# The Calculation of Structural Budget Balance: Case of Morocco

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**ABSTRACT**: In this paper, we present the concept of the structural budget balance and its empirical application on the Moroccan data. For this, we choose the *two-step method*. In the first step, we estimate the potential production according to Hodrick-Prescott's method, obtaining the output gap value. This allows us to identify the business cycles of the Moroccan economy during the period 1980-2011. In the second step, we evaluate the sensitivity of the fiscal revenue and the public expenditure to economic activity. The obtained results show that the sensitivity of the fiscal revenue and the public expenditure are very low. We deduce that the budget balance in Moroccan economy is mainly structural and less sensitive to the business cycle.

**Keywords:** Budget balance; Structural budget balance; Hodrick-Prescott method; Potential production
**JEL Classifications**: E62; H62

## 1. Introduction

The budget balance is defined as the difference between total government revenue and its expenditures. It could be a surplus, balance or deficit. It is considered as the main indicator to appreciate the stance of the fiscal policy. It is analyzed as the sign of the presence or absence of an expansionary fiscal policy. Indeed, an important deficit means that the government pursues a Keynesian economic policy based on the expenditure, while a moderate or nil deficits indicates the use of a budget austerity, supported by the advocate of a modest State (Monnier and Tinel, 2006).

Indeed, the change in a budget balance can be due not only to the Government actions but also to the fluctuations in an economic activity. Thus, in a recession phase, the household incomes and the companies profits decrease, the taxes revenue turndown and hence the budget deficit becomes very wide. In the converse, for an expansion phase, the tax revenues related to value added tax (VAT), the income tax (IR) and corporate tax (IS) increase, which provide a positive budget balance.

Hence, we distingue two notions of fiscal balance: *the structural budget balance* and *the cyclical budget balance*. The first results from the deliberate actions of the public authorities while the second is due to the fluctuations of the economic activity.

This article aims to estimate the structural budget balance in Moroccan economy. For this, we use an approach known in the literature as *two-step method*, which is used by the international organizations (EU, IMF, and OECD)[1]. Its calculation allows us to estimate the impact of fiscal policy on the macroeconomic variables such as global domestic production (GDP) and household consumption. Thus, in the second Section, we present our methodology for calculating the structural budget balance and in the third Section, we give our application. Forth Section concludes.

## 2. Methodology of Calculating the Structural Budget Balance

To calculate the structural budget balance, we use the two-step method, proceeding in two steps. The first step evaluates the potential production while the second step aims to estimate the budgetary elasticities of revenue and expenditure regarding to the economic activity changes.

### 2.1. Evaluation of the potential production

The potential production is defined as the maximum level of production in a long term under low unemployment level and without inflationary pressures (Okun, 1962, Cadoret et al., 2004). Its fluctuation is called Output Gap, which is equal to the relative difference between actual GDP and

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[1] European Union (EU), International Monetary Fund (IMF) and Organization for Economic Cooperation and Development (OECD).

potential GDP. Generally, the Output Gap is used in an environmental scan; it allows identifying the different cycles of economic growth.

Therefore, if an effective production is greater than a potential production (output gap positive), then there is a pressure on the capacity of production factors and hence an excess demand, which generate inflationary pressures. In the other hand, if an effective production is smaller than a potential production (output gap negative), then this implies that there is a partial use of the production factors and hence an excess offer, which generate disinflationary pressures.

However, the potential production is an unobservable variable; hence it requires for its calculation many statistical and theoretical assumptions. To evaluate it, there are in the literature two methods: The first method extracts the trend of GDP by using a purely statistical approach, it is called *univariate method*. It uses the smoothing technique of moving averages that needs only the GDP series information. This means that the effective GDP gravites around to the potential GDP in a long period (Clerc, 2002). Note that this method contains several techniques like those of Hodrick and Prescott (1980), Beveridge and Nelson (1981), Harvey (1989) and Baxter and King (1995). Nevertheless, these techniques have two major inconvenient [2]. The first inconvenient appears in the case of a sudden rupture of the trend when a chosen technique will smooth the potential production on several years without taking into account the trend break. The second inconvenient occurs in the *extreme points* where the trend value cannot be calculated by the moving average technique. One of the ways to resolve the extreme point's problem is to prolong artificially the time series by using some forecast methods.

The second method formalizes the production function, it is known as *structural method*. It often identifies the production's factors like the labor and capital factors, and specifies the production functions like the Cobb-Douglass or Leontief functions and estimates their parameters by using some statistical inference's methods. This method also appears to be theoretically more robust than the non-structural methods, because, it incorporates the behavior of agents and the constraints of the production factors. Nevertheless, it is more complex than the univariate method because the empirical implementation of such production function requires a considerable effort (Chagny and Döpke, 2001).

Among the methods cited above, we have opted for the Hodrick-Prescott technique (Hodrick, 1997). Our motivation for this technique is justified by its simple way to be implemented compared to other methods, which require more information and assumptions relating to the economic interrelationships. Moreover, the Hodrick-Prescott technique is largely used by the international institution like the EU and the IMF (Hedwig and Werner, 1997; Tanimoune et al., 2008).

## 2.2 Evaluation of budgetary elasticities

### 2.2.1. Evaluation of fiscal elasticity

The second step for our methodology is to evaluate the fiscal and expenditure elasticities to economic activity. For this, we use the ordinary least squares (OLS) method which involves the government revenue relative to the GDP (in logarithms):

$$Log(R) = \eta_r \cdot Log(Y) + \nu \qquad (1)$$

Where R represents the public revenue and Y denotes the effective production which is measured by the GDP. In the following, we give the fiscal elasticity that is equal to the OLS estimator:

$$\hat{\eta}_r = \frac{\Delta Log(R)}{\Delta Log(Y)} = \frac{\Delta R/R}{\Delta Y/Y} \qquad (2)$$

### 2.2.2. Elasticity of public expenditure

Regarding to the public expenditure, we can pointed out that their main components [3] are naturally invariant in relation to economic activity fluctuations. This is mainly due to the incompressibility of the public expenditure and to the lack of the unemployment benefits system in Morocco.

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[2] The advantages and disadvantages of these methods, which carry a comparative analysis, are detailed in (Chagny and Döpke, 2001; Ladiray et al., 2003).

[3] The main components of public expenditure is staff costs, Public debt service, Compensation Fund expenditures which is currently subsidizing the price of the essential consumer goods (sugar, wheat, petroleum products, butane gas) and investment expenditure.

Thus, we consider *a priori* a little sensitivity of the public expenditure to the economic activity $\eta_d \approx 0$. El Ansary (2009) confirms this requirement and illustrates that the public expenditure has a structural nature, and hence their variation is independent to the economic environment. In some developed countries that introduced an unemployment compensation system, the elasticity of public expenditure is often negative. This is because when an economic activity decrease, the unemployment increases and hence its expenditure becomes more important. Conversely, when an economic activity is in the expansion phase, the unemployment rate falls and hence its expenditure decreases.

Once the budget elasticities and the potential production are calculated, we deduce the structural budget balance according the two step approach as follows:

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\begin{aligned}
SBS &= (R - \eta_r \cdot R \cdot GAP) - (D - \eta_d \cdot D \cdot GAP) \\
&= (R - D) - (\eta_r \cdot R - \eta_d \cdot D)GAP \qquad (3) \\
&= SB - (\eta_r \cdot R - \eta_d \cdot D)GAP
\end{aligned}
$$

Where:
- R and D are, respectively, the fiscal revenue and the public expenditure;
- $\eta_r$ and $\eta_d$ are, respectively, elasticities of the fiscal revenue and expenditure to the economic activity ;
- $GAP = \frac{(Y - Y^*)}{Y^*}$ denotes the output Gap ;
- SB is the global budget balance.

## 3. Application of the Method in Two Steps for the Case of Morocco
### 3.1. Estimation of potential production in Morocco

To estimate the potential production in Morocco, we use the Hodrick-Prescott technique. As mentioned above, this method produces a bad result in the extreme points of the series. To close this gap, we extend artificially the GDP series beyond 2011 using the prognostics of the Commissariat for Planning of Morocco [4] for 2012 and 2013.

We model the GDP as an ARIMA (p, d, q) [5] of order p, d and q, which are estimated by the Box and Jenkins methodology [6]. We find that *Log (GDP)~ARIMA (0,1,1)*. Based on this model, we forecast the GDP series from 2014 to 2020. This allows us to restore the GDP series from 1970 to 2020. The application of the Hodrick-Prescott technique for λ=100 [7] value we permit to calculate potential production where its evolution is shown in figure 1(a).

The analysis of business cycle helps to identify the expansion and slowdowns phases in the Moroccan economy. These phases are detected from the sign of the difference between GDP and its potential level [8].

According to Figure 1(b), we can deduce that they are four cycles [9] for the Moroccan economy from 1980 to 2011: the two low cycles are (1980-1987) and (2000-2007) and the two high cycles are (1988-1999) and (2008-2011) [10].

### 3.2. Evaluation of the fiscal elasticity

To estimate the fiscal elasticity, we have largely followed the methodology of Bouthevillain and Garcia (2000). Thus, we have distinguished four categories of taxes: the household income tax (IT), the corporate tax (CT), the value added tax (VAT), and the tax on consumption (TC). These tax

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[4] Exploratory economic budget for 2012 (Commissariat for Planning, 2012).
[5] Autoregressive Integrated Moving Average.
[6] For more detail for this method, see Box et al. (1994).
[7] The choice is often related to the periodicity of the series in question: $\lambda = 100k^2$ where k is the number of period in the year. Thus, λ =100 for annual data (k=1), λ =1600 for quarterly data (k=4), λ =14400 for monthly data (k=12), λ=270400 for weekly data (k=52).
[8] This difference is obtained by using the formula: $OG = \frac{(Y - Y^*)}{Y^*}$ where Y is the effective production and Y* is potential production. A positive output gap is a sign of tension on the production system, while a negative output gap reflects an under-utilization of the factor productivity.
[9] A cycle is a period between two successive troughs.
[10] The low cycle is a period for which the GDP is below than its potential level while the high cycle is a period for which the GDP is above its potential level.

revenues are related to economic activity fluctuations. Other types of fiscal revenue like the customs duty, the registration fees and of stamp and the non-fiscal revenue are neglected; because their variations are not directly affected by the economic environment.

**Figure 1. Evolution of the potential production in Morocco**



(a) : Evolution of potential output in Morocco  (b) Ecart au PIB tendanciel (filtre HP, $\lambda = 100$)
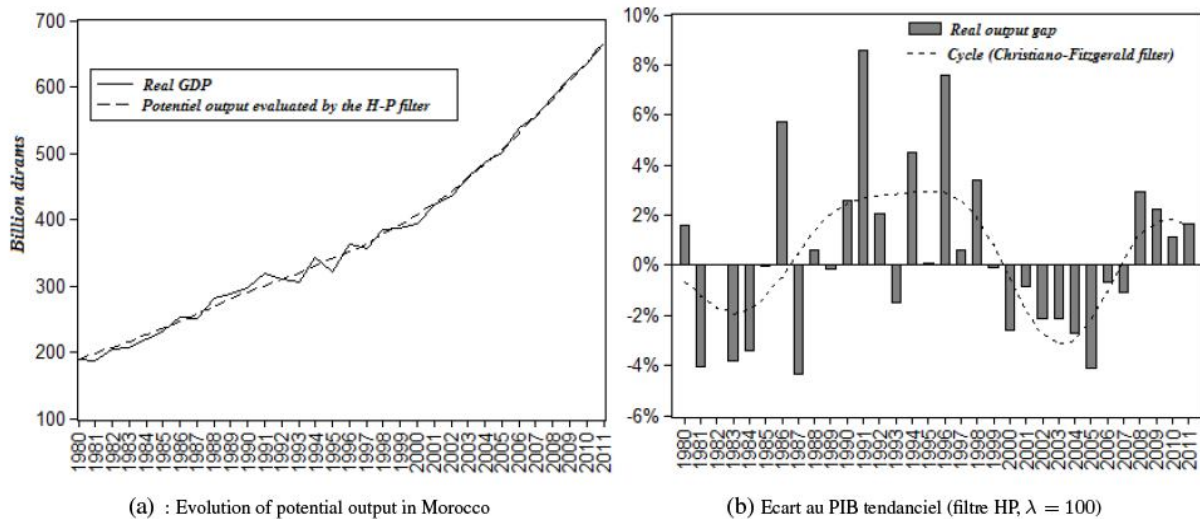
We note that the Moroccan agriculture is exempted from the taxes; hence the fiscal elasticity should be calculated on the non-agricultural GDP. In the following, we provide the regression model for the different types of taxes:

$$\frac{\Delta R_i}{R_i} = \alpha_i + \eta_i \frac{\Delta GDP_{na}}{GDP_{na}} + \nu_i \qquad (4)$$

Where $R_i$: the various categories of taxes, $GDP_{na}$ : the non-agricultural GDP, $\alpha_i$ : a constant terme and $\nu_i$ : the residue.

and :  $\eta_i = \dfrac{\Delta R_i / R_i}{\Delta GDP_{na}/GDP_{na}}$  is the fiscal elasticity for each tax category relative to the non-agricultural GDP.

The results of the estimated parameters for the equation (4) are given in Table 1.

**Table 1. Regression results of different types of taxes on GDP (in logarithms)**

| Tax category | $\eta_i$ | $\alpha_i$ |
|---|---|---|
| indirect taxes, noted $R_{ii}$ | 0.95 | 0.02 |
| direct taxes on businesses, noted $R_{is}$ | 1.35 | -0.002 |
| direct taxes on households, noted $R_{ir}$ | 1.30 | 0.003 |
| other taxes, noted $R_{autre}$ | 2.10 | -0.11 |

In the following, we deduce the estimation of the fiscal elasticity:

$$\eta_r = \frac{R_{ii}}{R_{rf}} \cdot \eta_{ii} + \frac{R_{ir}}{R_{rf}} \cdot \eta_{ir} + \frac{R_{is}}{R_{rf}} \cdot \eta_{is} + \frac{R_{autre}}{R_{rf}} \cdot \eta_{autre}$$

$$= (0.44 \times 0.95) + (0.15 \times 1.35) + (0.16 \times 1.30) + (0.24 \times 2.10)$$

$$= 1.33$$

Where $R_{rf}$ is the total tax revenue.

From this estimation, we conclude that an increase of 1% of the non-agricultural GDP produces an increase of 1.33% of the fiscal revenue. This result illustrates clearly that the Moroccan fiscal system is weakly sensitive to the economic activity.

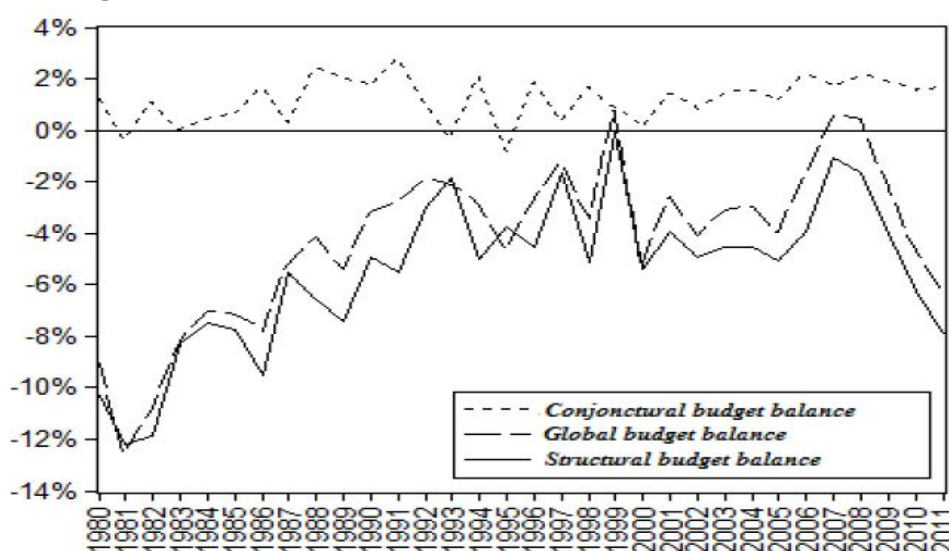### 3.3. Evaluation the structural budget balance

After estimating the fiscal elasticity and the potential production, we shall determinate the structural budget balance. For this, we refer to equation (3) and give the following calculation of SBS:

$$SBS = (R - D) - 1.33 \cdot GAP \cdot R$$
$$= SB - 1.33 \cdot GAP \cdot R \qquad (5)$$

As shown in Figure (2) below, the structural budget balance appears to be closest to the global budget balance. The high level of the structural balance is due to the incompressible nature of the public expenditures, which is mainly constituted by the staff expenditure, the public debt service and the compensation fund expenditures. Also, the highness of the structural balance level is due to the lower elasticity of the fiscal revenue in relation to the economic activities.

Thus, the evaluation of cyclical component of the budget balance is very small [11]. Indeed, during the low cycles i.e., (1980-1987) and (2000-2007), the *cyclical* budget balance is respectively equal (in average) to 0.28% and 0.65% of GDP. Similarly, during the high cycles (1988-1999) and (2008-2011), the *cyclical* component is respectively equal (in average) to 0.66% and 0.71% of GDP.

**Figure 2. Evolution of the SBB, the SB and the SBC in Morocco**



### 4. Conclusion

In this study, we have calculated the structural budget balance via the two-step method. Firstly, we have estimated the potential production using the Hodrick-Prescott technique. Secondly, we have evaluated the first element (fiscal elasticity) of the budgetary elasticities by the OLS method while the second element (expenditure elasticity) is considered *a priori* near to zero. We have found that the budget balance in Morocco is highly structural and is not influenced by the economic environment.

**References**
Bouthevillain, C., Garcia, S. (2000). Limites des méthodes d'évaluation et pertinence du concept de déficit public structurel. Revue Française d'Economie, 15(1), 106–107.
Box, G.E.P., Jenkins, G.M., Reinsel, G.C. (1994). Time Series Analysis, Forecasting and Control. Prentice Hall, Englewood Clifs, 3rd edition.
Bruno, C. (1999). Les déficits publics en Europe: suggestions pour un nouvel indicateur de l'orientation de la politique budgétaire. OFCE, 1999-05.

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[11] Cyclical component of the budget balance results from the difference between the global budget balance and the structural budget balance.

Cadoret, I., Benjamin, C., Martin, F., Herrard, N., Tanguy, S. (2004). Econométrie appliquée : Méthodes, Applications, corrigés. De Boeck, Bruxelles, Belgique.

Changny, O., Döpke, J. (2001). Measures of the output gap in the euro-zone: An empirical assessment of selected methods. Working paper 1053, Kiel Institute for the World Economy.

Clerc, L. (2002). PIB potentiel, écart de production et politique monétaire. Bulletin de la banque de France, No: 103, 93-103.

El Ansary, A. (2009). Evaluation de la soutenabilté de la politique budgétaire au Maroc. Thesis for access to chief engineer, Ministry of the Economy and Finances, Morocco.

Hedwig, O., Werner, R. (1997). Les estimations de l'écart de production de la Commission Européenne. Economie Internationale, 69, 77–95.

Hodrick, R.E.P. (1997). Post-war U.S. business cycles: an empirical investigation. Journal of Money, Credit and Banking, 29, 1–16.

Ladiray, D., Mazzi, G.L., Sartori, F. (2003). Statistical methods for potential output estimation and cycle extraction. Working Papers and Studies, European Commission.Association (1962).

Monnier, J.M., Tinel, B. (2006). Endettement public et redistribution en France. Cahiers de la maison des sciences économiques, 6006.

Okun, A. (1962). Potential GNP: Its measurement and significance. American Statistical Association.

Tanimoune, N.A., Combes, J.L., Plane, P. (2008). La politique budgétaire et ses effets de seuil sur l'activité en Union Economique et Monétaire Ouest Africaine (UEMOA). Economie & Prévision, 5(186), 145–162.