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THE CYCLICALITY OF FISCAL POLICY IN BOLIVIA

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ABSTRACT

This paper analyzes the performance of fiscal policy in Bolivia in years 2003-2015. To this end, the structural fiscal balance and the fiscal impulse are calculated with the aim of characterizing the expansive or contractive nature thereof and determining whether the fiscal policy in recent years has been procyclical or countercyclical relative to evolution of the economic cycle. The findings suggest that the fiscal policy in Bolivia was contractive over years 2003 to 2008 and expansive in the period 2009-2015. Moreover, compared to the economic cycle the fiscal policy was countercyclical from 2003 to 2012, procyclical in 2013 and 2014 and countercyclical in 2015. These results are maintained when using information from the Non-Financial Public Sector (NFPS) or of the Treasury, different classifications of the fiscal accounts or when approximating the non-hydrocarbons fiscal balance. Additionally, the paper highlights the heterodox nature of Bolivia's fiscal policy and identifies public investment as a countercyclical fiscal policy instrument.

Classification JEL: H61, E62, E32
Keywords: Structural Fiscal Balance, Fiscal Impulse, Cyclicality of the Fiscal Policy

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I. INTRODUCTION

The economic vision on the fiscal policy has gone through significant changes in recent years. The discretionary expansionary fiscal measures responded adequately during the financial crisis in 2008-09, thanks to which the fiscal policy became a relevant and important policy instrument to counter international shocks, Hernández (2010).

For natural resource-exporting countries, the fiscal policy is a fundamental factor explaining the relationship between the commodity price and economic growth. According to El Anshasy (2012) and Collier et al. (2010), in these countries the fiscal policy determines the way in which the revenues from the sale of these resources are administered as well as the effectiveness to turn this income into economic growth during periods of high prices and to maintain the levels of desired growth in periods of low prices.

One of the relevant topics mentioned in literature when making an assessment of the role of fiscal policy is to know how it responds to changes in the economic cycle. There is a general consensus in literature concerning the normative prescription of an optimal countercyclical pattern of the fiscal policy, i.e. during an economic boom public spending should be lowered (because of the automatic stabilizers), the government revenues should rise and, consequently, the fiscal surplus should increase. During slowdowns, a countercyclical policy would expand public spending and increase fiscal deficits when the aggregate demand declines. A procyclical fiscal policy, on the other hand, would exacerbate the cycle and create distortions in the economy, among which lower growth rates, and a greater volatility and inflation, McManum and Ozcan (2015).

In theory, effectiveness of the fiscal policy to accomplish economic growth is a long-standing topic of debate in economic thinking – see Ramey (2011) for an overview[1]. Nonetheless, the message of using fiscal policy as a countercyclical instrument is not the sole domain of Keynesian or neoclassical models, since the theoretical considerations of both economic schools suggest that strengthening the economic cycle with fiscal expansions in good times and contractions in bad times is not the optimal path. In a neoclassical setting, an optimal fiscal policy would entail constant tax rates throughout the economic cycle in order to minimize the costs resulting from distortive taxes (Barro's tax smoothing hypothesis, 1979). With regard to the cyclical behavior of fiscal spending, the neoclassical recommendations are less exact in view of their skepticism as to spending as an effective policy instrument. Ilzetzki and Vegh (2008) analyze scenarios in which the optimal behavior of expenditure could be either procyclical or countercyclical and they conclude that for the neoclassical approach public spending should be acyclical. On the other hand, in a Keynesian world, price rigidity implies immediate and incomplete price adjustments in

[1] An expansionary fiscal policy within a Keynesian perspective would stimulate both consumption and private investment, increasing the aggregate demand and output. From a neoclassical perspective, only unanticipated policies could have an impact on the aggregate demand; otherwise, the fiscal policy would lower consumption and output due to rational expectations, intertemporal substitutions and flexible prices. In addition, according to classical approaches the pressure on prices resulting from the fiscal impulse may increase interest rates and bring down private investment; see the fiscal theory of the price level developed by Leeper (1991), Sims (1994) and Woodford (1995).

response to fluctuations in demand; thus, a countercyclical fiscal policy would be helpful for the economy to adjust faster to such fluctuations, Halland and Bleaney (2009).

In this regard, for developing countries evidence suggests a propensity to apply procyclical policies[2], while in developed countries the fiscal policy tends to behave in a countercyclical manner, Ilzetzki and Vegh (2008). However, more recent evidence suggests a shift in the trend towards the application of countercyclical policies in developing countries, see Klemm (2014) for the case of Latin America and Lledó et al. (2009) for Africa.

In Bolivia, following years of economic austerity and a passive fiscal policy, as from 2006 and as a result of the natural resource nationalization, the fiscal policy is playing a more prominent role. This is within the framework of the so-called Economic Social Communitarian Productive Model (MESCP, in Spanish), one of the primary foundations of this model is the active participation of the state in the economy as the agent responsible for administering the surpluses from strategic sectors, and the distribution thereof to the income and employment-generating sectors and directly to the population. In this manner, for the Bolivian economy fiscal policy has become one of the main development instruments.

Ten years after this change in Bolivia's fiscal policy approach, this paper aims to assess the performance thereof. Accordingly, it considers that the fiscal variables, and therefore the results of the government accounts, vary in response to both discretionary policy actions and the automatic impacts derived from changes in macroeconomic conditions. This simultaneity in fiscal account movements, resulting from policy decision-making and exogenous factors, creates problems for the formulation and interpretation of the fiscal policy. For example, in the event of a fiscal deficit due to a period of economic contraction, it would be necessary to identify whether this was the result of a deliberately expansionary policy or of a declining tax base as a result of factors beyond the authority's control. In case of a fiscal deficit caused by cyclical changes in GDP, one may have the incorrect impression that automatic stabilizers should be implemented to correct the deficit, when the concern should focus on the growth cycle rather than the adjustment scenario. Thus, a restrictive fiscal policy may lead to an excessive adjustment of public finance, creating a deeper negative impact on growth. On the contrary, if the deficit can be attributed mainly to structural reasons, for example an excessive spending rhythm, the fiscal authority should take the necessary measures and use the available instruments for correcting the situation. In view of this simultaneity, the structural balance approach is adopted to distinguish cyclical or transitory movements from more permanent changes resulting from the authority's interventions.

In turn, for these findings to be of practical use in the formulation, analysis and evaluation of the fiscal policy, it is necessary to link the said discretionary component to performance of the economy. In order to analyze the fiscal policy stance in relation to economic performance, the *fiscal impulse* is calculated, as an indicator of the additional fiscal stimuli provided by a government's public finance to incentivize or contract the economy at each point of the economic cycle.

[2] Alesina et al. (2008) and Ilzetzki (2011) suggest that credit market restrictions and political factors are the main factors explaining the procyclicality in these countries.

It is important to analyze the fiscal impulse since the attempts to balance public finance at a given point of the economic cycle may in turn enhance the depth and extension of the cycle. For example, if during a downturn an attempt is made to offset the fall in tax collection caused by the lower activity level through expenditure cuts or higher taxes, the government will contribute to a further tightening of the aggregate spending and to deepening the recessive cycle. Using the fiscal impulse indicator, it is possible to identify this procyclical bias, stating that the policy decisions respond to the real needs of macroeconomic stabilization.

The general framework used to calculate the structural balance and the fiscal impulse in Bolivia is the conventional methodology proposed by Hagemann (1999), Fedelino et al. (2009) and Bornhorst et al. (2011). Some applications of this approach can be found in Marcel et al. (2001) for Chile, Gay and Escudero (2010) for Argentina, and Lozano and Toro (2007) for Colombia.

The results obtained in this paper show that in general terms, the fiscal policy was contractive in 2003-2008 and expansionary from 2009 to 2015. Furthermore, making a comparison to the economic cycle, it is found - that the fiscal policy was procyclical from 2003 to 2005, countercyclical from 2006 to 2012, procyclical in 2013 and 2014, and countercyclical in 2015. These results were obtained by using the fiscal accounts of the Non-Financial Public Sector (NFPS).

In Bolivia, there is no consensus in the literature about the direction of the fiscal policy impact on the economic cycle. Different authors reach different conclusions, depending on the period covered by the analyses and methodological details. Frankel et al. (2012) and Puig (2015) make an assessment of the correlation between the cyclical component of the expenditure and the Gross Domestic Product (GDP); the former concludes that the fiscal policy in Bolivia was countercyclical from 2000 to 2009 while Puig (2015) points out that it was acyclical between 1990 and 2013. Within the framework of structural balance calculations, reference is made to the work of Zambrano and Aguilera (2010), Valdivia and Loayza (2012), Velasco and Bernal (2014), and Banegas and González (2015). Zambrano and Aguilera (2010), and Banegas and González (2015) provide more details about implementation of the structural balance methodology; in general, both papers agree that the fiscal policy in 2003-2012 initially displayed a contractive behavior (2003-2004), followed by an expansionary phase (2005-2009) and then again a contractive phase (2010-2011), albeit that the exact dates vary[3]. With regard to the direction of the fiscal policy, both documents suggest that on average Bolivia's fiscal policy was neutral in 2003-2006, procyclical in 2007-2009 and neutral in 2010-2011.

The lack of consensus as to the fiscal stance in the cycle for the Bolivian case points to the need for addressing the matter with greater methodological rigor. In summary, the differences in the findings of this paper vis-à-vis previously obtained findings for Bolivia are caused by taking into account the following generally omitted details: (i) the elasticities are obtained by using methods that keep in mind the endogeneity bias, (ii) the potential output is the average of applying three methods (the Hodrick-Prescott filter, the Kalman filter and the production function), (iii) to deal

[3] The analysis made by Zambrano and Aguilera (2010) only takes into account years 2003-2009.

with volatility, the long-term oil price is obtained through moving averages (IMF, 2012), (iv) all fiscal accounts are subject to an evaluation of the existence of two cyclical components, one of the output and another one of the oil price, (v) capital spending is not automatically deemed to be structural; it has a cyclical component as well, and (vi) a real structural balance is considered, using the deflator of public expenditure.

It should be underlined that the results obtained in this paper are maintained when using the fiscal accounts of the Treasury (TGN) or when considering a different classification of the NFPS fiscal accounts, following the work of Banegas and González (2015). In both cases, the overall findings do not change. Likewise, the robustness analysis is based on an approximation of the Non-Oil Structural Balance, in line with the suggestions found in Medas and Zakharova (2009), and Villafuerte and Lopez-Murphy (2010).

Moreover, public investment as a contemporary countercyclical fiscal policy instrument is identified and there is a discussion on the heterodox nature of the fiscal policy to the extent it is an active economic policy instrument to deliver growth.

The remainder of this paper is structured as follows: the next section briefly characterizes the fiscal policy in the last few years; the third section calculates and analyzes the structural balance; the fourth section sets out the estimated fiscal impulse; the fifth section analyzes the results and characterizes the heterodox nature of the fiscal policy in Bolivia. Finally, the sixth section has the conclusions.

II. CONTEMPORARY FISCAL POLICY IN BOLIVIA

In the early years of the previous decade, the fiscal policy was characterized by its passiveness or inexistence since the austerity of the fiscal accounts limited its action capacity and the state was incapable of satisfying the demand of a country with many needs. On average, the fiscal deficit of the NFPS in percentage of GDP in years 2000-2005 was -5.8% per annum, while the annual average growth rate of total expenditure in percentage of GDP was -1.0%.

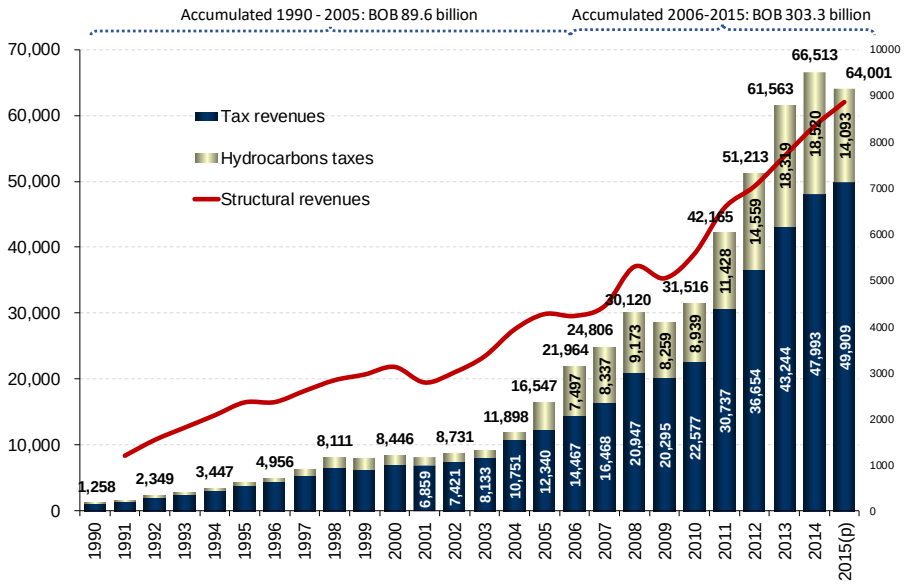
As from 2006, the state takes on a fundamental role in economic development of the country as the agent responsible for administering the surpluses from strategic sectors, distributing them to the so-called income and employment generating sectors and directly to the population. In this way, Bolivia's fiscal policy became one of the primary instruments for developing its economy. For comparative purposes, it should be noted that the average annual fiscal surplus of the NFPS in percentage of GDP in years 2006-2015 was 0.4%, while the annual average growth rate of total spending in percentage of GDP was 5.1%.

Additionally, the greater dynamism of the fiscal policy is explained by and, in turn, expressed in the noteworthy growth of fiscal revenues, which is attributed to the following factors: (i) the greater dynamism of the country's domestic economic activity, which led to higher levels of consumption[4]

[4] A proxy to assess consumption consists of considering the value of the sales and/or services invoiced in restaurants, supermarkets and the air transportation of passengers and cargo, which increased from USD 78 million in 2000 and USD 138 million in 2005 to USD 1,239 million in 2015. Source: Internal Revenue Service (SIN, in Spanish).

and investment[5], generating new and more revenues which in turn allowed a higher tax collection. In this sense, it should be noted that in 2006-2015 non-hydrocarbons tax revenues of the General Government[6] totaled BOB 303.3 billion, i.e. 3.4 times more than in 1990-2005 (BOB 89.6 billion), see Graph 1. (ii) The greater administrative efficiency of the tax collection entities also explains the increasing fiscal revenues; in this regard, the red line measured on the right-hand axis of Graph 1 shows the structural real non-hydrocarbons tax revenues, i.e. adjusted to the cycle, in line with the methodology applied in the document (section III)[7]. This variable can be seen as a proxy of the efficiency in tax collection to the extent it matches the level of collection dissociated from the cyclical factors with an impact thereon, factors related to the economic activity and the oil price. The upward trend of this variable suggests an increase in the efficiency of tax collection in recent years. (iii) The higher fiscal revenues are also the result of the revenues generated by the State-Owned Enterprises[8]. Of note is that in 2006-2015, the latter generated BOB 400 billion in revenues and paid BOB 106.9 billion in taxes, according to information from the Ministry of Economy and Public Finance (MEFP).

Graph 1: Non-hydrocarbons tax revenues of the General Government (Millions of bolivianos and millions of bolivianos of 1990)



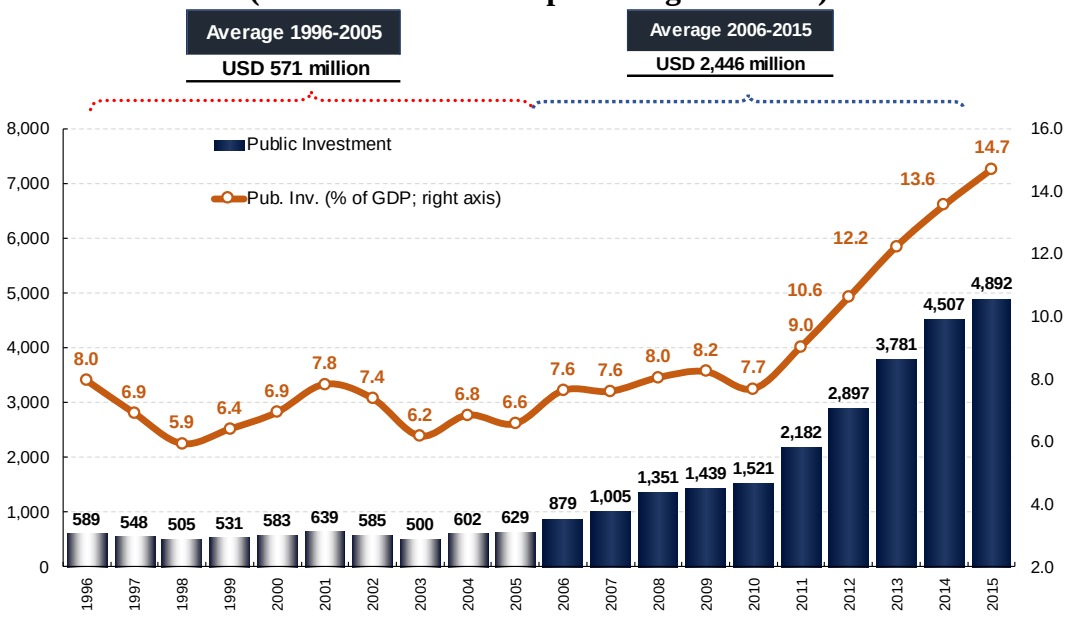
Source: Prepared by the author based on data from the Ministry of Economy and Public Finance.

On the expenditure side, the greater dynamism of the fiscal policy was evidenced from the following: (i) the prioritization of public investment, with the aim of ensuring a greater dynamism of the national economy and strengthening the productive capacity (see Graph 2), which was in turn used as a countercyclical policy instrument. See Annex 2 for evidence. (ii) Likewise, current

[5] Note that, for example, the number of private companies grew from 64,632 in 2005 to 272,249 in 2015, i.e. 20,762 new companies per year, according to information provided by Company Register FUNDEMPRESA (Fundación para el Desarrollo Empresarial).
[6] Note that the General Government accounts do not include the State-Owned Enterprises.
[7] The elasticities pertaining to column one of Table 1 were used for the adjustment.
[8] Annex 1 details the names of the universe of SOEs to date.

spending has been focused on strengthening the domestic demand, with the aim of generating a virtuous cycle between this spending and the productive sector, on the premise that the variations in the demand for consumer goods be translated into broader variations of the demand for means of production, which is also known as the accelerator principle[9]. Thus, the fiscal policy invigorated the domestic demand through increases of the national minimum wage and inversely proportional wage increases, primarily through income redistribution[10]. This was done through the implementation of conditional cash transfer programs, targeting the most vulnerable social sectors, which did not only stimulate the domestic market but which also had a significant impact on poverty reduction[11]. In this regard, it should be noted that the national minimum wage of 2005 was BOB 440, which rose to BOB 1,656 in 2015, i.e. a variation of 310%; in real terms, the national minimum wage rose by an average annual rate of 7.9% between 2006 and 2015. Moreover, in the same period as part of the redistribution policies 4.8 million people (45% of the Bolivian population) were benefited through the allocation of a total amount of approximately BOB 20.6 billion, according to data provided by the Authority for Supervision and Control of the Pension and Insurance Sectors (APS, in Spanish).

Graph 2: Executed Public Investment, 1996 – 2015
(Millions of USD and percentages of GDP)



Source: Prepared by the Ministry of Economy and Public Finance.

[9] References in the texts suggest that this theory emerged in the work of Clark (1917).
[10] This policy is a fundamental pillar of the contemporary economic policy and is based on the premise that economic growth disconnected from a greater equality or a better income distribution will not generate sustainable development in the future. Furthermore, this notion substantiated in the works of Michal Kalecki (1899- 1970) changes the vision of economic growth, which is no longer an end in itself but rather a means for enhancing the population's income and living standard.
[11] Ugarte and Bolivar (2015) provide recent evidence on the impact of the conditional cash transfers (Bono Juancito Pinto, Bono Juana Azurduy and Renta Dignidad) on poverty.

III. THE STRUCTURAL FISCAL BALANCE IN BOLIVIA

In order to have a clear idea regarding the direction and evolution of the fiscal policy, there is a need to initially keep in mind that it fundamentally depends on (i) the accounting criteria used for preparing the fiscal balances, and (ii) the simultaneity of the fiscal movements derived from policy decisions and those originated due to exogenous factors, e.g. the revenues that follow the evolution of the economic cycle and the expenditures that reflect commitments taken on previously by the state. As emphasized above, omitting these aspects hinders interpretation of the intention of the fiscal policy and of the way in which it has accompanied economic performance of the country.

This paper follows the conventional approach to deal with these considerations and the structural fiscal balance (SFB) is estimated by following the methodological framework proposed by Hagemann (1999), Fedelino et al. (2009), and Bornhorst et al. (2011). The structural fiscal balance contrasts with the simple fiscal balance (FB) to the extent that it isolates the transitory and/or cyclical components of the fiscal accounts, i.e.:

$$SFB_{t\,=}\left(RevF_t - RevF_t^{cycl}\right) - \left(ExpF_t - ExpF_t^{cycl}\right)$$

Where SFB_t is the structural fiscal balance and the superscript *cycl* is the cyclical component of the fiscal account under consideration. For economies like Bolivia, these cyclical components are related to the effects of the economic cycles and the fluctuations of important prices for the fiscal budget, e.g. commodity prices. Therefore, the adjustment made keeps in mind these two sources of cyclicality, that is to say, one adjustment related to the economic activity (measured by GDP) and the second one related to the international oil price (measured by the WTI)[12]. The adjustment is based on the following equation:

$$X_t^{ST} = X_t \left(\frac{GDP_t^{pot}}{GDP_t}\right)^{\beta_1} \left(\frac{GDP_{t-1}^{pot}}{GDP_{t-1}}\right)^{\beta_2} \left(\frac{WTI_t^{lt}}{WTI_t}\right)^{\delta_1} \left(\frac{WTI_{t-1}^{lt}}{WTI_{t-1}}\right)^{\delta_2}$$

where X_t represents the fiscal categories of tax revenues, hydrocarbons revenues and capital expenditure, measured as specified in the next subsection. Variable WTI_t is the average international oil price in two quarters prior to *t*, as an approximation of the value related to the contemporary revenues provided for in the gas sales contracts concluded with Brazil and Argentina. X_t^{ST} is the structural component of variable X_t, GDP_t^{pot} represents the potential GDP, WTI_t^{lt} represents the long-term oil price and coefficients β_1, β_2, δ_1 and δ_2 are the elasticities.

This method to correct for the cyclical behavior starts from the assumption that the observed output fluctuates around its long-term trend, which is subject to both permanent and transitory shocks. While the first shocks produce changes in the trend that last over time, the second shocks generate cyclical variations around the trend.

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[12] The West Texas Intermediate (WTI) is a type of crude oil of a very good quality produced in Texas and the south of Oklahoma, the price of which is used as a reference to set the price of other types of crude oil. In Bolivia, the WTI is used as a reference to calculate the price of the gas exported to Brazil and Argentina.

The ratio GDP_t^{pot}/GDP_t captures these output deviations around the long-term trend, while elasticities β_1 and β_2 contain the level of sensitivity of the fiscal account to these output variations in times *t* and *t-1*, respectively. Likewise, WTI_t^{lt}/WTI_t represents the deviations of the oil price around its long-term trend and elasticities δ_1 and δ_2 contain the sensitivity of the fiscal account thereto in times *t* and *t-1*, respectively. Thus, the structural budget can be understood in the sense of the fiscal balance that would have existed if the level of activity and the oil price had been situated around their trend, abstracting the cyclical factors influencing public finance.

The remainder of this section is structured as follows: first, a description is given of the accounting adjustments made to the considered fiscal variables, followed by a description of the estimate of the potential GDP, the long-term WTI, the respective elasticities of the fiscal accounts relative to these variables, to then conclude with the estimated SFB.

III.1 Adjustments to the variables

In order to calculate the structural balance, initially the consolidated operations of the NFPS are considered. To extract the cyclical component of these fiscal accounts, the following classification is used: both the revenues and expenditures are divided into current and capital ones, in line with the accounting structure of these public accounts; in turn, current revenues are divided into tax revenues, hydrocarbons revenues and the other current revenues.

Expectations are that tax revenues (internal revenues and customs revenues) are highly dependent on the economic activity, which is why their cyclical component is important. Tax revenues do not take into account mining royalties, whereby the latter fall under the category of other current revenues since a large part of the mining production goes to the external market, so there are doubts as regards the dependence of this account on the national contemporary economic cycle. In addition, this category comprises the revenues from hydrocarbons sales on the domestic market, since it is expected that the demand for these products on the domestic market is related to economic activity.

Hydrocarbons revenues comprise the taxes on hydrocarbons (IEHD, in Spanish, and royalties) as well as the revenues from selling hydrocarbons (to the external market). It is expected that the dependence of this category is related more closely to the international oil price (WTI).

The category ‘other current revenues’ (other companies, transfers, other revenues, as well as the mining royalties) is assumed to be structural, in the sense that it does not have a cyclical component relative to GDP or the WTI. An additional assumption is that capital revenues do not have a cyclical component since they are mainly made up of capital grants and transfers, which by nature do not follow the cycle of GDP or of any asset or variable.

On the expenditure side, in most structural balance estimations the assumption is that all expenditures are structural. Nonetheless, for the Bolivian case it is necessary to keep in mind that at present public investment is considered to be one of the engines of the economy. Therefore, (i) it may be that capital expenditure depends directly on the economic performance in previous

periods, as a "discretionary" mechanism for the government to make adjustments to the economy. In other words, if the growth rate of the economy in previous periods was not as desired, the decision may be made to speed up the execution of public investment to enhance dynamism of the economy and improve growth; evidence in this regard can be found in Annex 2. (ii) Under the same logic, in scenarios with a falling oil price, the probable response is an effective increase of public investment in order to encourage the dynamism of the economy and counter undesired effects; Ugarte and Bolivar (2015) provide evidence on this. Within the framework of these considerations, this study makes an estimate of the elasticities of capital spending relative to GDP and the WTI.

With regard to current expenditure, the interests on debt are deducted since they represent prior obligations. This component is assumed to be structural; an attempt was made to estimate the elasticity of current expenditure in relation to GDP and the WTI, with statistically non-significant results.

III. 2. Estimating potential GDP

In order to calculate the output gap, the potential output is estimated using three approaches (the Hodrick-Prescott filter, the Kalman filter and the production function), using the average value of the results obtained from them for subsequent calculations. Below is a brief description of these techniques; a detailed explanation on implementation of these approaches can be found in Annex 3.

Using the Hodrick-Prescott filter, it is possible to extract the trend from a series and break it down into a permanent component (trend) and a temporary component (cycle), minimizing the sum of the deviations to the square of the variable of interest Y_t in relation to its trend values Y_t^T (which is a measure of the degree of adjustment), subject to a penalty that restricts the second difference of Y_t^T (which is a measure of the degree of smoothness). The unobservable components model (Kalman filter) is based on the specification of a state-space model. These models can be used to estimate vectors of unobservable variables for each period t, based on the available information of the variable of interest in period t, assuming that the unobserved variables (state) affect the observed ones, through a deterministic stochastic process. The third approach of the production function refers to an estimation of potential GDP based on the supply determinants: capital, K_t, labor, L_t, and total factor productivity, TFP_t, approximating a production function that follows a functional form of the Cobb-Douglas type:

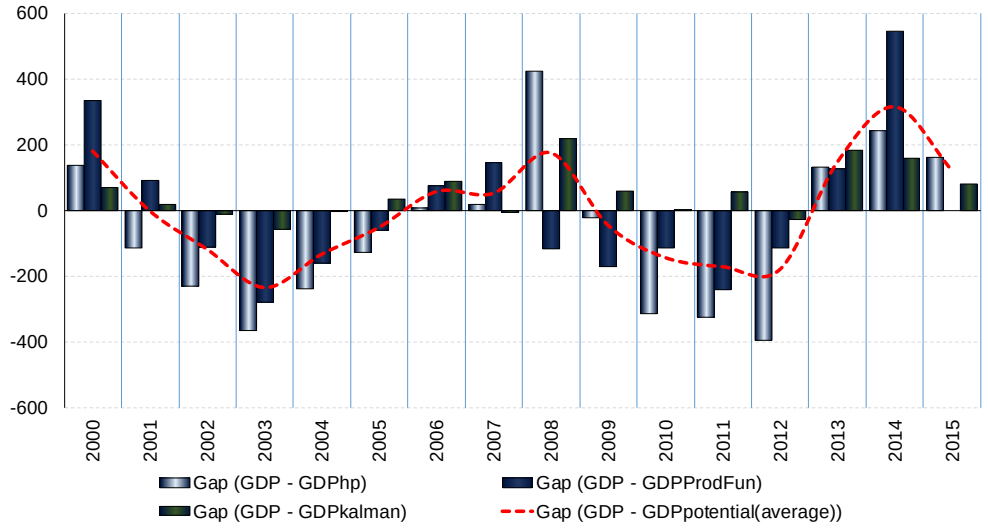
$$Y_t = TFP_t K_t^{\alpha} L_t^{1-\alpha}$$

More details about these methodologies and the estimated potential GDP values using the three approaches can be found in Annex 3.

Using the potential GDP values, the output gap was calculated for each approach with the aim of approximating the years in which aggregate performance of the Bolivian economy was above or below its full-employment level. Graph 3 shows the values of the output gap in years 2000-2015, describing the observed GDP deviation from its potential level in million BOB of 1990. Similarly,

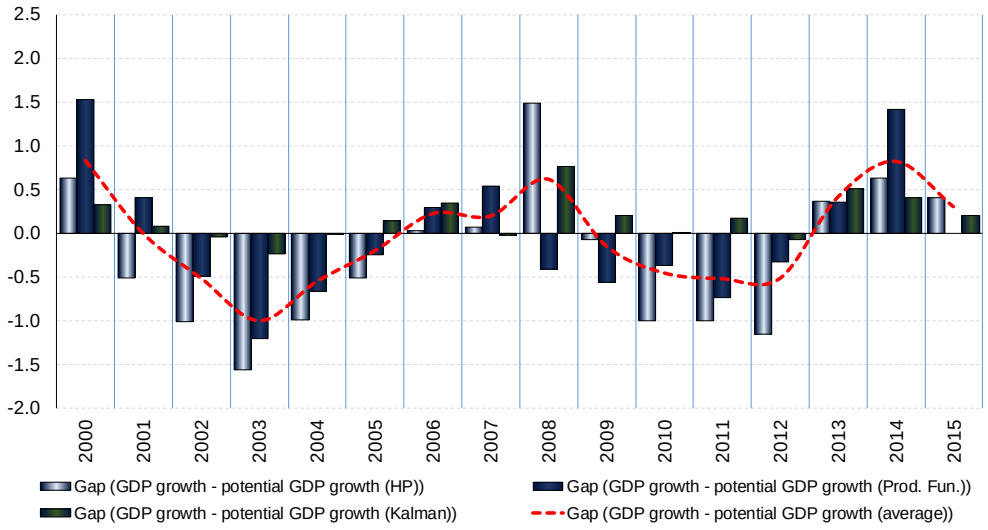
Graph 4 shows the gap between the growth rates of the observed GDP versus the potential growth rates[13] (the deviations are specified in percentage points).

Graph 3: Gap between observed and potential GDP, by level (Millions of bolivianos of 1990)



Source: Prepared by the author based on data from the National Statistics Institute.

Graph 4: Gap between observed and potential GDP growth rates (Percentage points)



Source: Prepared by the author based on data from the National Statistics Institute.

[13] The potential growth rate is obtained as follows:

$$g_{GDP}^{FULL} = \left(\frac{GDP_t^{potential} - GDP_{t-1}^{observed}}{GDP_{t-1}^{observed}} \right) \times 100$$

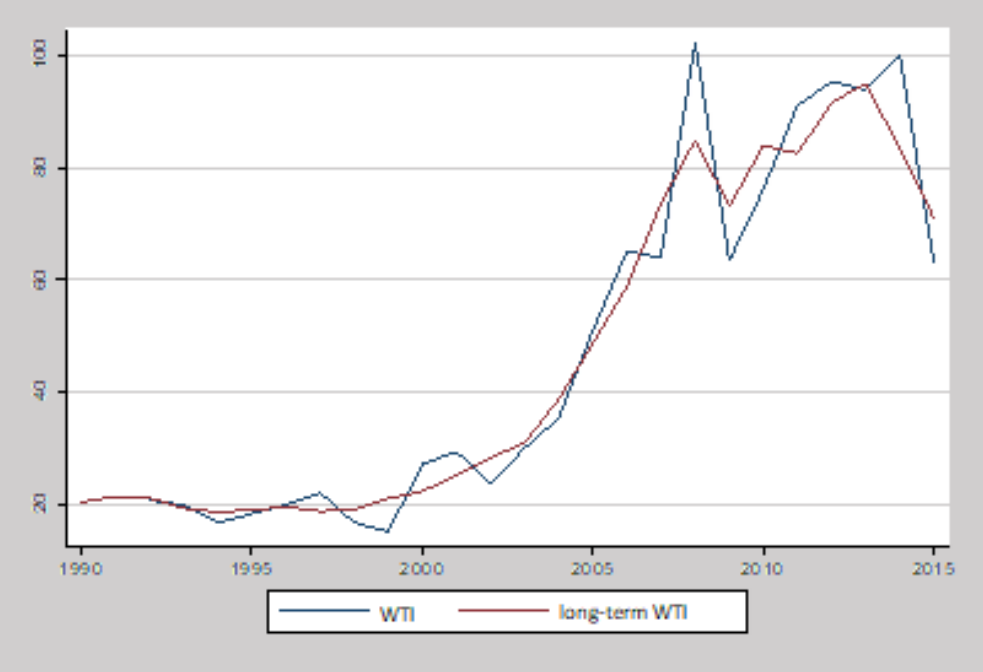
With regard to the results associated to the output gap, note that in most cases the three methodological approaches agree on the direction of the gap, both in terms of levels and in terms of growth rates. For example, if the production factors had been used fully in years 2011 and 2012, the Bolivian economy might have recorded growth levels of around 6%.

III.3. The long-term oil price

There is no consensus as regards the methodology to be used to determine the long-term level of commodity prices. Several studies on the characteristics of these prices, among which Frankel (2011), suggest that the property of reversal of the international commodity prices from their historical highs to the long-term balance is weak and that the hypothesis of a random path or of a permanent trend would be hard to refuse unless the sample were sufficiently large. For the oil price, Hamilton (2008) underscores the significant volatility and the high persistence to shocks of this variable.

Within this framework, the filter techniques used to obtain the trend of this series (e.g. the Hodrick-Prescott filter) are probably not the most adequate techniques for application on commodity prices, because the high volatility causes the estimated trends to be highly sensitive to the selected sample. Accordingly, international practice suggests using moving averages with one historical and one projected component, with the objective of reflecting a structural change in case of a persistent and significant decrease or increase of this prices– see IMF (2012). Thus, the long-term oil price $\left(WTI_t^{lt}\right)$ is simply calculated as a moving average of order eleven, 8 quarters backwards, the current one and 2 subsequent ones. The series obtained in this manner is shown in the graph below.

Graph 5: Long-term oil price



Source: Prepared by the author based on data from the International Monetary Fund.

III.4. Estimating elasticities

The following specification is used to calculate elasticities:

$$lnX_t = \alpha + \beta_1 lnGDP_t + \beta_2 lnGDP_{t-1} + \delta_1 lnWTI_t + \delta_2 lnWTI_{t-1} + \varepsilon_t$$

Quarterly data of the NFPS fiscal accounts of years 2000-2015 are used to estimate these coefficients. The data were deseasonalized using the CENSUS-X13 method. The elasticities are obtained through Instrumental Variables (IV); using this method, it is possible to consider the endogeneity between fiscal variables and GDP, which is very important for the Bolivian case, considering the role of fiscal policies for economic growth. Ilzetzki and Vegh (2008) provide empirical evidence to highlight the importance of considering the simultaneity between fiscal variables and output. The results of this estimation are presented below, while the goodness-of-fit tests can be found in Annex 4.

Table 1: Calculation of elasticities

	(1)	(2)	(3)
Estimation method:	VI	VI	VI
Dependent variable:	Δln TaxRev	Δln HydrRev	Δln CapitalExp
Δln real GDP(t)	2.401*	-1.894	0.858
	(1.794)	(-0.602)	(0.303)
Δln real GDP(t-1)	2.636**	0.963	1.913
	(2.487)	(0.467)	(0.921)
Δln real GDP(t-2)	1.643	0.772	-0.965
	(1.571)	(0.355)	(-0.348)
Δln real GDP(t-3)	-0.045	-1.566	3.690**
	(-0.072)	(-0.642)	(2.170)
Δln WTI(t)	-0.081	0.682***	0.005
	(-0.899)	(3.461)	(0.042)
Δln WTI(t-1)	-0.015	-0.179	0.122
	(-0.148)	(-0.875)	(0.595)
Δln WTI(t-2)	0.153***	0.907***	-0.074
	(2.962)	(5.656)	(-0.511)
Dependent variable(t-1)	-0.254*	-0.348***	-0.304*
	(-1.898)	(-3.120)	(-1.862)
Dependent variable(t-2)	-0.065	-0.012	0.086
	(-0.802)	(-0.123)	(0.592)
Dependent variable(t-3)	0.028	-0.121	-0.419***
	(0.267)	(-1.372)	(-2.897)
Dummy (2006q1-2015q4 =1)	-0.019		-0.022
	(-0.980)		(-0.430)
Dummy outlier	0.071***	0.146***	
	(3.401)	(3.638)	
Dummy fin crisis (2008q4-2009q2=1)		-0.106	
		(-1.458)	
White noise in residues	yes	yes	yes
F test of weak instruments	14.10	25.81	18.53
Hansen test of exogeneity	0.28	0.27	0.16
Observations	59	59	59

Heteroskedasticity-robust t-statistics (standard errors through GMM in two stages).

*** p<0.01, ** p<0.05, * p<0.1.

NOTE: Instruments for endogenous variable Δln real GDP(t): Δln Consumption, Δln Deposits in bolivianos. The outliers were identified by using the algorithm of Ugarte and Verardi (2012)

III.5. Structural Balance

Using the information of Table 1, it is possible to extract the cyclical component of the fiscal revenues and expenditure and calculate the Structural Balance as follows:

$$Structural\ Revenues_t = TaxRev_t * \left(GDP_t^{pot} / GDP_t\right)^{2.4} * \left(GDP_{t-1}^{pot} / GDP_{t-1}\right)^{2.6} * \left(WTI_{t-1}^{lt} / WTI_{t-1}\right)^{0.15}$$

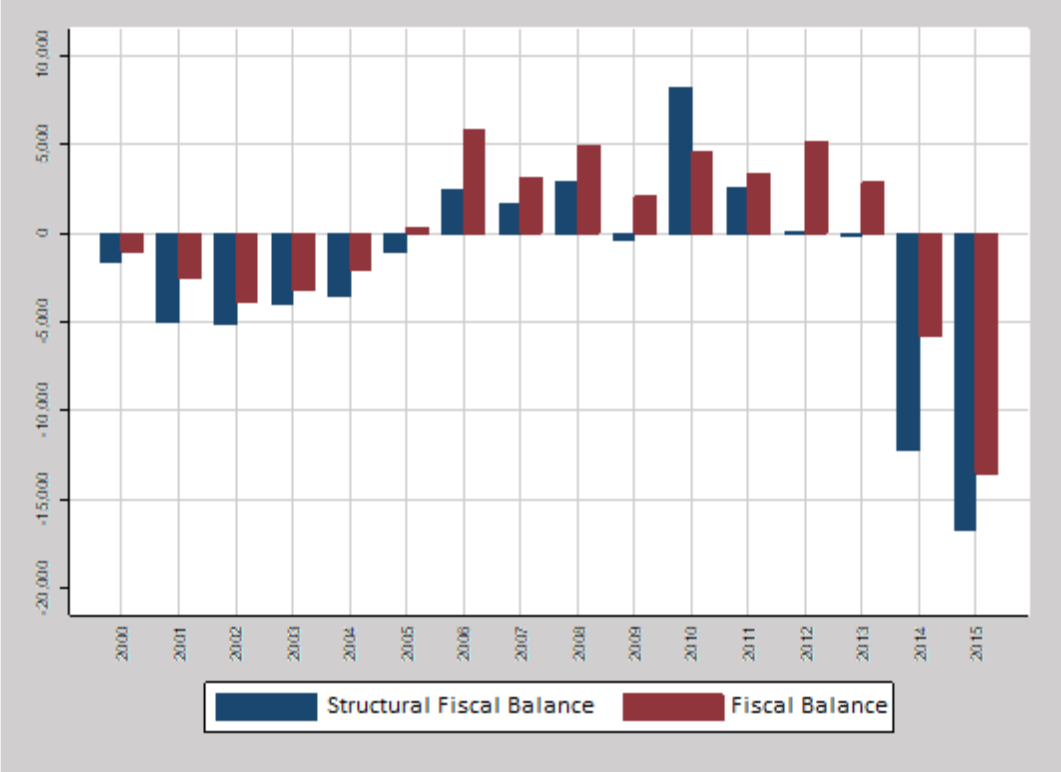
$$+HydrRev_t * \left(WTI_t^{lt} / WTI_t\right)^{0.7} * \left(WTI_{t-1}^{lt} / WTI_{t-1}\right)^{0.9} + OtherRev_t$$

$$Structural\ Expenditure_t = CapExp_t * \left(GDP_{t-1}^{pot} / GDP_{t-1}\right)^{3.7} + CurrExp_t$$

$$Structural\ Balance_t = Structural\ Revenues_t - Structural\ Expenditure_t$$

The results of the estimation are shown in the following graph. This structural balance is understood as the budget balance that would have existed in the fiscal accounts if output were at its potential level and if the oil price were equal to the trend, i.e. excluding the cyclical and random effects of two centrally important factors: economic activity and the oil price.

Graph 6: Structural Fiscal Balance and Primary Fiscal Balance
(Millions of bolivianos)



Considering the primary fiscal balance shown in Graph 6, after permanent fiscal deficits we see that as from 2006 and during eight consecutive years there were positive fiscal balances, except in

the two last years. These recent deficits can be considered healthy since they are the result of a greater spending on public investment. Other factors include supply shocks such as the Plan Patujú and the lower revenues from hydrocarbons due to the oil price decline.

In turn, the previous graph explains the extent to which the fiscal balance observed over recent years is the result of exogenous factors, e.g. GDP growth and WTI variations, rather than fiscal policy decisions. Initially, it should be noted that the directions of the calculated structural balance are not very different from those of the conventional primary balance. However, the results show that between 2000 and 2004, the size of the observed fiscal deficits was smaller than what should have been observed thanks to the economic cycle and the deviations of the hydrocarbons prices relative to their trend level, i.e. the structural deficit was higher than the level observed. Likewise, in years 2005 and 2009, while the conventional balance displayed a surplus balance, from a structural perspective the fiscal account displayed a deficit. In general, the conventional fiscal surpluses observed in 2006-2013 (except in 2011) are greater than the ones observed in the structural balance. On the contrary, the fiscal deficits observed in 2014 and 2015 were smaller than the structural ones.

IV. THE FISCAL IMPULSE IN BOLIVIA

Fiscal impulse (FI) is the indicator of additional fiscal stimuli provided by the public finance of a government to incentivize the aggregate demand through an increase of fiscal spending or a tax cut, in relation to a reference situation. Thus, the fiscal impulse is an analysis instrument to evaluate the degree of neutrality of the fiscal policy relative to the aggregate demand, categorizing it as an expansionary, neutral or contractive fiscal stance.

In literature, the fiscal impulse is measured as the first difference between the SFB of one year in relation to the previous year, $FI_t = -\Delta SFB_t$, reflecting the discretionary fiscal policy stance in the short run. If $FI_t > 0$, the fiscal policy is considered to have been expansive, if $FI_t < 0$, it is considered to have been contractive, and if it is equal to zero, neutral. The reason is that with a $FI_t > 0$: $SFB_{t-1} > SFB_t$, i.e. at time t the stance is of a greater deficit, either because of an increase in spending or because of a decrease of taxes.

FI is an indicator that tries to measure the discretionality of the fiscal policy, i.e. what part of the changes in fiscal balances are the result of autonomous decisions made by the authority, as opposed to the impact of exogenous factors on the budget. To understand why the variation in the structural components of the revenues and expenditures is considered an indicator of the discretionality of the fiscal stance, below the first component of the adjustment equation is represented in terms of logarithms and differences:

$$\Delta \ln X_t^{EST} = \Delta \ln X_t - \beta_1 \Delta \ln GDP_t + \beta_2 \Delta \ln GDP_t^{pot}$$

$$gX_t^{EST} = (gX_t - \beta_1 gGDP_t) + \beta_1 gGDP_t^{pot}$$

Note that the interpretation of the discretionality is derived from the possibility of breaking down the variation of the structural component into variations resulting from policy decisions and

variations resulting from "fiscal drag". Where $gGDP_t$ and $gGDP_t^{pot}$ are the growth rates of the effective output and the output trend, respectively; β_1 is the "fiscal drag" component of the fiscal accounts (tax collection and fiscal expenditure), whereby $(gX_t - \beta_1 gGDP_t)$ can be interpreted as the policy component, i.e. autonomous decisions taken by the authority[14].

Within this framework, an expansionary/contractive policy at times when the output gap is positive/negative is considered to be a procyclical fiscal policy; in turn, an expansionary/contractive policy at times when the output gap is negative/positive is considered a countercyclical fiscal policy.

As explained above, the fiscal impulse characterizes the fiscal stimuli relative to a reference situation. The results obtained when considering the previous years as the baseline of the impulse are shown in column 3 of Table 2. These results suggest a contractive fiscal policy in years 2003-2006, 2008 and 2010, and an expansionary fiscal policy in 2000-2002, 2007, 2009, and 2011-2015. One aspect to be kept in mind with regard to these results is the fluctuating nature thereof because a dynamic reference point is chosen. Thus, having an expansionary policy preceded and followed by a contractive policy is probable, which renders any conclusion concerning a clear pattern in terms of the applied fiscal approach impossible.[15]

In this regard, and with the purpose of characterizing behavior of the fiscal policy in relation to a specific macroeconomic context, (i) the fiscal policy is evaluated by relating it to concrete cycles of the economy, i.e. in periods of expansion and contraction, defined through the slope of the output gap. Thus, following the pattern observed in Graphs 3 and 4, the following periods are distinguished: 2003-2008 when the economy starts from a remote position below its trend level towards an optimal position above the trend level; 2009-2012 when the output gap starts to contract until reaching a maximum negative gap point; 2013-2014 when the negative gap is closed and takes on positive values to then go back down in 2015. (ii) Once these periods have been distinguished, the fiscal behavior thereof is characterized based on the average fiscal impulse for those periods.

Another aspect to be kept in mind in interpretation of the SFB is that the measurement unit is expressed in nominal terms. Therefore, in order to avoid the disruptions there might be in the value of the balance due to variations in the current value of money, and considering that the fiscal impulse is compared to the output gap, which is measured in real terms, the real structural balance is calculated by deflating this variable with the deflator of public expenditure. These results are shown in the second column of Table 2[16].

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[14] Note that the FI measures the stimulus of the fiscal policy and not the final effect, which can be calculated through the fiscal multiplier or other multivariate dynamic models that help obtain the final net effect of these stimuli on the economy.

[15] Another alternative to calculate the fiscal impulse, suggested by Hagemann (1999), is to consider the fiscal balance where the output gap is near zero as the optimal initial point of reference and make the difference for calculating the fiscal impulse in relation to this point. Following this logic, one of the points of reference for the Bolivian case is the balance of 2005. Thus, it is difficult to justify a comparison of the fiscal balance, for example, of year 2008 relative to that of year 2005 (for calculating the fiscal impulse), since both contexts were very different. That is why this approach is not considered.

[16] Note that the conclusions do not change when considering the balance in nominal or real terms.

The fifth column of Table 2 shows the average value of the FI in the periods identified for the Bolivian economy. Thus, it is possible to conclude that, on average, fiscal behavior related to the dynamic of the economy has been expansionary in 2001-2002, contractive in 2003 to 2008 and expansionary in 2009-2015. Furthermore, comparing the fiscal impulse of these periods with the output gap (columns 6 and 7a), it can be concluded that, on average, the fiscal policy in Bolivia was countercyclical in 2003-2012, procyclical in 2013 and 2014, and countercyclical in 2015.

Table 2: The discretionality and cyclicality of the fiscal policy

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(7a)	(8)
Years	**Str. B**	**Real Str. B**	**FI (t,t-1)**	**Real FI (t,t-1)**	**Aver. real FI**	**Fiscal Pol.**	**Output gap**	**Cycle**	**Cyclicality**
2000	-1170	-396	971	326	499	Expansionary	180	Recessive	Countercyclical
2001	-5477	-1689	4307	1293	499	Expansionary	-1	Recessive	Countercyclical
2002	-5241	-1566	-236	-123	499	Expansionary	-118	Recessive	Countercyclical
2003	-3599	-985	-1641	-581	-459	Contractive	-234	Expansionary	Procyclical
2004	-3226	-825	-374	-160	-459	Contractive	-133	Expansionary	Procyclical
2005	-778	-189	-2448	-636	-459	Contractive	-51	Expansionary	Procyclical
2006	2208	518	-2986	-708	-754	Contractive	58	Expansionary	Countercyclical
2007	1364	302	844	217	-754	Contractive	53	Expansionary	Countercyclical
2008	3342	696	-1977	-394	-754	Contractive	175	Expansionary	Countercyclical
2009	-1482	-287	4823	982	207	Expansionary	-45	Recessive	Countercyclical
2010	9876	1852	-11358	-2139	207	Expansionary	-143	Recessive	Countercyclical
2011	3268	549	6608	1304	207	Expansionary	-171	Recessive	Countercyclical
2012	-816	-131	4084	679	207	Expansionary	-179	Recessive	Countercyclical
2013	126	19	-942	-150	867	Expansionary	148	Expansionary	Procyclical
2014	-13232	-1864	13358	1884	867	Expansionary	315	Expansionary	Procyclical
2015	-18843	-2443	5611	579	579	Expansionary	122	Recessive	Countercyclical

These results are different from the ones obtained in empirical literature about this topic for the Bolivian case, in which there is no consensus on the conclusions. In brief, the difference in the results mentioned in this paper in relation to the ones obtained previously for the Bolivian case may be due to the following factors: (i) the elasticities are obtained by using methods that take into account the endogeneity bias, (ii) the potential output is the average of the implementation of three methods (the Hodrick-Prescott filter, the Kalman filter, and the production function), (iii) to deal with volatility, the long-term oil price is obtained through moving averages, (iv) for all fiscal accounts, there is an evaluation of the existence of two cyclical components, one of the output and one of the oil price, (v) capital expenditure is not automatically considered to be structural, it also has a cyclical component, and (vi) a real structural balance is considered, using the deflator of public spending.

The measure of robustness was based on the calculation of the structural balance and the fiscal impulse, considering the Treasury accounts, whereby this is deemed to be a more precise measure of the discretionary policy since these accounts are absolutely dependent on the government's policy decisions. The details can be found in Annex 5. Note that the general nature of the results does not vary.

A second aspect to be kept in mind is the vulnerability of the results to different categorizations of the fiscal accounts. Thus, in order to analyze robustness of the results, we have calculated the structural balance and the fiscal impulse using a different classification of the fiscal accounts, following Banegas and González (2015). In this manner, the elasticities of the hydrocarbons revenues were separated in relation to the domestic market and the external market. Likewise, domestic revenues and customs revenues were considered separately within the tax revenues. The details of these estimations can be found in Annex 6. Considering this structure, once again the general nature of the conclusions does not change.

Another factor that may explain the difference, for example in relation to the results of Banegas and González (2015), and Zambrano and Aguilera (2010), is the fact that these authors analyze the fiscal policy based on the Non-Oil Structural Balance (NOSB) approach. Villafuerte and Lopez-Murphy (2010), and Medas and Zakharova (2009) suggested this approach for hydrocarbons exporting countries, arguing that the hydrocarbons revenues have external sources and do not take away resources from the domestic private sector, which is why the NOSB is a more reasonable measure of the fiscal effort. Moreover, they argue that hydrocarbons revenues tend to be extremely volatile since they depend on uncertain prices. In this regard, the following elements should be highlighted: (i) the pertinence of the NOSB is believed to be relative for the Bolivian case because, since the state is responsible for generating and administering the surplus from the hydrocarbons resources, a large part of the fiscal resources are allocated to this sector, e.g. in 2015, YPFB's expenditure for commercializing the hydrocarbons accounted for 15.8% of the NFPS current expenditure; likewise, public investment in the hydrocarbons sector accounted for 13.8% of total public investment. (ii) With regard to the vulnerability of this source of income to the fluctuating oil price, we should necessarily remember that for all fiscal categories mentioned in this paper to be called structural, they include both extraction of the cyclical component of the output and that of the oil price.

However, as a measure of robustness and in order to enable a comparison to this literature, in Annex 7 the NOSB is approximated in line with the following considerations: a) non-hydrocarbons current expenditure is the result of subtracting YPFB's current expenditure from the NFPS current expenditure, b) hydrocarbon capital expenditure is approximated by applying the proportion of hydrocarbon public investment in total public investment to the NFPS capital expenditure; this means that non-hydrocarbons capital expenditure is simply the result of subtracting the approximate hydrocarbon capital expenditure from the NFPS capital expenditure. c) Non-hydrocarbon fiscal revenues are the result of subtracting hydrocarbons taxes and hydrocarbons revenues (domestic and external market) from the total revenues of the NFPS. Thus, d) the Non-Oil Balance (NOB) is the result of the difference of non-hydrocarbons revenues with non-hydrocarbons current and capital expenditure. e) For calculating the structural components, Annex

6 presents the elasticities of the internal and customs revenues; non-hydrocarbons current expenditure is assumed to be structural (without a cyclical component), and the elasticities for capital expenditure are the ones mentioned in Table 1.

Before continuing with the analysis of these results, it is important to underline that they are merely an approximation of the NOSB. A precise measure would require detailed information and a more in-depth analysis of the fiscal accounts to, for example, bear in mind the element of the fiscal subsidies on hydrocarbons and the double accounting in various fiscal accounts. This is a pending task for future research.

The table of Annex 7 shows that the only difference in the results of the approximation to the NOSB approach is found in the conclusion for years 2009-2012, in which case the fiscal policy could be characterized as contractive and therefore procyclical. These results suggest that during this period the public administration of the hydrocarbons resources allowed for having an expansionary and countercyclical fiscal policy over this period.

V. ANALYSIS OF THE RESULTS

Below is an explanation of the results obtained in the previous section. First, the contractive/expansionary nature of fiscal policy in Bolivia is explained, followed by an analysis of the cyclicality thereof. The discussion mainly emphasizes the results in years 2006-2015.

V.1. The expansionary/contractive nature of fiscal policy in Bolivia

The findings obtained in the previous section adequately characterize the fiscal policy in Bolivia in recent years. As explained in section II and according to the results obtained in Table 2, column 6, the contractive fiscal policy in years 2003-2008 can be divided into two phases, the first one between 2003 and 2005 when the contractive fiscal policy is explained by the lack of resources on the fiscal accounts, and the second phase in 2006-2008 when the contractive fiscal policy is related to a cautious start of implementation of the measures explained in section II. Note that the NFPS primary fiscal balance in percentage of GDP in years 2003 to 2005 averaged -2.6% per year, compared to an average of 4.5% per year in 2006 -2008.

Thus, years 2009 to 2015 can be seen as a period (still ongoing) in which the active fiscal policies were deepened in order to boost dynamism of the economy. In this respect it should be noted that the executed public investment grew linearly from an annual average of 8.6% between 2003 and 2005 to an average 17.8% in years 2006-2008 and an average linear 39.9% between 2009 and 2015. Likewise, the real current expenditure in wages and salaries of the NFPS increased by an average linear 0.2% per year between 2003 and 2005, to an annual 5.1% in 2006-2008 and an annual 9.0% between 2009-2015. On the other hand, the slope of the redistribution policy changed in 2006, whereby the average linear growth of the real expenditure on transfers to the private sector went from 3.9% between 2003 and 2005 to an annual 40.3% in 2006-2015.

V.2. Cyclicalilty and heterodoxy of the contemporary fiscal policy

As explained above, in periods 2003-2008 and 2013-2014, the slope of the output gap was positive, suggesting that those years were associated to an expansionary cycle of output relative to its potential level (expansionary gap). Subsequently, in years 2009-2012 and in year 2015 the output gap slope was negative, characterizing those years as recessive (recessive gap).

Within this framework, if the characterization of the cyclicality of the fiscal policy in years 2003-2008 leaves out the average Fiscal Impulse for this period and if the annual values thereof are considered, it is clear that in the first three years, 2003 to 2005, the fiscal policy can be defined as *"procyclical in recessive gap period"*. In other words, it was contractive in recessive period and it seems to have contributed to the recessive cycle in those years. Remember that those years were characterized as years with a passive fiscal policy and without resources. Inversely, in years 2006-2008, the contractive nature of the fiscal policy in a period with an expansionary gap characterizes it as *"countercyclical in expansionary gap periods"*. That is to say, the mentioned careful start in implementation of the fiscal measures described in section II seems to have been prudent in relation to the position in the cycle.

In turn, in both periods in which the gap was recessive in relation to the potential output, i.e. 2009 to 2012 and 2015, the fiscal policy was expansive and so those periods can be characterized as *"countercyclical in recessive times"*. It should be noted that the average annual expenditure of the NFPS in the recessive gap periods amounted to BOB 79,9 billion, while in the years with an expansionary gap, 2006-2008 and 2013-2014, it amounted to BOB 71,3 billion. Furthermore, Annex 2 makes an estimation of the asymmetrical effect of GDP on public investment; the results suggest that the elasticity thereof in times with negative GDP rates is much greater than the elasticity when GDP has positive growth rates. This is evidence of public investment as a countercyclical fiscal policy instrument. Likewise, Ugarte and Bolivar (2015) show that fiscal stimuli in periods of an oil price decline are an instrument to reduce the negative effects thereof on the output.

Finally, in 2013 and 2014, the fiscal policy was expansionary in years in which the output gap reflected a period of expansion of the economy, i.e. the fiscal policy was *"procyclical in periods with an expansionary gap"*. This seems to imply that it may have lacked prudence and that it may have exacerbated the output cycle.

However, in the author's opinion, this behavior correctly reflects the heterodox nature of contemporary fiscal policy in Bolivia. In order to understand this, it should be considered that in this economy the fiscal policy is an active economic policy instrument for economic growth, the objective of which goes beyond the conventional roles provided for in literature, namely being a stabilizing instrument that is active in crisis times and reduced in times of prosperity. Thus, it results coherent that the expansionary fiscal policy in Bolivia is related to the expansionary gap cycles of the output.

The arguments used in literature to consider that a procyclical fiscal policy is suboptimal are that it exacerbates the output cycle and produces inflationary pressure, lower growth rates and a greater

volatility in the output. McManus and Ozcan (2015) present recent evidence in this sense. The table below presents these variables for the case of Bolivia and the Latin American countries characterized for having procyclical fiscal policies (following the work of Klemm (2014) and Celasun et al. (2015)); it also shows the average values for South America and for countries depending on hydrocarbons exports similar to Bolivia[17]. The conclusion derived from the table is that in the two years of an expansionary procyclical fiscal policy, Bolivia has obtained high levels of growth with no signs of the distortions suggested in literature.

Table 3: Average values of growth, volatility and inflation of countries with a procyclical fiscal policy, 2006 – 2015

	GDP growth (%)		Growth Volatility	Inflation (%)	
	2006-2015	2013-2014	2006-2015	2006-2015	2013-2014
Bolivia	5.04	6.13	0.97	6.28	5.75
Average of countries with procyclical fiscal pol.	3.78	2.32	3.25	13.33	15.91
Argentina	4.61	4.11	3.89	9.44	10.62
Ecuador	3.91	2.94	2.42	4.23	3.16
Honduras	3.58	3.94	2.44	6.05	5.65
Uruguay	4.74	-1.28	2.03	7.85	8.73
Venezuela, BR	2.08	1.90	5.48	39.08	51.40
South America	4.14	3.45	3.26	9.18	10.29
Hydrocarbons-exporting countries	3.59	2.47	4.52	14.39	16.19

Note: Volatility is calculated as the standard deviation of growth.
Source: Prepared by the author based on data from the World Bank (WDI).

VI. CONCLUSION

At present, Bolivia is a country whose economic policy approach advocates for active participation of the state in the economy, being responsible for administering the surpluses from the strategic sectors and the distribution thereof to income and employment generating sectors and to the population. Thus, the fiscal policy becomes one of the primary development instruments used in this economy.

The purpose of this paper was to make an assessment of the performance of fiscal policy in Bolivia. This was based on a calculation of the structural balance and fiscal impulse indicators to the extent that these indicators isolate exogenous factors of the fiscal accounts and ensure measurement of the authority's intervention in the observed fiscal results.

[17] The criterion to define similarity is the value of hydrocarbons exports in percentage of GDP. The average for Bolivia in years 2006-2014 was 18.3%. Hence, the similar countries are: Belarus [18.9%], Bhutan [14.3%], Ecuador [15.2%], Iran [18.4%], Malaysia [14.2%], Norway [21.3%], Russia [17.4%], Venezuela [23.4%] and Yemen [21.3%].

The results suggest that the fiscal policy in Bolivia was contractive between 2003 and 2008 and expansive in 2009-2015. On the basis of several statistics, the conclusion was that the contractive fiscal policy of years 2003 and 2005 was a result of the austerity of the fiscal accounts. Furthermore, the contractive nature of the fiscal policy in years 2006-2008 was seen as the result of the initial implementation of a more active growth-oriented fiscal policy, which was deepened as from 2009, explaining the expansive nature thereof.

Comparing these behaviors to the economic cycle, the conclusion was that overall the fiscal policy was countercyclical from 2003 to 2012, procyclical in 2013 and 2014, and once again countercyclical in 2015. More specifically, between 2003 and 2005, the fiscal policy was defined as "procyclical in recessive gap periods", during 2006to 2008 as "countercyclical in expansive gap periods", and in 2009 to 2012 and in 2015 as "countercyclical in recessive periods", and in 2013 and 2014 as "procyclical in expansionary gap periods". The latter performance highlights the heterodox nature of contemporary fiscal policy in Bolivia, in the sense that for this country the fiscal policy is an active policy instrument to reach higher levels of economic growth without producing the distortions suggested in literature. Furthermore, the countercyclical role of public investment in Bolivia stands out.

These results are maintained when considering the data of the Non-Financial Public Sector (NFPS), of the Treasury, if it is used a different classification of the fiscal accounts or when approximating the non-oil structural balance. Likewise, these results are different from the ones obtained in literature for Bolivia by keeping in mind the following aspects omitted in previous work: (i) the elasticities are estimated using methods that take into account the endogeneity bias, (ii) the potential output is the average of the application of three methods (the Hodrick-Prescott filter, the Kalman filter and the production function), (iii) the long-term oil price is obtained by using moving averages, (iv) in all fiscal accounts, an assessment is made of the existence of two cyclical components, one of the output and one of the oil price, (v) capital expenditure is not automatically considered to be structural, and (vi) a real structural balance is considered, using the deflator of public expenditure.

REFERENCES

Alesina, A., Campante, F. & Tabellini, G. (2008). Why is fiscal policy often procyclical? Journal of the European Economic Association, 6 (5)

Banegas, R. A. & González V., R. (2015). Institutional Changes and Cyclical Transition in the Fiscal Stance for Bolivia (2003-2011). Revista Latinoamericana de Desarrollo Económico, 23.

Barro, R. (1979). On the Determination of Public Debt. Journal of Political Economy. 87(5).

Bornhorst, F., Dobrescu, G. & Fedelino, A., Gottschalk, J. & Nakata, T. (2011). When and How to Adjust Beyond the Business Cycle? A Guide to Structural Fiscal Balances. International Monetary Fund Technical Notes and Manuals.

Celasun, O. & Moreno-Badia, M. (2015). Fiscal Policy in Latin America: Lessons and Legacies of the Global Financial Crisis. IMF staff Discussion Note. SDN/15/06.

Clark, J.M. (1917). Business Acceleration and the Law of Demand: A Technical Factor in Economic Cycles. Journal of Political Economy, 25(1), 217-235.

Chahin, F. (2011). Medición de la Brecha del Producto para la Economía Boliviana. Document presented in the 4th Gathering of Economists of Bolivia, BCB.

Collier, P., van der Ploeg, R., Spence, M. & Venables, A. (2010). Managing Resource Revenues in Developing Economies. International Monetary Fund, IMF.

El Anshasy, A. A. (2012). Oil revenues, government spending policy, and growth. Public Finance and Management, 12, 2, 120-146.

Fedelino, A., Horton, M. & Ivanova, A. (2009). Computing Cyclically Adjusted Balances and Automatic Stabilizers. IMF Technical Note and Manuals 09/05

International Monetary Fund (2012). Macroeconomic Policy Frameworks for Resource-Rich Developing Countries. International Monetary Fund Policy Paper for the Executive Board.

Frankel, J. (2011). A solution to fiscal procyclicality: the structural budget institutions pioneered by Chile. Working Papers, 604, Central bank of Chile.

Frankel, J.A., Végh, C.A. & Vuletin, G. (2011). On Graduation from Fiscal Procyclicality. NBER Working Papers 17619.

Gay, A. & Escudero, M. (2010). El resultado fiscal estructural en la Argentina: 1983-2010. XXIII regional seminar on fiscal policy, ECLAC

Gollin, D. (2002), Getting Income Shares Right. Journal of Political Economy, 110(2).

Halland, H. & Bleaney, M. (2009). Explaining The Procyclicality of Fiscal Policy in Developing Countries. CREDIT Research Paper No. 11/09

Hamilton, J. (2008). Understanding crude oil prices. NBER Working Paper No. 14492.

Harberger, A. (1978). Perspectives on Capital and Technology in Less Developed Countries. Contemporary Economic Analysis (London: Croom Helm).

Hernández, P. (2010). El papel de la política fiscal en la crisis económica. Presupuesto y Gasto Público, 59: 39-54.

Hagemann, R. (1999). The structural budget balance: The IMF's methodology. International Monetary Fund Working Paper No. 99/95.

Ilzetski, E. & Végh, C. (2008). Procyclical Fiscal Policy in Developing Countries: Truth or Fiction? NBER Working Paper 14191.

Ilzetzki, E. (2011). Rent-seeking distortions and fiscal procyclicality. Journal of Development Economics, 96(1)

Juselius, K. (1992) "Domestic and Foreign Effects on Prices in an Open Economy: The Case of Denmark". Journal of Policy Modeling.

Klemm, A. (2014). Fiscal Policy in Latin America over the Cycle. International Monetary Fund Working Paper No. 14/59

Leeper, E. (1991). Equilibria under active and passive monetary policies. Journal of Monetary Economics, 27(1), 129–147

Lewbel, A. (2012). Using Heteroscedasticity to Identify and Estimate Mismeasured and Endogenous Regressor Models, Journal of Business and Economic Statistics 30.

Lledó, V., Yackovlev, I. & Gadenne, L. (2009). Cyclical Patterns of Government Expenditures in Sub-Saharan Africa: Facts and Factors. International Monetary Fund Working Paper No. 09/274

Lozano, I. & Toro, J. (2007). Fiscal Policy Throughout the Cycle: The Colombian Experience. Borradores de Economía, 43.

Marcel, M. C., Tokman, M. R., Valdes, R. P. & Benavides, P. S. (2001). Structural budget balance: The pilar of the new Chilean fiscal policy rule. Journal de Economía Chilena, 4 (3)

McManum, R. & Ozcan, F.G. (2015). On the Consequences of Procyclical Fiscal Policy. Fiscal Studies, 36(1), 29–50.

Medas P. & Zakharova, D. (2009). A Primer on Fiscal Analysis in Oil-Producing Countries. International Monetary Fund Working Paper No. 09/56

Puig, J.P. (2015). Multiplicador del gasto público en Bolivia: una primera aproximación. LAJED 24, 47 – 78.

Ramey, V. A. (2011). Can Government Purchases Stimulate the Economy? Journal of Economic Literature, 49(3): 673-85.

Rodriguez, H. (2007). Producto Potencial. Proyecto de Investigación conjunta sobre variables no observables, CEMLA.

Sims, C. A. (1994). A simple model for study of the determination of the price level and the interaction of monetary and fiscal policy. Economic Theory, 4(3), 381–399.

Ugarte, D. & Bolivar, O. (2015). El efecto de la redistribución del ingreso sobre la reducción de la pobreza en Bolivia. Bolivian Economic Research Papers, 1(1).

Ugarte, D. & Bolivar, O. (2015a). La relación precio del petróleo y crecimiento económico en Bolivia: el rol de la política económica. Revista de Análisis - Central Bank of Bolivia, 22.

Ugarte, D., Verardi, V. & Gassner, M. (2012). Robustness for dummies. ECARES working papers 2012-015.

Valdivia, D. & Loayza, L. (2012). Transformación económica desde la óptica fiscal. ¿Puede existir un equilibrio entre el corto, mediano y largo plazo para fomentar el desarrollo? MPRA Paper 43087, University Library of Munich, Germany.

Velasco, O. & Bernal, E.A. (2014). El Rol Estabilizador de la Política Fiscal en el Nuevo Modelo Económico Boliviano. 9th gathering of economists, Central Bank of Bolivia.

Woodford, M. (1995). Price level determinacy without control of a monetary aggregate. Carnegie-Rochester Conference Series on Public Policy, 43, 1–46.

Villafuerte, M. & Lopez-Murphy, P. (2010). Fiscal Policy in Oil Producing Countries during the recent oil Price cycle. International Monetary Fund Working Paper WP/10/28.

Zambrano, O. & Aguilera, G. (2010) Elementos de sostenibilidad fiscal en países ricos en hidrocarburos: el caso de Bolivia. Interamerican Development Bank WP/286.

ANNEX 1

LIST OF STATE-OWNED ENTERPRISES

Taxpaying State-Owned Enterprises
Hydrocarbons: Yacimientos Petrolíferos Fiscales Bolivianos – YPFB
Power: Empresa Nacional de Electricidad – ENDE
Mining: Corporación Minera de Bolivia – COMIBOL
Smelter: Empresa Metalúrgica VINTO
Post: Empresa de Correos de Bolivia – ECOBOL
Airline: Transportes Aéreos Bolivianos (TAB)
TV channel: Bolivia TV
Armed Forces: Corporación de las Fuerzas Armadas para el Desarrollo Nacional (COFADENA)
Food: Empresa de Apoyo a la Producción de Alimentos – EMAPA
Iron and Steel: Empresa Siderúrgica del Mutún (ES-MUTUN)
Dairy products: Lácteos de Bolivia (LACTEOSBOL)
Cardboard: Cartones de Bolivia (CARTONBOL)
Airline: Boliviana de Aviación – BOA
Customs: Depósitos Aduaneros Bolivianos (DAB)
Brazil nuts: Empresa Boliviana de Almendras y Derivados (EBA)
Hydrocarbons industrialization: Empresa Boliviana de Industrialización de Hidrocarburos (EBIH)
Sugar mill: Empresa Azucarera San Buenaventura (EASBA)
Construction: Empresa estratégica Boliviana de Construcción – EBC
Construction: Empresa de Construcciones del Ejército – ECE
IT: Empresa Pública “QUIPUS”
Port services: Administración de Servicios Portuarios Bolivia - ASPB

ANNEX 2

THE ASYMMETRICAL ELASTICITY OF CAPITAL EXPENDITURE WITH GROWTH IN BOLIVIA

This section approximates the asymmetrical elasticity of capital expenditure relative to GDP. In this sense, the following variables are defined:

$$\Delta \ln GDP_t^{pos} = \begin{cases} \Delta \ln GDP_t & if \ \ \Delta \ln GDP_t > 0 \\ 0 & if \ \ \Delta \ln GDP_t \leq 0 \end{cases} \quad ; \qquad \Delta \ln GDP_t^{neg} = \begin{cases} 0 & if \ \ \Delta \ln GDP_t \geq 0 \\ \Delta \ln GDP_t & if \ \ \Delta \ln GDP_t < 0 \end{cases}$$

And the following model is estimated:

$$\Delta \ln GCap_t = \alpha + \sum_{i=1}^{3} \beta_i \Delta \ln GDP_{t-i}^{pos} + \sum_{i=1}^{3} \gamma_i \Delta \ln GDP_{t-i}^{neg} + \sum_{i=1}^{3} \varpi_i \Delta \ln WTI_{t-1} + \Delta \ln GCap_{t-1} + X_t + \varepsilon_t$$

where $GCap_t$ represents the NFPS capital expenditure, GDP_{t-i}^{pos} y GDP_{t-i}^{neg} represent the positive and negative shocks of GDP, respectively; WTI_{t-1} is the oil price, and Xt is a matrix that includes the following dichotomous variables, one of which representing the financial crisis of 2009 (2008q4 to 2009q2=1), another one representing the oil price decline (2014q3 onward=1), and two dummies identified as outliers (2010q3=1 and 2012q1=1). The data cover years 2000-2015 with a quarterly frequency. The estimation method used is that of Ordinary Least Squares (OLS) in view of the absence of relevant and valid instruments; that explains why the regressors start at t-1, to avoid the endogeneity bias. As mentioned at the beginning, this is a first approximation of the countercyclical role of public investment. The estimations using non-linear multivariate models will be dealt with in future research. The results shown below suggest that the capital expenditure responds to GDP variations of two quarters back. Interestingly, the sensitivity is greater when the GDP growth rate is negative, suggesting a countercyclical role of fiscal policy through capital expenditure. The residues are white noise (p-value=0.254).

DEPENDENT VARIABLE	ΔlnCapExp
$\Delta lnGDP^{pos}(t-1)$	-0.572
	(-0.215)
$\Delta lnGDP^{pos}(t-2)$	4.212**
	(2.023)
$\Delta lnGDP^{pos}(t-3)$	3.051
	(1.289)
$\Delta lnGDP^{neg}(t-1)$	0.390
	(0.070)
$\Delta lnGDP^{neg}(t-2)$	-12.689*
	(-1.858)
$\Delta lnGDP^{neg}(t-3)$	4.922
	(0.680)
ΔlnWTI(t-1)	0.065
	(0.328)
ΔlnWTI(t-2)	-0.100
	(-0.437)
ΔlnWTI(t-3)	0.133
	(0.691)
ΔlnCapExp (t-1)	-0.371**
	(-2.220)

Robust t-statistics in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

ANNEX 3

METHODOLOGICAL CONSIDERATIONS FOR CALCULATING POTENTIAL GDP

This section provides a detailed description of the methodologies used for estimating potential GDP. As mentioned above, the potential output was obtained by using three approaches: the Hodrick-Prescott filter, the Kalman filter and the Production Function.

i. Hodrick-Prescott Filter

Using this filter, it is possible to extract the trend from a series and break it down into a permanent component (trend) and a temporary component (cycle). Thus, this approach defines the economic cycle as the recurrent fluctuations in real activity in relation to a smooth but variable path which is the trend. To estimate this trend, the filter minimizes the sum of the square deviationsof variable of interest Y_t, in relation to its trend values Y_t^T subject to a penalty that restricts the second difference of Y_t^T (the curvature of the series at each point). In other words, the values of the trend are the ones minimizing the following expression:

$$L = \sum_{t=1}^{S} (Y_t - Y_t^T)^2 + \lambda \sum_{t=2}^{S-1} (\Delta Y_{t+1}^T - \Delta Y_t^T)^2$$

The first term of the foregoing equation is the sum of the deviations of the series in relation to the squared trend, a measure of the degree of adjustment. The second term is the sum of squares of the second differences of the trend components and a measure of the degree of smoothness. The smoothness parameter of the trend is lambda (λ); high values of this number entail smoother series.

For the Bolivian economy, Rodríguez (2007)[18] calibrated the parameter at a value of 7.185 for quarterly data; this value allows for trend component Yt to change smoothly over time. In this manner, in order to approximate the trend component (HP) in this research paper λ is assumed to have a value of 7.185.

ii. Unobserved components model (Kalman Filter)

This technique is based on the specification of a state-space model. Using these models, it is possible to estimate vectors of unobserved variables for each period t, based on the available information on the variable of interest in period t. This is possible by assuming that the unobserved variables (state) affect the observed ones, following a certain stochastic process.

Considering that a time series can be broken down into its unobserved components (Watson, 1989), in order to obtain the trend GDP this approach assumes the specification of a simple state-space model, as follows:

$$y_t = u_t + e_t$$

[18] Rodriguez, H. (2007). "Producto Potencial". Joint research project on unobserved variables, CEMLA, 2007, Mimeo.

$$u_t = u_{t-1} + v_t$$

where y_t is GDP (in logarithms), u_t is the permanent component (trend) that follows a random process, $e_t \approx N(0, \sigma_y^2)$ and $v_t \approx N(0, \sigma_u^2)$

The estimate is based on maximization of the maximum likelihood function.

$$\log \Lambda = -\frac{NS}{2}\log 2\pi - \frac{1}{2}\sum_{t=1}^{S}\log|F_t| - \frac{1}{2}\log\sum_{t=1}^{S} v_t' F_t^{-1} v$$

This is done by using the Kalman filter, in which N is the number of observable variables, S is the size of the sample, v is the matrix for predicting errors and F is the matrix of squared mean errors of the matrix.

iii. Production Function

This methodology is used to estimate the potential GDP based on its supply determinants: capital, K_t, labor, L_t, and the total factor productivity, TFP_t. Concretely, a production function will be approximated by following a functional form of the Cobb-Douglas type.

$$Y_t = TFP_t K_t^{\alpha} L_t^{1-\alpha}$$

For estimating this function, it is necessary to calculate the series of capital stock and factor productivity.

Capital stock calculation

In order to approximate the capital stock of the Bolivian economy, the perpetual inventories methodology was used. Within the framework of this methodology, investment is the flow enabling capital accumulation; nonetheless, it is necessary to discount the depreciation resulting from use. Concretely, capital evolves as follows:

$$K_t = K_{t-1}(1-\delta) + I_t$$

Where K_t is capital; I_t is the investment, which is approximated by Gross Fixed Capital Formation at constant prices; and δ is the rate of depreciation, the value of which is 3.2%, following Chahin (2011)[19].

The initial capital was estimated using the methodology of Harberger (1978)[20]. The supposition is that the capital is allocated to replenish the depreciated capital and increase capital:

$$I_t = \gamma K_t + \delta K_t$$

---

[19] Chahin, F. (2011). "Medición de la Brecha del Producto para la Economía Boliviana*". Document presented in the 4th gathering of economists of Bolivia, BCB.*

[20] Harberger, A. (1978). "Perspectives on Capital and Technology in Less Developed Countries". *Contemporary Economic Analysis (London: Croom Helm).*

where γ is the output growth rate. Thus, it can be derived that:

$$K_t = \frac{I_t}{(\gamma + \delta)}$$

Solow Residual

Within the framework of growth accounting, the growth rate of the aggregate output can be broken down into the contributions to the growth of factors (capital and labor) and the growth rate of the total factor productivity.

Concretely, the breakdown is conducted as follows:

$$g_{TFP} = g_y - \alpha_K g_K - \alpha_L g_L$$

where g_{TFP} is the growth rate of the total factor productivity, g_y, g_K, g_L are the growth rates of GDP, capital stock and the NAIRU-adjusted EAP (economically active population), respectively. α_K and α_L represent the participation of capital and labor factors in the total income of the economy. In this research, the assumption was that α_K is 1/3 and α_L 2/3, considering the evidence found by Gollin (2002)[21] and as suggested in the standard literature of growth accounting for developing countries. Based on the information provided by these variables, in order to approximate potential GDP the following equation was estimated[22]:

$$\ln Y_t = \alpha \ln k_t + \beta \ln l_t + \chi \ln TFP_t + \ln \varepsilon_t$$

The data are annual for years 1986-2014, since there is no quarterly information on the EAP (Economic Active Population). The results of the estimate are shown below:

VARIABLES	ln(GDP)
ln(Capital)	0.353***
	(8.528)
ln(EAP)	1.328***
	(18.199)
TFP	0.003***
	(2.272)
Trend	-0.007***
	(-20.849)
Dummy=1 if t=1998 & t=1999	0.040***
	(5.479)

[21] Gollin, D. (2002), "Getting Income Shares Right". *Journal of Political Economy, 110(2): pp. 458-474*

[22] To obtain the goodness-of-fit, a dichotomous variable was used that assigns value 1 to years 1998 and 1999, as the years with outlier values resulting from abrupt changes in the capital stock growth rates.

Observations	29
Jarque-Bera normality test (p-value)	0.586
White test for heteroskedasticity (p-value)	0.487
Portmanteau test for white noise (p-value)	0.121

t-statistics in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

The estimated values of potential GDP and its respective growth rates obtained through the three approaches are as follows:

	Levels (million BOB of 1990)				Growth rate (%)				
	Observed	Trend (HP)	Trend (Kalman)	Potential (Prod. Fun.)	Observed	Trend (HP)	Trend (Kalman)	Potential (Prod. Fun.)	Average of 3 methods
1990	15,443	15,312	15,486	15,418	4.6	3.7	4.9	4.5	4.4
1991	16,256	16,029	16,135	16,225	5.3	3.8	4.5	5.1	4.4
1992	16,524	16,746	16,607	16,380	1.6	3.0	2.2	0.8	2.0
1993	17,230	17,469	17,250	17,220	4.3	5.7	4.4	4.2	4.8
1994	18,034	18,198	18,029	18,238	4.7	5.6	4.6	5.9	5.4
1995	18,877	18,927	18,849	18,989	4.7	5.0	4.5	5.3	4.9
1996	19,701	19,644	19,713	19,708	4.4	4.1	4.4	4.4	4.3
1997	20,677	20,335	20,659	20,419	5.0	3.2	4.9	3.6	3.9
1998	21,717	20,989	21,495	21,642	5.0	1.5	4.0	4.7	3.4
1999	21,809	21,610	21,847	21,884	0.4	-0.5	0.6	0.8	0.3
2000	22,356	22,219	22,286	22,022	2.5	1.9	2.2	1.0	1.7
2001	22,733	22,847	22,715	22,641	1.7	2.2	1.6	1.3	1.7
2002	23,298	23,528	23,309	23,410	2.5	3.5	2.5	3.0	3.0
2003	23,929	24,294	23,986	24,210	2.7	4.3	3.0	3.9	3.7
2004	24,928	25,166	24,929	25,087	4.2	5.2	4.2	4.8	4.7
2005	26,030	26,157	25,995	26,091	4.4	4.9	4.3	4.7	4.6
2006	27,279	27,270	27,190	27,203	4.8	4.8	4.5	4.5	4.6
2007	28,524	28,504	28,531	28,378	4.6	4.5	4.6	4.0	4.4
2008	30,278	29,854	30,060	30,394	6.1	4.7	5.4	6.6	5.5
2009	31,294	31,317	31,234	31,466	3.4	3.4	3.2	3.9	3.5
2010	32,586	32,900	32,585	32,701	4.1	5.1	4.1	4.5	4.6
2011	34,281	34,608	34,225	34,523	5.2	6.2	5.0	5.9	5.7
2012	36,037	36,433	36,064	36,151	5.1	6.3	5.2	5.5	5.6
2013	38,487	38,356	38,303	38,360	6.8	6.4	6.3	6.4	6.4
2014	40,588	40,346	40,430	40,042	5.5	4.8	5.1	4.0	4.6
2015	42,536	42,374	42,455		4.8	4.4	4.6		4.5

ANNEX 4

GOODNESS-OF-FIT TESTS OF THE ESTIMATES

The Model of Instrumental Variables (IV) is a method to make consistent estimates of the estimators of endogenous explanatory variables, conditioned to the existence of instrumental variables, i.e. external variables that satisfy the criteria of relevance and exogeneity: variables that are quite correlated to GDP and that do not directly explain the hydrocarbons revenues and capital expenditure.

Tax revenues

White noise test of the instrumental variables model

```
 Portmanteau test for white noise
---------------------------------------
Portmanteau (Q) statistic  = 28.6603
Prob > chi2 (28)           =  0.3776
```

Hydrocarbons revenues

White noise test of the instrumental variables model

```
 Portmanteau test for white noise
---------------------------------------
Portmanteau (Q) statistic  = 24.1684
Prob > chi2 (28)           =  0.6210
```

Capital Expenditure

White noise test of the instrumental variables model

```
 Portmanteau test for white noise
---------------------------------------
Portmanteau (Q) statistic  = 24.0096
Prob > chi2 (28)           =  0.6298
```

ANNEX 5

CALCULATION OF THE STRUCTURAL BALANCE WITH TREASURY DATA

Calculation of elasticities

Dependent variable:	Δln TaxRev	Δln HydrRev	Δln CapExp
Δln real GDP(t)	5,223***	-7,550	1,269
	(4,910)	(-0,562)	(0,128)
Δln real GDP(t-1)	2,857**	-1,369	2,799
	(2,565)	(-0,331)	(0,543)
Δln real GDP(t-2)	3,871***	-5,580	10,739**
	(2,656)	(-1,635)	(2,451)
Δln real GDP(t-3)	-1,721	4,588	-1,448
	(-1,415)	(1,150)	(-0,351)
Δln WTI(t)	-0,035	0,701**	0,147
	(-0,370)	(1,959)	(0,363)
Δln WTI(t-1)	0,234*	-0,492	0,206
	(1,740)	(-0,680)	(0,382)
Δln WTI(t-2)	-0,122	0,891**	-0,366
	(-0,693)	(2,501)	(-0,820)
Dependent variable(t-1)	-0,487***	-0,044	-0,122
	(-5,205)	(-0,330)	(-0,700)
Dependent variable(t-2)	0,033	0,029	-0,167
	(0,297)	(0,229)	(-0,883)
Dependent variable(t-3)	-0,025	-0,214***	0,070
	(-0,257)	(-2,678)	(0,553)
Dummy (2006q1-2015q4 =1)	-0,053**		0,108
	(-2,332)		(1,125)
Dummy outlier	-0,237***	-0,508**	0,896***
	(-5,939)	(-2,157)	(10,389)
White noise in residues	yes	yes	yes
F test of weak instruments	15,17	15,03	15,71
Hansen test of exogeneity	0,16	0,23	0,37
Observations	59	59	59

Heteroskedasticity-robust t-statistics (standard errors through GMM in two stages).

*** p<0,01, ** p<0,05, * p<0,1.

NOTE: Instruments for endogenous variable Δln real GDP(t): Δln Consumption, Δln Deposits in bolivianos, In (1), in addition internal instruments according to Lewbel (2011) were used, The outliers were identified by using the algorithm of Ugarte and Verardi (2012)

Calculation of the Structural Balance

$$Structural\ Revenues_t = TaxRev_t * \left(GDP_t^{pot} / GDP_t\right)^{5.2} * \left(GDP_{t-1}^{pot} / GDP_{t-1}\right)^{2.9} * \left(WTI_{t-1}^{lt} / WTI_{t-1}\right)^{0.2}$$

$$+HydrRev_t * \left(WTI_t^{lp} / WTI_t\right)^{0.7} * \left(WTI_{t-1}^{lt} / WTI_{t-1}\right)^{0.9} + OtherRev_t$$

$$Structural\ Expenditure_t = CapExp_t * \left(GDP_{t-1}^{pot} / GDP_{t-1}\right)^{10.7} + CurrExp_t$$

$$Structural\ Balance_t = Structural\ Revenues_t - Structural\ Expenditure_t$$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(7a)	(8)
Years	**Str. B**	**Real Str. B**	**FI (t,t-1)**	**Real FI (t,t-1)**	**Aver. real FI**	**Fiscal Pol.**	**Output gap**	**Cycle**	**Cyclicality**
2000	-223	-75	459	158	243	Expansionary	180	Recessive	Countercyclical
2001	-2119	-653	1896	578	243	Expansionary	-1	Recessive	Countercyclical
2002	-2161	-646	42	-8	243	Expansionary	-118	Recessive	Countercyclical
2003	-562	-154	-1599	-492	-364	Contractive	-234	Expansionary	Procyclical
2004	618	158	-1180	-312	-364	Contractive	-133	Expansionary	Procyclical
2005	1834	446	-1217	-288	-364	Contractive	-51	Expansionary	Procyclical
2006	1790	420	44	25	-453	Contractive	58	Expansionary	Countercyclical
2007	3232	716	-1442	-295	-453	Contractive	53	Expansionary	Countercyclical
2008	3421	712	-188	3	-453	Contractive	175	Expansionary	Countercyclical
2009	440	85	2981	627	39	Expansionary	-45	Recessive	Countercyclical
2010	3638	682	-3198	-597	39	Expansionary	-143	Recessive	Countercyclical
2011	2926	491	712	191	39	Expansionary	-171	Recessive	Countercyclical
2012	3469	556	-543	-65	39	Expansionary	-179	Recessive	Countercyclical
2013	5215	786	-1745	-230	194	Expansionary	148	Expansionary	Procyclical
2014	1197	169	4018	617	194	Expansionary	315	Expansionary	Procyclical
2015	-2423	-314	3620	483	483	Expansionary	122	Recessive	Countercyclical

Goodness-of-fit tests of the estimated elasticities

Tax revenues

White noise test of the residues of the error correction model

```
  Portmanteau test for white noise
---------------------------------------
Portmanteau (Q) statistic  = 26.4052
Prob > chi2 (28)           =  0.4962
```

Hydrocarbons revenues

White noise test of the instrumental variables model

```
  Portmanteau test for white noise
---------------------------------------
Portmanteau (Q) statistic  = 35.7668
Prob > chi2 (28)           =  0.1486
```

Capital expenditure

White noise test of the instrumental variables model

```
  Portmanteau test for white noise
---------------------------------------
Portmanteau (Q) statistic  = 23.6358
Prob > chi2 (28)           =  0.7006
```

ANNEX 6

CALCULATION OF THE STRUCTURAL BALANCE USING THE CATEGORIZATION OF BANEGAS AND GONZÁLEZ (2015)

Calculation of elasticities

Dependent variable:	Δln Int Rev	Δln Customs Rev	Δln H Int Mark	Δln H Ext Mark	Δln Hydr Tax
Δln real GDP(t)	2.189*	6.179***	4.719	-0.189	-3.869
	(1.924)	(2.803)	(0.654)	(-0.064)	(-1.165)
Δln real GDP(t-1)	2.370**	4.272***	5.623	-0.340	0.172
	(2.419)	(2.724)	(0.756)	(-0.151)	(0.080)
Δln real GDP(t-2)	4.059***	1.729	-2.724	-3.466	0.481
	(4.749)	(1.097)	(-0.894)	(-1.154)	(0.216)
Δln WTI(t)	0.147	0.078	0.301	0.123	0.718***
	(1.634)	(0.612)	(0.917)	(0.473)	(3.794)
Δln WTI(t-1)	-0.121	0.098	-0.084	0.491**	-0.268
	(-1.420)	(0.606)	(-0.184)	(2.163)	(-1.324)
Δln WTI(t-2)	0.191***	0.044	0.156	0.471**	0.887***
	(2.963)	(0.291)	(0.423)	(2.362)	(5.375)
Dependent variable(t-1)	-0.346***	-0.218*	0.016	-0.473***	-0.338***
	(-2.875)	(-1.736)	(0.212)	(-4.199)	(-3.286)
Dependent variable(t-2)	-0.238**	-0.324*	0.033	-0.273***	0.026
	(-2.083)	(-1.775)	(0.399)	(-2.644)	(0.258)
Dependent variable(t-3)	-0.227*	-0.276*	-0.037	0.041***	-0.105
	(-1.865)	(-1.813)	(-0.399)	(2.644)	(-1.149)
Dummy (2006q1-2015q4 =1)	-0.031*	0.000	0.098		
	(-1.762)	(0.004)	(0.957)		
Dummy outlier	-0.082***	-0.028	0.861	0.249***	0.150***
	(-5.548)	(-0.380)	(1.463)	(2.811)	(4.258)
Dummy oil crisis (2014q3-2015q4=1)			0.159	-0.281***	0.089
			(0.979)	(-4.584)	(1.342)
Dummy fin crisis (2008q4-2009q2=1)			0.017	-0.198***	0.009
			(0.241)	(-3.460)	(0.192)
White noise in residues	yes	yes	yes	yes	yes
F test of weak instruments	26.53	17.11	16.61	15.94	22.06
Hansen test of exogeneity	0.31	0.75	0.69	0.67	0.51
Observations	59	59	59	43	59

Heteroskedasticity -robust t-statistics (standard errors through GMM in two stages).

*** p<0.01, ** p<0.05, * p<0.1.

NOTE: Instruments for endogenous variable Δln real GDP(t): Δln Consumption, Δln Deposits in bolivianos, In (4), in addition internal instruments according to Lewbel (2011) were used. The outliers were identified by using the algorithm of Ugarte and Verardi (2012)

Calculation of the Structural Balance

$$Structural\ Revenues_t = Internal_Revenue_t * \left(GDP_t^{pot} / GDP_t\right)^{2.2} * \left(GDP_{t-1}^{pot} / GDP_{t-1}\right)^{2.4} * \left(WTI_{t-1}^{lt} / WTI_{t-1}\right)^{0.19} + Customs_Rev_t * \left(GDP_t^{pot} / GDP_t\right)^{6.2} * \left(GDP_{t-1}^{pot} / GDP_{t-1}\right)^{4.3} + Hydr_Tax_t * \left(WTI_t^{lt} / WTI_t\right)^{0.7} * \left(WTI_{t-2}^{lt} / WTI_{t-2}\right)^{0.9} + Hydr_Int_m_t * \left(GDP_t^{pot} / GDP_t\right)^{4.1} * \left(WTI_{t-1}^{lp} / WTI_{t-1}\right)^{0.2} + Hydr_Ext_m_t * \left(WTI_{t-1}^{lp} / WTI_{t-1}\right)^{0.5} * \left(WTI_{t-2}^{lp} / WTI_{t-2}\right)^{0.5} + OtherRev_t$$

$$Structural\ Exp_t = CapExp_t * \left(GDP_{t-1}^{pot} / GDP_{t-1}\right)^{3.7} + CurrExp_t$$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(7a)	(8)
Years	**Str. B**	**Real Str. B**	**FI (t,t-1)**	**Real FI (t,t-1)**	**Aver. real FI**	**Fiscal Pol.**	**Output gap**	**Cycle**	**Cyclicality**
2000	-1616	-546	506	158	392	Expansionary	180	Recessive	Countercyclical
2001	-5055	-1559	3440	1012	392	Expansionary	-1	Recessive	Countercyclical
2002	-5234	-1564	179	5	392	Expansionary	-118	Recessive	Countercyclical
2003	-3783	-1035	-1451	-529	-460	Contractive	-234	Expansionary	Procyclical
2004	-3271	-836	-512	-198	-460	Contractive	-133	Expansionary	Procyclical
2005	-751	-182	-2520	-654	-460	Contractive	-51	Expansionary	Procyclical
2006	2535	595	-3286	-778	-753	Contractive	58	Expansionary	Countercyclical
2007	1018	225	1517	370	-753	Contractive	53	Expansionary	Countercyclical
2008	3336	695	-2319	-469	-753	Contractive	175	Expansionary	Countercyclical
2009	-661	-128	3997	823	99	Expansionary	-45	Recessive	Countercyclical
2010	6494	1218	-7155	-1346	99	Expansionary	-143	Recessive	Countercyclical
2011	3443	578	3052	640	99	Expansionary	-171	Recessive	Countercyclical
2012	1863	298	1580	280	99	Expansionary	-179	Recessive	Countercyclical
2013	469	71	1394	228	904	Expansionary	148	Expansionary	Procyclical
2014	-10707	-1509	11176	1579	904	Expansionary	315	Expansionary	Procyclical
2015	-17722	-2298	7015	789	789	Expansionary	122	Recessive	Countercyclical

White noise tests of the residues of the estimations of elasticities

Internal Revenues

```
  Portmanteau test for white noise
Portmanteau (Q) statistic  = 21.3831
Prob > chi2 (28)           =  0.7680
```

Customs Revenues

```
Portmanteau test for white noise
Portmanteau (Q) statistic =     17.3161
Prob > chi2 (12)          =      0.1381
```

```
  Portmanteau test for white noise
Portmanteau (Q) statistic  = 17.3161
Prob > chi2 (28)           =  0.1381
```

Hydrocarbons Taxes

```
Portmanteau test for white noise
Portmanteau (Q) statistic =     24.3695
Prob > chi2 (27)          =      0.6097
```

```
  Portmanteau test for white noise
Portmanteau (Q) statistic  = 24.3695
Prob > chi2 (28)           =  0.6097
```

Domestic Market

```
Portmanteau test for white noise
Portmanteau (Q) statistic =     17.7490
Prob > chi2 (27)          =      0.9110
```

```
  Portmanteau test for white noise
Portmanteau (Q) statistic  = 17.7490
Prob > chi2 (28)           =  0.9110
```

External Market

```
  Portmanteau test for white noise
Portmanteau (Q) statistic  = 20.4714
Prob > chi2 (28)           =  0.1997
```

ANNEX 7

CALCULATION OF THE NON-OIL STRUCTURAL BALANCE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(7a)	(8)
Years	**Str. B**	**Real Str. B**	**FI (t,t-1)**	**Real FI (t,t-1)**	**Aver. real FI**	**Fiscal Pol.**	**Output gap**	**Cycle**	**Cyclicality**
2005	-10720	-2605							
2006	-11227	-2636	507	31	-311	Contractive	58	Expansionary	Countercyclical
2007	-9531	-2110	-1696	-526	-311	Contractive	53	Expansionary	Countercyclical
2008	-8031	-1672	-1500	-438	-311	Contractive	175	Expansionary	Countercyclical
2009	-10406	-2013	2375	341	-197	Contractive	-45	Recessive	Procyclical
2010	-7216	-1353	-3190	-660	-197	Contractive	-143	Recessive	Procyclical
2011	-9772	-1640	2556	287	-197	Contractive	-171	Recessive	Procyclical
2012	-5513	-883	-4259	-757	-197	Contractive	-179	Recessive	Procyclical
2013	-7118	-1072	1604	189	1053	Expansionary	148	Expansionary	Procyclical
2014	-21210	-2989	14093	1916	1053	Expansionary	315	Expansionary	Procyclical
2015	-31019	-4022	9809	1033	1033	Expansionary	122	Recessive	Countercyclical