d u_{\Delta d} + s_{d,s} u_{\Delta s} \\ \varepsilon_{\Delta s} = s_{s,d} u_{\Delta d} + s_s u_{\Delta s} \end{cases} \tag{3}$$

where u corresponds to a vector of unknown structural shocks that are associated with economic variations by using a transformation matrix *S*. By assuming the independence of structural shocks, we will have the following variance and covariance matrix[5]:

$$V(u) = \begin{bmatrix} \delta^2_{\Delta d} & 0 \\ 0 & \delta^2_{\Delta s} \end{bmatrix} \qquad V(\varepsilon) = SV(u)S' \tag{4}$$

[5] On the one hand, it is possible to realize this hypothesis numerically. On the other hand, when the canonical residuals are distributed following a normal centered distribution, the structural shocks found and formulated as a linear combination and follow a normal standard distribution in accordance with the selected condition of normalization.

Also, to simplify the specification, we suppose that the structural shocks u_t are not comptemporarily auto-correlated (which shows a weak side of SVAR methodology), and that they present unitary variance. This requires imposing $n(n+1)/2$ constraints, here three bilinear constraints, on the elements of *S* matrix to attain the following system:

$$V(\tilde{\varepsilon}) = SS' \Leftrightarrow \begin{cases} \tilde{\sigma}_1^2 = s_{11}^2 + s_{12}^2 \\ \tilde{\sigma}_2^2 = s_{21}^2 + s_{22}^2 \\ \tilde{\sigma}_{12} = s_{11}s_{21} + s_{12}s_{22} \end{cases} \quad \text{and} \quad V(\tilde{u}) = I \qquad (5)$$

with three equations and four unknowns where the indices 1 and 2 correspond respectively to variables Δd and Δs. To identify n^2 parameters under these conditions, we have to impose $n(n-1)/2$ constraints (here one constraint). This additional constraint concerns the responses of system to different structural impulsions: it expresses a mixture of short and long run effects. Once the coefficients s_{ij} of matrix S are calculated, we can determine the unknown structural residuals.

Operationally, we first recalculate the canonical residuals of Δs to make their covariance with other variable null, and we have to make an iterative numerical calculation to converge toward a unitary variance-covariance matrix of unknown structural residuals. The procedure of this iterative calculus consists in orthogonalizing the matrix of variance-covariance by premultiplying the equation of saving by the quantity $-\sigma_{\Delta d}^2 / \sigma_{\Delta d,\Delta s}$ and by adding respectively the terms of deficit equation[6]. This orthogonalization procedure of structural impulsions requires only the choice of variables order that must be ranging from most exogenous to most endogenous. This procedure is founded on identifying constraints from economic theory and permits to obtain, via the canonical VAR form, a structural VAR form equivalent to recursive simultaneous equations. In the framework of this methodological approach to obtain the structural shocks $\tilde{u}_t$ from estimated random residuals $\tilde{\varepsilon}_t$, it is required to determine the elements of the matrix *S*. However, when the variance matrix $V(\varepsilon)$ is symmetrical we have three constraints serving to determine the four elements of matrix *S*. Thus it is necessary to impose a supplementary restriction to determine completely the four coefficients of matrix *S* and then to identify the two structural shocks. This supplementary constraint expresses the responses of system to different structural impulsions, and it coincides generally with the above economic typology, that relates to the apriori sensitivity of saving vis-à-vis the effect of impulsions or shocks occurring in public budget, or to the sensitivity of budget vis-à-vis saving shocks.

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[6] The saving equation is then transformed and its error term is $\omega_{\Delta s_t} = \varepsilon_{\Delta s_t} - \frac{\sigma_{\Delta d,\Delta s}}{\sigma_{\Delta d}^2}\varepsilon_{\Delta d_t}$ and $\omega_{\Delta d_t} = \varepsilon_{\Delta d_t}$ suchthat. $Cov\ (\varepsilon_{\Delta d_t}\ ;\ \omega_{\Delta s_t}) = E[(\varepsilon_{\Delta s_t} - \frac{\sigma_{\Delta d,\Delta s}}{\sigma_{\Delta d}^2}\varepsilon_{\Delta d_t})\varepsilon_{\Delta d_t}] - E(\varepsilon_{\Delta s_t} - \frac{\sigma_{\Delta d,\Delta s}}{\sigma_{\Delta d}^2}\varepsilon_{\Delta d_t})E(\varepsilon_{\Delta d_t}) = 0$

The drawback of the Choleski factorization of matrix $V(\varepsilon)$ lies in the fact that it imposes a semi-structural statistical interpretation and does not provide a direct economic explanation. This factorization apriori presupposes a recursive link between residuals of VAR and structural shocks, by suggesting a structure of chain-like causality between budget shock and saving shocks without any reference to instantaneous or non-instantaneous causality between two variables. In return, the economic theory informs us about the links, which join several variables in the long run rather than the instantaneous causality. So it seems natural, in the framework of this theoretical paradigm, to impose long run constraints more than instantaneous correlations.

At this stage, there seems to be no universal way to identify these structural innovations. The choices cannot be tested statistically. Most studies use Choleski factorization because of its simplicity and it imposes $s_{21} = 0$; this means that the private agents or households have myopic anticipations towards the financial policy of government. This idea expresses exactly the content of the Ricardian Neutrality hypothesis of households. When this is true then the private saving does not react to short run budget shocks.

3.2 Proposition for estimate structural shocks. This is why we propose a method based on specific regression criteria in order to select the constraints of identification, which allow sorting out the system (5) above. When all series of VAR model are stationary: they cannot be away from the average value so that at the end each shock has a null impact in the long run within this framework. This does not impose any relation on the stationary variables in the long term. This problem can be resolved when the series are stationary in first difference. This non-stationarity in level implies that the series is governed by stochastic tendency i.e. a shock on the tendency can have a persistent effect on the level of series. This seems to be the case for saving and deficit rate variables; and the restriction can be put on the impact of long run persistent effect variables. Despite this justification, we avoid imposing a long run constraint to obtain efficient multipliers.

These are developed following the economic typology which provides only variation directions, but does not completely determine the matrix *S*. Taking into account the relation between short run effects s_{12} and s_{21}, it is possible to solve the above system by imposing a linear economic constraint in the short run deduced from an existing non-symmetrical instantaneous effect:

$$s_{ij} = \alpha \; s_{ji} \tag{6}$$

The economic intuition and theoretical support exhibit the relation (6). So, this relation is founded on economic bases by instantaneous determination of variables Δd_t and Δs_t, because it is deduced from the regressions from system (1). These regressions indicate precisely short run quasi-elasticities, which prove the pertinence of VAR model and describe the impact of economic interaction. Following the results of the instantaneous causality test, we work out the following relation: $s_{21} = \alpha \; s_{12} = 0.3571 s_{12}$, the choice of which relies on usual statistical tests. This relation allows us to avoid imposing constraints on the effect of long run shocks, which is a simple approach to determine the solutions of the following system in three equations and three unknowns:

$$\begin{cases} \widetilde{\sigma}_1^2 = s_{11}^2 + s_{12}^2 \\ \widetilde{\sigma}_2^2 = \alpha^2\ s_{12}^2 + s_{22}^2 \\ \widetilde{\sigma}_{12} = \alpha\ s_{12}s_{11} + s_{12}s_{22} \end{cases} \tag{7}$$

This system leads to the solutions $\widetilde{s}_{11}^2$, $\widetilde{s}_{12}^2$, $\widetilde{s}_{22}^2$, which permits to determine the structural VAR residuals by solving $u_{\Delta d}$ and $u_{\Delta s}$, which define respectively the two components of structural innovation by sorting out the following system[7] $\hat{\varepsilon} = \widetilde{S}u$:

$$\begin{cases} \hat{\varepsilon}_{\Delta d} = \widetilde{s}_{11}u_{\Delta d} + \widetilde{s}_{12}u_{\Delta s} \\ \hat{\varepsilon}_{\Delta s} = \alpha^*\widetilde{s}_{12}u_{\Delta d} + \widetilde{s}_{22}u_{\Delta s} \end{cases} \tag{8}$$

we find out a solution to the unknown components $\widetilde{u}_{\Delta d}$ and $\widetilde{u}_{\Delta s}$. These components can determine conjunctural and structural contributions of both budget deficit and saving. Using this solution, we determine -from first equation- the structural contribution of the government's budget balance dynamic (first term), and the transitory contribution due to saving process in the deficit dynamic (second term).

In practice, we argue that the relation between instantaneous multipliers in the short run is more efficient than a constraint imposed on dynamic multipliers in the long run, it leads to more precise estimation of a compensation rate by national saving of the supplementary level in the deficit. Knowing that the important long run relation takes the following pattern:

$$\theta(1) = \psi(1)\theta_0 \quad \text{with} \quad \theta_0 := S \tag{9}$$

where $\theta(1)$ is the matrix of long run structural effects or multipliers, and θ_0 is sometimes called impact multipliers. $\psi(1)$ is the matrix of long run effects or total multipliers.

We can identify supplementary constraints (here only one is needed), for instance we can rely on the following long run hypothesis: $\varepsilon_{\Delta s}$ has no permanent effect on Δd i.e. $\theta_{12} = 0$. This economic constraint is shown out of the matrix $\theta(1)$ in what follows:

$$\theta_\infty := \theta(1) = \begin{bmatrix} \theta_{11} & \theta_{12} \\ \theta_{21} & \theta_{22} \end{bmatrix}, \quad \varepsilon_t := \begin{bmatrix} \varepsilon_{\Delta d_t} \\ \varepsilon_{\Delta s_t} \end{bmatrix}, \quad \Delta X_t := \begin{bmatrix} \Delta d_t \\ \Delta s_t \end{bmatrix} \tag{10}$$

In this framework, the test of REH consists in ensuring whether $\theta_{21} = 0$ or $\theta_{21} \neq 0$. Actually, when we use short term constraints of identification in the basis of an economic analysis, primarily we do not need to introduce long run constraints such as the absence of effect by saving shocks on budget deficit rate; and secondly, we let the matrix of dynamic multipliers interact freely and completely in the long run. When we suppose that $\theta_{12} = 0$ we lessen the memory of the saving series in the long run.

[7] We have used the Gauss program to resolve this non-linear system by the procedure NSYS.

When the long run effect of shock $\varepsilon_{\Delta d}$ on the variable Δs divided by its effect on the variable Δd varies between 0 and 1, then national saving and notably the private saving partly compensates the changes in budget deficit when $\theta_{12} = 0$ in the case of long run constraint or when $s_{12} = \alpha\ s_{21}$ in the case of a short run relation.

The REH also allows to infer that the private agents are short-sighted in the short run i.e. $s_{21} = 0$, but this conjecture is not necessarily true especially since the idea represents a constraint on instantaneous multipliers of matrix *S*. Synthetically, the REH can be summed up into three following types:

- In the long run, when the public saving shock can be modified in the same account as the additional budget deficit, then $\frac{\theta_{21}}{\theta_{11}} = 1$ i.e. the private saving remains constant. Therefore, the REH is rejected.
- When the private saving does not react to budget shock, then $\frac{\theta_{21}}{\theta_{11}} = 0$ i.e. the private saving fully compensates public saving fluctuations ($\theta_{12} = 0$)[8]. Thus, the REH is accepted.
- When the public saving shock cannot be modified exactly in the same account as the additional budget deficit, then $0 < \frac{\theta_{21}}{\theta_{11}} < 1$. Therefore, the REH is partially verified.

This view of REH reinforces the interpretation that the interactions between the public deficit and the private saving are determinant in the increase of real interest rates.

4. Empirical results of SVAR model

The data used covers the last three decades 1970-2001, and contains national and foreign events and shocks of Moroccan economy. After the usual tests in the second section, we apply the REH test by estimating the reduced form i.e. VAR model. Once we determine the matrix of long run structural multipliers:

$$\theta_{\infty} = \begin{bmatrix} 0.022278 & -0.004849 \\ 0.002307 & 0.016915 \end{bmatrix},$$

it becomes clear by the occurrence of a positive budget deficit shock with an increase of one point, the long run response of saving tends toward a structural increase fairly higher than 0.23%. In the same way, the occurrence of positive shock of national saving yields a structural effect on the budget deficit rate, for the response of this deficit will tend to a long run decrease. This result constitutes an acceptable hypothesis in the economic

[8] Generally, we can use the following formulae to compute the compensation rate: $0 \le 1 - \frac{\theta_{21}}{\theta_{11}} \le 1$.

theory.

Concerning the statistical characteristics of SVAR model variables where the structural residuals are orthogonal, it is important to note that the theoretical effect of budget deficit shocks is clearly emphasized in the above economic typology. After the estimation of structural multipliers, it is now possible to make the following interpretation (see Figure 2 below):

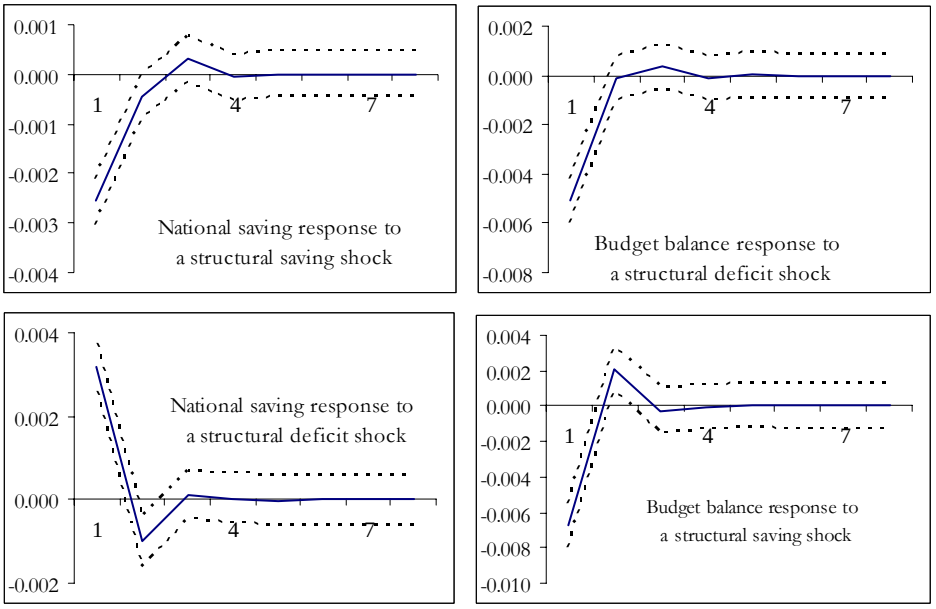

Figure 2. Structural Responses functions to shocks

there exist positive then negative permanent effects on the saving rate (i.e. transitory and decreasing effects in first differences of saving rate Δs). Also in the budget deficit with decreasing positive effects which relatively reduce the deficit rate. Moreover, as the private saving rate interact with delayed changes in the fiscal situation of the government, we make long-run-responses analysis of saving rates following a negative budget shock i.e. here a positive shock of government's deficit.

The interpretation of the function of responses to shocks allows us to apprehend the far-reaching successive effects i.e. the dynamic multipliers according to economic literature. It appears that the dynamic multiplier of saving shrinks faster than the dynamic multiplier of budget deficit. During the second year of horizon (see Figure 2) and as a consequence of a structural negative shock in the public budget of government, national saving is reduced around 0.002 point, because of an increase in the public debt and this reduction decreases progressively. As for the long run cumulative response of national saving (see Figure 3 below), it tends toward 0.0023 after three years, showing that national saving mainly the private one, compensates $1-\frac{0.002307}{0.022278}$ that is a rate of 89.6 percent of a budget deficit supplementary level due to a negative budget shock.

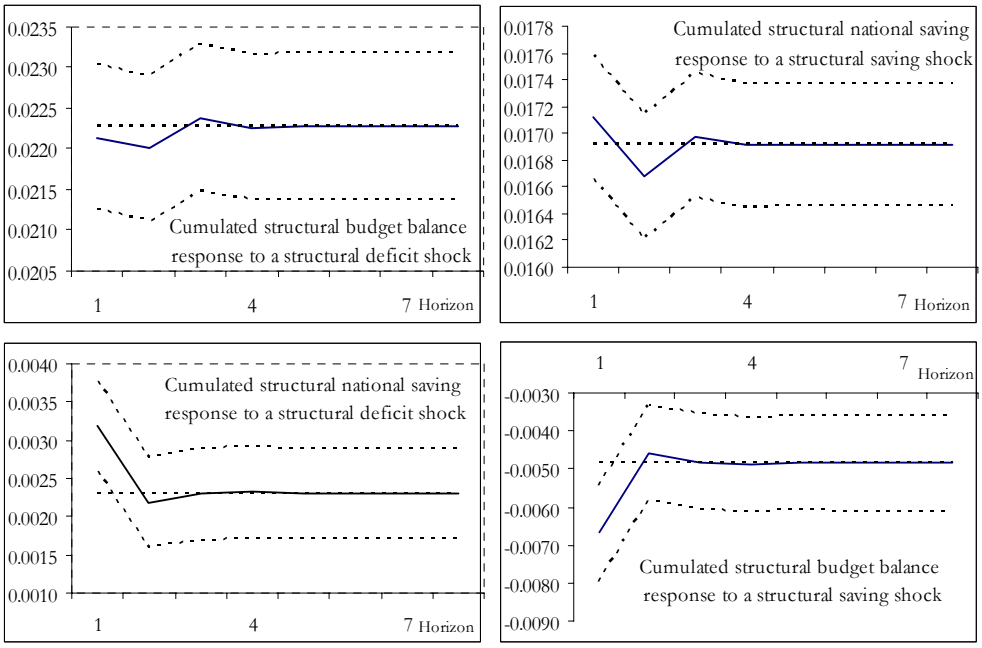

Figure 3. Cumulated Structural Dynamics multipliers

In the OECD countries, the study of Doménech *et al.* (2000) shows that short run national saving falls by one point because of a negative fiscal shock i.e. a positive shock in the government deficit. The long run response of national saving is around 0.8 point. They have concluded that national saving compensates only 40 percent of the public deficit increase, whereas the effective rate of compensation must be lower than 0.4.

Contrary to the present research, the preceding study (Doménech *et al.*, 2000) suggests that the permanent changes of national saving do not affect the government budget in the long-term i.e. $\theta_{12} = 0$. So, if we accept this hypothesis we will overestimate the rate of compensation (compare respectively the elements of constraint and non-constraint matrix θ_{∞} and $\theta_{\infty,c}$).

If we suppose that $\theta_{12} = 0$ then we exclude the long run structural interaction between a positive shock in the saving rate and the future value of deficit rate. In the case of non-industrialized countries such as Moroccan, the compensation rate which attains 105.9 percent is overestimated compared to non-constraint case:

$$\theta_{\infty,c} = \begin{bmatrix} -0.022799 & 0.000000 \\ 0.001344 & -0.017019 \end{bmatrix}$$

However, the growth of saving rate is generally related to the increase of income, which inevitably leads to the rise up of fiscal receipts of government, and then influences the budget deficit rate. It follows then, as indicated above, that the most efficient estimation of compensation rate is the one that does not constraint the long run multipliers.

The Figures 2 and 3 show the most important results, because they sum up the empirical application of this study. It is clear that according to the cumulative responses

which stem from successive shocks with a long-lasting effect, saving rate is interactive with deliberate or involuntary shocks occurring in the budget deficit of Moroccan government. Therefore, the REH is subtly checked. This is so because the average compensation of this deficit by national saving in the long run is nearly 90 percent[9]. This is supported by an increasing rate of interior debts which covers the financing of public deficits, growing from 30% of national income during the last years of 1990's to 50% during the beginning of the third millennium.

The effect of short run finance policy shocks on the saving may be transitory (as is the case of most demand shocks). It is also related to households' behaviour according to the Ricardo Neutrality RN[10]. The identification procedure that we have used is not directly based in this hypothesis, at least in its short run facet. However, we do not suppose an absence of long run effect of saving rate on budget deficit rate, and this influence seems to reduce the public deficit to 0.5 percent.

In this paper and from the matrix *S*, the identification mode is not based on the neutrality constraint in the short run at each budget shock in saving. We reach the RN by the SVAR model because $\theta_{12,0} := s_{12} \approx 0$. Similarly, structural shocks in saving behaviour do not indicate any instantaneous effect on the deficit rate of the government, because we have $\theta_{21,0} := s_{21} \approx 0$.

We should not assume that a restrictive finance policy described in public budgets cannot have long run effects on saving. As variations in the available income may not influence consumption immediately i.e. the immediate repercussion can occur at the saving level; this shows that the available income is a crucial determinant in the ongoing of budget deficit and saving. The persistence of a transitory shock is therefore more probable, for the conjunctural events also have long run effects displayed permanently in the structural tendency. This persistence is so important in that conjunctural deficit contains all past fluctuations in the saving efforts linked to economic growth.

Likewise, systematic policies relative to the economic cycle can be attributed to conjunctural deficit. It follows then that structural deficit obtained corresponds to a gap in budget policy relative to an average behaviour in managing public finance. So, in this case, it does not make it possible to evaluate the size of automatic stabilizers i.e. it is not certain that the growth of public deficit will incite a revitalization of the economy.

In the same way, it is not possible to take some discretionary measures without global coherence and without taking into account the financial sustainability of a new public deficit (throughout exterior debts and mainly interior debts). These discretionary measures converge more with the conviction of several studies conducted by the international finance institutions, lies essentially the aim of recuperating their debts. The liberalization of financial market by eliminating the input barriers for the newly innovative finance products might increase the public deficit in the short term, but it may reduce it simultaneously by attracting the investments and activating foreign trade.

[9] Accordingly, when we take away any observation from the sample, the long run response of national saving seems more robust.

[10] With the RN, the behaviour of saving does not react to effects of deficit shocks even in the short run.

5. Bootstrapping

The SVAR model takes into consideration the economic dynamic between the budget deficit rate and the national saving rate. By means of this model we generate the explanatory simulation deduced essentially from structural shocks. These shocks would be explicit when we impose economic constraints of identification to specify the model. Similarly, these structural shocks incorporate in average the observed events and allow the specification of the evolution of described variables.

In order to control the robustness of results at any probable change in the elements of residuals of VAR and the effect of innovation on these residuals, it seems important to use the bootstrapping. This technique consists in realizing the simulations by N replications in the empirical distribution of residuals $(\varepsilon_s, \widetilde{\varepsilon}_d)$ with $N = 10,50,100,300,500,5000$ (see Figure 4); doing that helps to obtain a significant confidence interval for the compensation rate of the budget deficit increase by national saving in the long run.

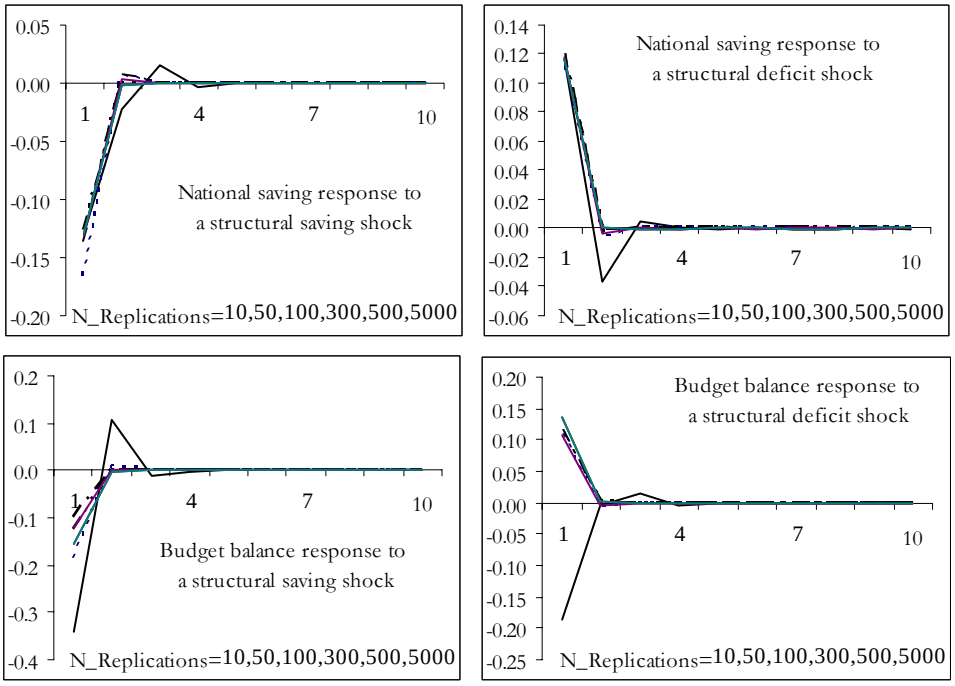

Figure 4. Bootstrapping the Function of Responses to Shocks

The calculation shows that this compensation rate varies between 89.3% and 90.4%, which indicates that our sample is relatively homogenous. The analysis of sensitivity of long run responses of the national saving to a negative shock in the government budget shows that the long run response remains relatively constant during the first three years of the horizon and stable in the long run. We notice that the bootstrapping confirms the evolution of the functions of responses to shocks except the response of the deficit to fiscal policy shock during the first year of the temporal horizon. This is notably due to the matrix of the estimated parameters and to the nature of original sample. Even if we use the estimation by 2SLS, SUR or GMM, the results do not change

and the estimated parameters keep the same signs and nearly the same values.

6. Conclusion

With the aim of evaluating the extent of the public deficits responsibility for the deficiency in the saving rate, this paper shows an estimation of this deficiency from SVAR model stand point without imposing any constraint in the long run parameters, because constraints generate a bias in the compensation rate. On the basis of the cumulated structural dynamic multipliers, it appears that the permanent shocks of saving, notably during the eighties and nineties, influence the government's budget permanently, and reduce the budget deficit rate to 0.5 percent in the long run.

The results indicate that the abrupt occurrence of shocks which increases the budget deficit of government lead to a process of compensation by national saving and mainly the private saving. This compensation of the growth in the public deficits levels reaches nearly 90 percent. This result is confirmed by a growth of the interior debt rate to satisfy the financing need of budget deficits. Similarly, the result does not seem surprising, as it reveals partially the fact that the current budget deficit and the historical long run deficit are the factors in explaining the nominal level of interest rate and the low level of saving efforts, and the process of compensation can be neutralized. Out of these interactive and dynamic processes spring up negative effects on the national wealth, on the economic growth and on the level of employment in the short run and particularly in the long run.

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