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Interaction of Economic Policy. Lessons on Social Welfare and Risk Premium

ROGER ALEJANDRO BANEGAS RIVERO[1], MARCO ALBERTO NÚÑEZ RAMÍREZ[2] and SACNICTÉ VALDEZ DEL RÍO[3]

[1] Professor, Department of Economics, Universidad Autónoma Gabriel René Moreno, Santa Cruz de la Sierra, Bolivia
e-mail: rbanegas@uagrm.edu.bo , https://orcid.org/0000-0002-3841-786X
[2] Professor, Department of Management, Instituto Tecnológico de Sonora, Ciudad Obregón, Mexico,
e-mail: marco.nunez@itson.edu.mx , https://orcid.org/0000-0001-5825-4482
[3] Professor, Department of Management, Instituto Tecnológico de Sonora, Ciudad Obregón, Mexico,
e-mail: sacnicte.valdez@itson.edu.mx , https://orcid.org/ORCID 0000-0002-1786-5567

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ABSTRACT

The Purpose of this paper is to quantify the impacts on social welfare and risk premium, by combination and alternatives to interactions of economic policy: fiscal-monetary, fiscal-exchange and monetary for the Bolivian case. There are also considered unidirectional economic policies with counterfactual analysis without interaction. The estimates are presented by a Dynamic Stochastic General Equilibrium (DSGE) model with the incorporation of Bayesian structural autoregressive vectors (SVAR). The findings suggest that the fiscal-monetary interaction generates 79% of variability in social welfare, while the unidirectional exchange rate policy is a relevant factor for Risk premium of more than 84%. In the absence of economic policy interaction, productivity shocks are the most relevant.

INTRODUCTION

This document originates from the motivation of a complexity area in the understanding of the combinations of economic policies-*literature of the economic coordination*- and in the so-called *macroeconomic policies that involve opportunity costs* between forces or instruments that compete in the economy, from a perspective of general, dynamic and stochastic equilibrium (Christiano et al*.,* 2018; Saulo et al*.,* 2013). The relevance of this paper is directed at demonstrating the established *Trade-Offs* relation-

ships between economic policy interactions (as combined policies). To achieve this, two main questions of interest were established: *Which interaction in the economic policy instruments has the greatest influence on social welfare and on the risk premium? What inference can be made about trade-offs between economic policies interactions?*

The main objective of the document is to evaluate the effects on the interaction of the economic policy on *social welfare* as the main purpose of the public policy and on the *risk premium,* since it constitutes a *proxy variable* of economic uncertainty and instability; in the case of Bolivia, it is interpreted as a possible opportunity cost for economic policy because it fulfills the assumptions of a small and open economy. Likewise, the general premise is the existence of *trade-offs* and substitutability in the possible combinations of economic policy, pointing out that the use of greater interaction of instruments would have as an opportunity cost the sacrifice of using other respective combinations to a lesser extent. In contrast to the above, diverse theoretical perspectives reflect inconclusive academic discussions, with contradictory empirical results on the role of the expansive economic policy (active) in the fiscal, monetary and exchange sector; this is done with the purpose of promoting the economic stabilization (Jia *et al.,* 2015; Cevik et al*.,* 2014; Benigno, 2001), according to different theoretical approaches: *post-Keynesian, neo-Keynesian and the neo-classical position of the economy*, under environments of volatility, instability or decline in the economic activity. On the other hand, individual assessment of economic policy instruments shows that it goes in one-way direction (e.g. Public expenditure, interest rate, exchange rate or others), and may lead to the loss of welfare for society or incomplete analysis of *'island economic policies'* (De Gregorio, 2007).

By omitting the effects of economic interaction, it can lead to fulfilling macroeconomic objectives in the presence of rivalry, direct and indirect effects where they neutralize each other, as well as controversial coordination and the dependence and independence on institutional foundations (e.g. the relationship between Government and Central Bank) (Hallett et al*.,* 2011; Leeper, 1991; Cooper, 1969; Timbergen, 1954). Similarly, there is academic discussion with inconclusive results about the relevance in the use of economic policy interaction (active, passive or neutral) or on the contrary, policies should be carried out independently (Flotho, 2018; Ko, 2015; Hallett et al*.,* 2011; Chadha and Nolan, 2007). Another academic debate revolves around the choice between ensuring the sustainability of public policies or relaxing the assumption of Ricardian equivalence and use of public investment, fiscal deficit and public debt to soften internal or external shocks (stabilization of current demand) (Krugman, 2013; Guajardo et al*.,* 2011; Beetsma and Jensen, 2005). In addition, the main risks to monetary policy focus on the absence of fiscal discipline, austerity and equilibrium (Bianchi and Ilut, 2017; Alesina and Ardagna, 2010). Therefore, it is agreed that inflationary pressures are based on joint monetary and fiscal expansions, of which most economists are in agreement with (Bernanke, 2003).

The most widely used current approach is the new macroeconomic consensus (DSGE models), with quantification of internal, external and economic policy stochastic shocks, as well as the implications of alternative rules on the fiscal, monetary or combined behavior (Ryoo and Skott, 2017; Drumond and De Jesus, 2016). On the other hand, it has been mentioned that the combined expansive policies and budgetary restrictions present limitations in the sustainability of the public debt, in the inflation; hence, it compromises the economic future (unsustainability - Thams, 2006), and puts the country at risk. Consequently, the document is organized in four sections: the first is about economic coordination literature; the second contains a general, dynamic and stochastic equilibrium model; the third section presents the main results of estimates and simulations; and the fourth one presents the discussion of the results and implications for public policies. At the end of the document, the main general conclusions are established.

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1. ECONOMIC COORDINATION LITERATURE

The philosophical debate on the role of economic policy is oriented towards its role in the economy (active, passive or neutral), according to different antagonistic currents in the economy (Keynesian, post-Keynesian, neo-Keynesian, classical and neoclassical); hence, the economic controversies are diverse under the argument 'nothing is robust or absolute'. Possibly, understanding the *literature of economic*

coordination as a function in the interaction or combination of economic policy instruments is one of the most complex issues in the economic field. Empirical evidence highlights the importance of fiscal-monetary coordination and the data generation for policy interaction, public debt role, uncertainty, as well as the preference of policymakers, especially in the contexts of monetary union (Foresti, 2018; Cabral and García, 2015). Price-determining fiscal theory involves not only the consequences of government decisions (spending and public investment) on inflation, but on real interest rate, the real economy and the entire economic structure. Everything can remain unchanged in the presence of a fiscal surplus (Cochrane, 2018), except for the determination with their respective refutations and arguments (Buiter, 1999), where there is a misunderstanding of the governmental intertemporal budgetary restriction. Consequently, the solution would be to endogenize both the public debt, as well as the debt *default* discount factor to the dependent variables on the economy *(fiscal reaction function*).

1.1 The New Macroeconomic Consensus, Social Welfare and the Risk Premium

Through the new macroeconomic consensus, neo-Keynesian or neo-classical synthesis, it has become evident that the central bank authorities and the government exercise better economic, fiscal and monetary stabilization results, in terms of complementarity with an explicitly active role in an open economy (Ryoo and Skott, 2017; Bi and Kumhof, 2011; Davig and Leeper, 2011; Chadha and Nolan, 2007), in addition to other common characteristics:

- Micro-funded models (consumers and producer firms),
- Incorporation in the dynamics of the role of Savings and Investment.
- A Phillips expectation curve (with short-term rigidities).
- A rule of monetary behavior (e.g. Taylor or McCallum).
- Public finances in intertemporal equilibrium or alternatively, a rule of fiscal behavior based on the behavior of the product (fiscal reaction function).

Consequently, the Neo-Keynesian approach shows an increasing trend in its use for assessment in the economic policy mix, through a system of dynamic equations to explain fluctuations in economic aggregates and due to the presence of exogenous disturbances.
In this regard, social welfare has been approached in models of dynamic and stochastic general equilibrium based on the utility of the consumer, which in aggregate represents the level of welfare of society. Therefore, families seek to reach the maximum level of social welfare (BS_t) according to their decisions on consumption $(C_t)$and work (L_t); because, there is greater welfare in higher levels of consumption (level of satisfaction) and leisure time:

$$BS_t = \left({C_t}^{1-\sigma} - {L_t}^{1+\psi}\right) \quad (1)$$

Where σ represents a risk aversion coefficient and ψ a dis-utility parameter of the work factor, respectively. Consequently, the role of interaction in the economic policy should be oriented towards seeking the highest level of social welfare, which has been widely addressed (Costa Junior *et al*., 2016; Nakata, 2016; Hallett *et al.,* 2011).
On the other hand, from the open economy approach, the flow of capital between a country and the rest of the world is measured by a probability of default that is directly linked to sovereign risk (an allusion that a country can claim to pay or not pay its obligations autonomously or sovereignly):

$$R_t^b = \frac{r_{world_t}}{p} \quad (2)$$

Where: r_{world_t}corresponds to the risk-free international interest rate; R_t^b to the domestic interest rate and $p$corresponds to the probability that pay their debt and$(1-p)$, as the probability that do not pay, respectively. In (2), a relevant relationship can be deduced: the higher the probability of payment, the lower the required national interest rate $(p)$and vice versa;in addition, the probability of default $(1-p)$will be directly linked to the country's level of external indebtedness. Similarly, the country's in-

debtedness (de_t)will be linked to its previous cumulative debt level, the level of current account deficit and the adjustment cost (ξ)bythe growth of the capital stock(K_t):

$$de_t = (1 + r_{world,t-1})de_{t-1} + P_t(-y_t + c_t + i_t + g_t) + \frac{\xi}{2}(k_{t+1} - k_t)^2 \quad (3)$$

In (3), the economy may acquire external debt to finance its consumption and investment not reflected by the income (production), equivalent to a macro-added budgetary constraint. As a result, depending on the level of indebtedness, it is possible to relate the level of deficit in current account and the domestic interest rate in a situation of imperfect capital mobility: the greater the deficit in current account, the higher the national interest rate, which would be reflected in the interest rate differential as a risk premium$(riskpremium)$ (De Gregorio, 2007):

$$R_t^b = r_{world_t} + riskpremium_t \quad (4)$$

In (4), the risk premium represents the additive differential that a country will have to pay for taking on additional indebtedness from financing the rest of the world, which has also been reflected as a proportional parameter $(\psi' > 0)$to the level of external indebtedness (Schmitt-Grohé and Uribe, 2003):

$$riskpremium_t = \psi' de_t \quad (5)$$

The relevant aspect focuses on the risk premium as an opportunity cost in the sustainability of the public policies and with emphasis on the quantification of impacts stemming from the interaction in economic policy. From the perspective of the level of public indebtedness (room for maneuver as regards public policies),there is need to determine the level of effectiveness between the role of active public spending and a passive monetary policy and vice versa (Ko, 2015; Leeper, 1991). The above can be contrasted with the Ricardian equivalence and the financing of the fiscal expansion in case of public indebtedness; therefore, the results will affect the future tax and its incidence will be negative for future private consumption and social welfare.

1.2 Stylized Facts on Risk Premium

The importance of the risk premium in the economic analysis is that it explains the characterized elements in the literature review: differential between the interest rate (national and foreign), probability of non-payment due to deterioration of the economic conditions and the level of external indebtedness, which reflects the mobility of capital in a sense of open economy (imperfect type for the case of Bolivia as the central assumption). When looking at the stylized facts in cross-sectional data, the following assessments can be seen in consecutive order of countries with higher levels of risk premium: Africa, South and Central America, the Caribbean, Eastern Europe and Russia; conversely, compared to the USA (0%), the lowest risk premiums were recorded in Western Europe, Australia and New Zealand (below 2%).

Furthermore, when looking at the risk premiums according to Moody's risk rating (Figures 2 and 3), there are thirteen countries with AAA positioning and 0% risk premium (better investment quality and lower credit risk)[1]; on the other hand, as the risk rating deteriorates, the premium rises: 1% to A2 (low credit risk); 2% to BAA1 (moderate credit risk); 4% to BA1 (speculative investments and substantial credit risk, e.g. Bolivia); 5% to B1 (high credit risk); eleven countries with risk premiums between 9 and 12% with deterioration greater than CAA1 (eminent loss of interest, capital or default)[2].

[1] Australia, Canada, Denmark, Germany, Liechtenstein, Luxembourg, Netherlands, New Zealand, Singapore, Sweden, Switzerland and United States.

[2] Belarus, El Salvador, Irak, Mongolia, Republic of Congo, Cuba, Greece, Ukraine, Barbados, Mozambique and Venezuela.

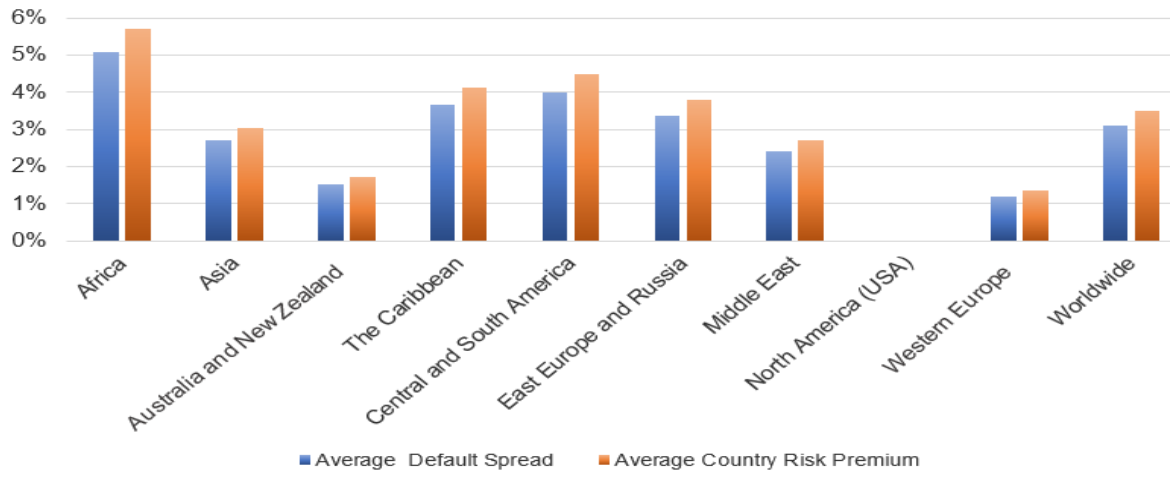

Figure 1. Risk premium by Continent (In percentage, January/2017)

Source: Based on Damodaran (2017).

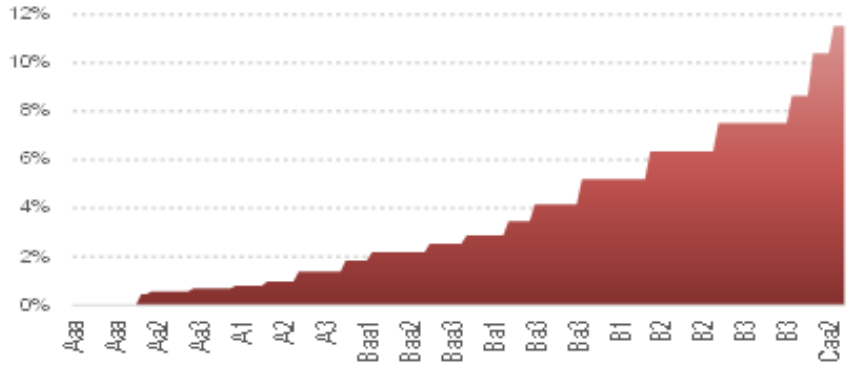

Figure 2. Country risk premium based on Moody´s rating (In percentage, January/2017)

Source: Based on Damodaran (2017).

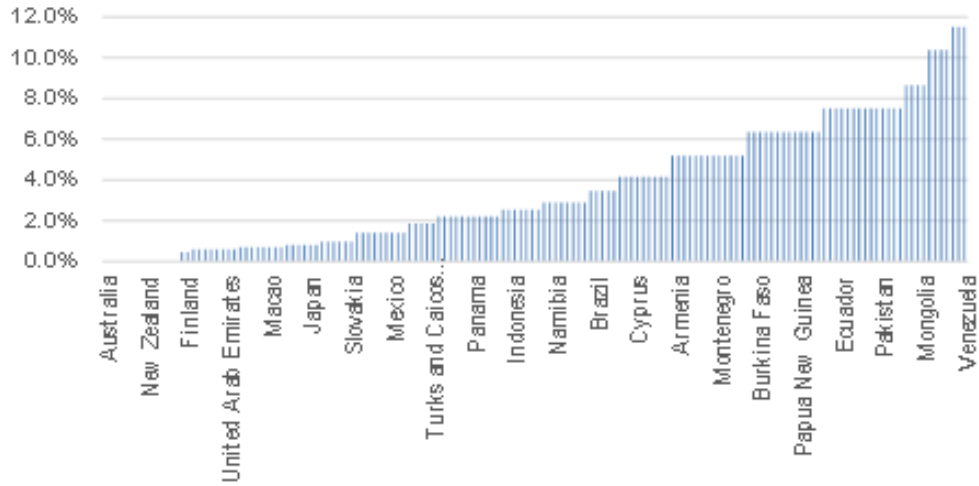

Figure 3. Country risk premium (In percentage, January/2017)

Source: Based on Damodaran (2017)

The determination of the Risk Premium is associated with the level of economic development; therefore, the *developed economies* have the best risk qualification and the lowest risk premium, respectively, based on their level of per capita income and macroeconomic stability. *Developing economies* show ratings from *investment grade* probability to *speculative investment* and the worst ratings were associated with those countries that are going through economic crises, legal and political instabilities and this could be linked to the weakening of their institutions. In summary, in order to evaluate the effects of interaction on economic policy, it is based on theoretical debate and philosophical orientation (active, passive or neutral role), especially under the new macroeconomic consensus, where two variables exercise importance in public policies: *social welfare* (higher goal) and the *risk premium* interpreted as a variable of expectations in sustainability and economic conditions in an open economy, which makes it necessary to measure impacts in the context of general, dynamic and stochastic equilibrium.

2. A GENERAL, DYNAMIC AND STOCHASTIC EQUILIBRIUM MODEL

The modeling is based on the *new macroeconomic consensus*, so it is a general equilibrium model, of dynamic, *log-linear* and stochastic type (DSGE). It is based on the following structure and characteristics (see Annex 1) with standard calibration (Christiano *et al.,* 2005; Woodford, 2003; Smets and Wouters, 2007) and from data of the Bolivian economy in the interaction of economic policy (2000-2015), in whose period it was characterized using different regimes and roles (active, passive or neutral) in the instruments of economic policy (fiscal, monetary and exchange). Consequently, a mixed and combined modeling was used between a structuralist approach in the presence of exogenous disturbances (Annex 1) and time series estimates (Annex 2):

a) There are representative consumers who try to maximize their functions of individual utility, starting from the consumption of goods and services, leisure and maintenance of real money balances, facing a budgetary restriction with intertemporal decisions in consumption, investment and purchase of government bonds.
b) *Social Welfare (SW)* is represented by the levels of consumer satisfaction as a function of the consumption of goods and services and more time devoted to leisure (dis-utility of the work factor) (*interest variable in the quantification of impacts).*
c) There are producing firms that try to maximize their profits, given a production function and a restriction of production costs; in addition, hiring labor factors and capital stock in conditions of optimization (relative prices).
d) There are *rigidities or stickiness* of prices, where the goods are in function of their past values and with a probability of transition towards an optimal price; therefore, there is a Phillips curve where the inflation is a function of the inflationary expectation and its marginal costs (considering the price stickiness).
e) There is a government that collects taxes, and it has oil tax revenues and does current public expenditure and fixed government investment. Government expenditure is seen as a factor dependent on its own innovations in the absence of a fiscal rule.
f) It is considered that the central bank, whose monetary policy is guided by an action of nominal and real growth in the balances of money with feedback from the *shock* in oil prices. Also, the discretion of the Central Bank in the interest rate responds to the product gap and in function of inflation (Taylor´s Rule).
g) The economy is small and opens through international trade (trade balance and current account), as well as through external indebtedness (double-entry in capital flows). The economy can acquire external debt to finance its consumption and investment not reflected by the income (production), equivalent to a macro-added budget constraint.
h) The risk premium proportionally responds to the level of external indebtedness of the country, and is reflected in an excess level of the national interest rate over the international interest rate (*variable of interest in the quantification of impacts*).
i) Economic policy interactions are in threefold: fiscal policy (on the investment side), monetary policy (money supply/GDP) and exchange rate policy (real exchange rate).

j) There are structural innovations, of a triangular type, in the interaction of economic policy, in the following order: fiscal-monetary, fiscal-exchange and monetary-exchange.
k) There are other exogenous shocks of control: *internal disturbances* (of productivity, savings and private investment); *innovations of unidirectional or isolated economic policy* (government expenditure, monetary growth, central bank interest rate, real exchange rate); *external shocks* (oil revenues, trade balance and imports).

Consequently, the model was done based on the determination of the steady state (from the model parameters), as well as the consideration of a Bayesian type calibration and estimates of AR, VAR and SVAR time series.

3. FINDINGS

According to the simulations carried out by the DSGE model, a priori, there is a *trade-off* between interaction in the fiscal-monetary policy or less interaction of the monetary-exchange policy with the perspective of reaching the greatest possible positive deviation of social welfare (Figure 4).

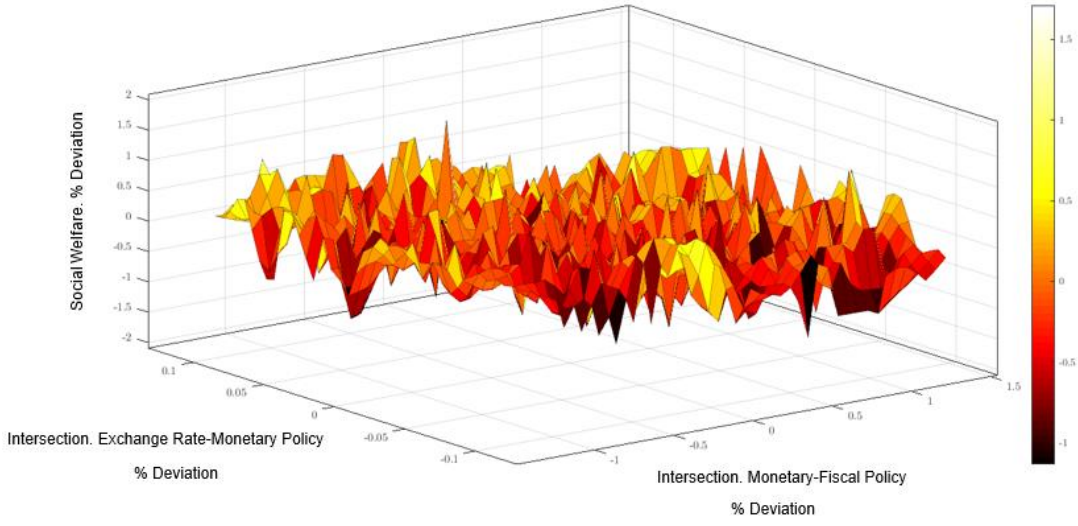

Figure 4. 3D Graphics. Intersection. Fiscal-Monetary Policy, Monetary-Exchange and Social Welfare

Source: Own Estimates

3.1 Analysis of Variance Decomposition

According to the established questioning about the type of combination in economic policy instruments, it is evident that the interaction in f*iscal-monetary policy* exerts the greatest source of variation on social welfare and consumption (79% variability) through the analysis of variance decomposition (Table 2).

Alternatively, when contemplating a counterfactual model, in the absence of economic policy interaction (fiscal-monetary, fiscal-exchange or monetary-exchange), it is evident that *productivity shocks* would generate the greatest source of variability in Social Welfare as in the aggregate variables (Production, Consumption and Investment). On the other hand, the unidirectional role of the exchange rate policy is robust and consistent as the major source of variability on the Country Risk, in the presence or absence of the interaction of instruments of economic policy (between 84 and 100% of the variation).

Table 2. Analysis of Variance Decomposition (in percentage composition)

Model	*Endogenous Variable*	*Productivity*	*Government Expenditure*	*Mon. Pol. Int. Rate*	*Private Savings*	*Exchange Policy*	*Fiscal-Monetary*	*Fiscal-Exchange*	*Monetary-Exchange*
	Social Welfare								
Counterfactual Base	With economic policy interaction	3	0	0	0	0	79	17	1
	Non-economic policy interaction	82	3	5	4	6	—	—	—
	Risk Premium								
Counterfactual Base	With economic policy interaction	0	0	0	0	84	6	7	4
	Non-economic policy interaction	0	0	0	0	100	—	—	—
	Production								
Counterfactual Base	With economic policy interaction	27	0	0	0	0	58	13	1
	Non-economic policy	98	1	0	1	0	—	—	—
	Investment								
Counterfactual Base	With economic policy interaction	19	0	0	31	0	40	9	1
	Non-economic policy interaction	37	0	0	63	0	—	—	—
	Consumption								
Counterfactual Base	With economic policy interaction	3	0	0	0	0	79	17	1
	Non- economic policy interaction	82	3	5	4	6	—	—	—

3.2 Impulse-Response Functions

Social Welfare Response: When comparing the impulse-response analysis of Social Welfare with diverse innovations in the interaction of economic policy (Figure 5), a positive impact is observed coming from shocks of fiscal-monetary interaction and monetary-exchange interaction. On the other hand, there is a negative response from innovation in fiscal-exchange interaction. *Risk premium response:* IRFs analysis reveals a negative effect (lower country risk) from positive innovations in the interaction of fiscal-monetary and fiscal-exchange policy (Figure 6). On the other hand, there is a positive response (increase in risk) from positive innovations in currency-exchange interaction.

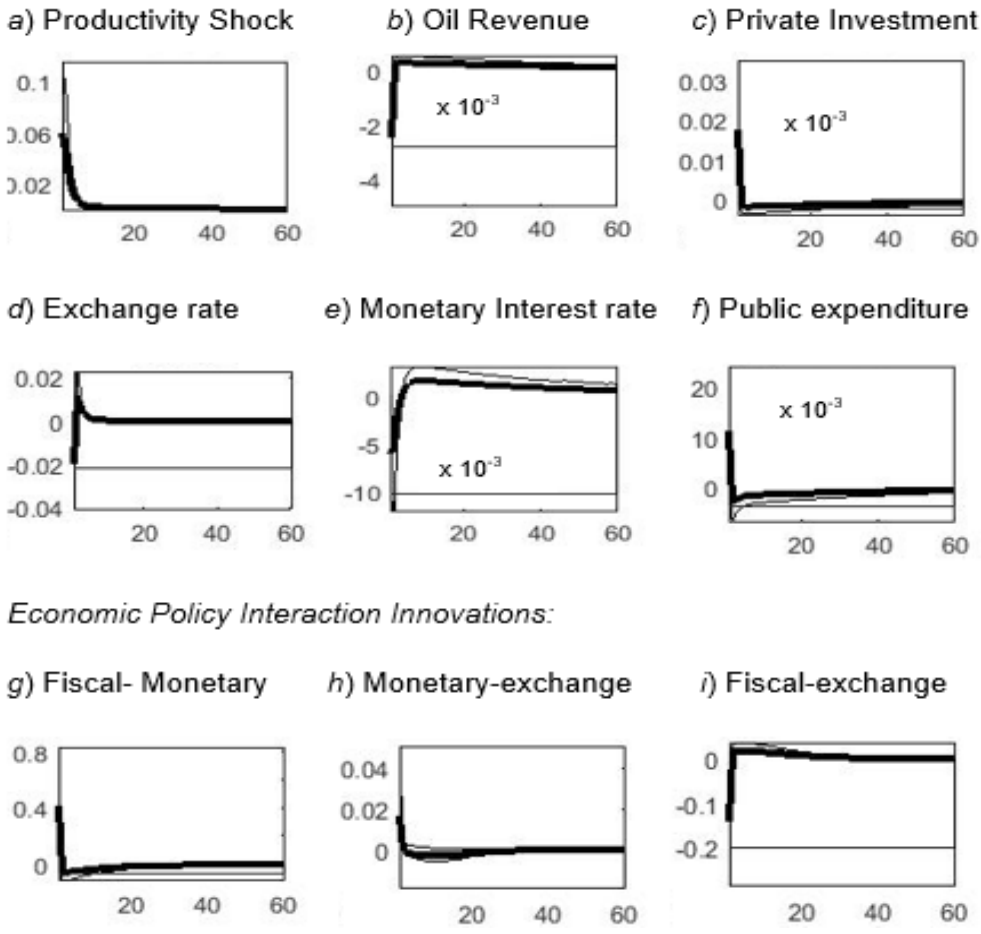

Figure 5. Impulse-Response Functions (IRF)

Response of Social Welfare to Various Shocks (Forward Quarters)
(+) It implies a positive effect
(-) It implies a negative effect

Source: Own estimations

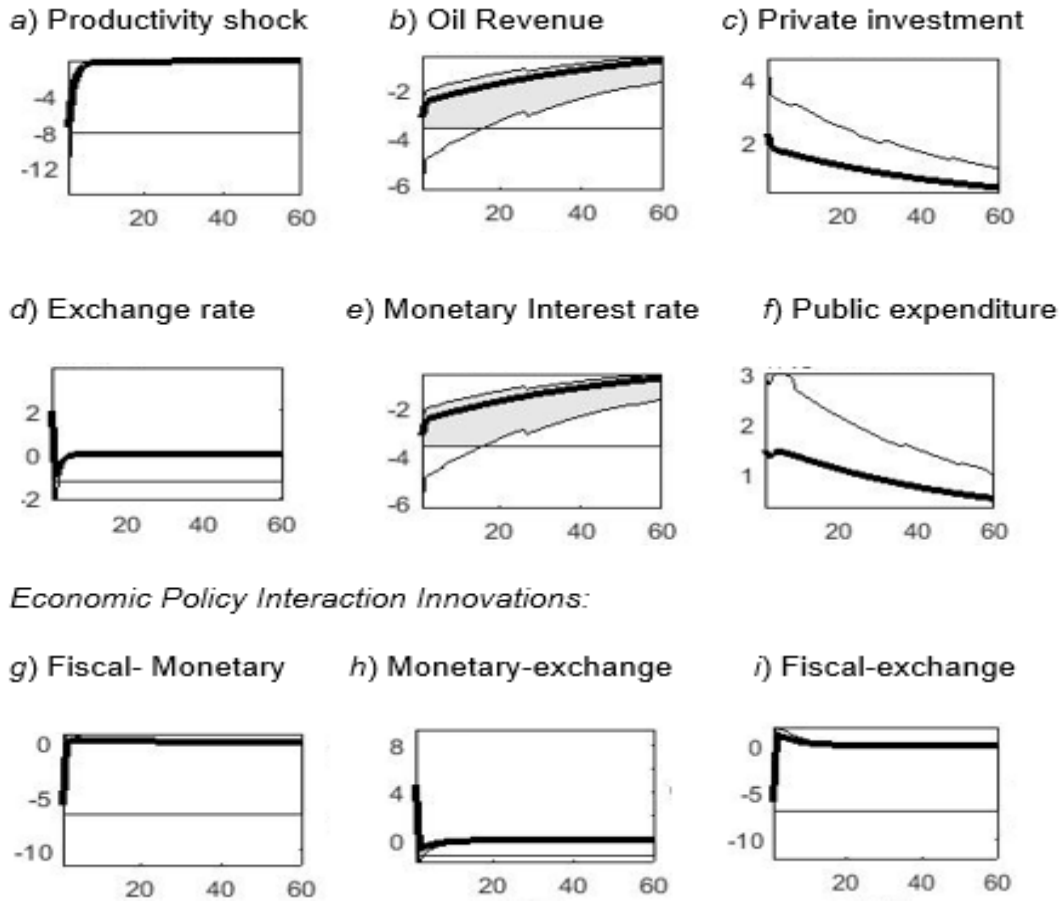

Figure 6. Impulse-Response Functions (IRFs) Response of the Risk Premium**** to various shocks (Forward Quarters)

***On a scale 10^{-3}
(+) It implies a positive effect
(-) It implies a negative effect

Source: Own estimations

According to the Figure 7 and the presented premise, there is empirical evidence through the analysis of impulse-response functions, with the presence of *Trade-Offs* and substitutability between the economic policy interactions: *Fiscal-Monetary (Fmi), Monetary-Exchange (Mei) and Fiscal-Exchange (fei);* therefore, since there is a positive innovation in the combination of instruments, it is negatively and consistently reflected in the use of other interactions in a forward dynamic manner. Also, it is based on the observed intertemporal relations.

3.3 Discussion and Implication for Public Policies

The trade-offs or sacrifice variables between the various macroeconomic aggregates (product stabilization, inflation, exchange rate, unemployment, public debt, among others) depend on the use of instruments in economic policy. It is important to note that not only in their individual/unidirectional use, but also in a combined manner or through interactions, which is consistent with the estimates and simulations carried out (substitutability between the interactions of instruments). In situations of negative external *shocks* (commercial or financial), negative internal disturbances (recession, crisis or low periods of growth in economic activity), economists and academics throughout economic history have discussed the effectiveness of economic policies and their implications on real activity and macro aggregates.

Diverse currents of economic thought (Classical, Neoclassical, Austrian, Keynesian, Neo-Keynesian and Post-Keynesian) have entered into controversial and philosophical debates on the role of economic policy (passive, neutral or active politics). Moreover, the inference is that the most relevant in the economic analysis should be oriented towards social welfare, as a subjective measure in the valuation of the consumer and of the population in general; as well as the analysis of the risk premium as a *proxy variable* in the sustainability of public policies, whose measurement send alert on the economic situation of a country (interpreted as a traffic light variable) and it is linked to the open economy.

Previous studies based on price rigidities, through the interaction of fiscal-monetary policy, have found gains and benefits in the welfare of active fiscal policy with cooperative monetary policy in play in the case of monetary unions, or (Lombardo and Sutherland, 2004) a non-activist fiscal policy of the non-cooperative type would be better if international shocks were negatively correlated. Similarly, previous studies have shown that less activist fiscal policies have less inflationary consequences (Bianchi, 2013; Fernández-Villaverde *et al.,* 2010) and with differentiated effects on social welfare dynamics (from fiscal stimuli): initially positive, and then negative (Nakata, 2016) or that the combination of fiscal and monetary policy would reduce the effect of domestic shocks (Jia *et al.,* 2015). Consequently, the interpretation of a doubly active interaction between fiscal policy and monetary policy comes from two elements: public investment accompanied by monetary expansion (M1 as a percentage of the GDP); which is equivalent to other levels of fiscal activist policy: increase in public expenditure and relaxation of taxes on the behavior of economic activity; on the line of active monetary policy, monetary increase is also incorporated, but conditioned to the behavior in the interest rate, which is as a function of the inflationary feedback (*Taylor rule).*

3.4 Other Alternatives for the Implementation of Public Policies

According to the findings of the study, there are two one-way innovations that have opposite effects on the social welfare and risk premium: that is, the greater the positive innovation in *private investment* and *public expenditure*, respectively, the greater the social welfare; however, it has dynamic implications for an increase in the risk premium. This can be explained by the shocks of private investment and public expenditure. If they are not accompanied by an increase in domestic savings, income or the government's budget balance, it causes an increase in indebtedness to the rest of the world: innovations with *trade-off* effects between social welfare and the risk premium.

In accordance with the results and the new macroeconomic consensus, it was found that positive disturbances in productivity favor an increase in social welfare and a decrease in the risk premium, interpreted as consistently favorable innovations.
Finally, a unidirectional role in the exchange policy had the greatest variability on the risk premium; however, a positive exchange innovation (depreciation) would show a dynamic deterioration in social welfare (lower purchasing power for goods and services), as well as a deterioration in the risk premium (increased risk).

3.5 Transgression of the Law

There are other studies in which it has been demonstrated that the interaction or coordination of the fiscal-monetary policy is not always preferable (Flotho, 2018; Herzog, 2006), especially in conditions of liquidity trap and in the absence of fiscal rules or fixation of an optimal size of government; consequently, unidirectional behaviors in public expenditure and the interest rate can be managed independently. The fiscal policy plays an active and stabilizing role in the economy, in conditions of monetary restriction (low interest rates) and with limits for fiscal performance.

In this regard, the findings that are the greatest source of variability coming from innovations in the interaction of fiscal and monetary policy, does not merit the inexistence of a transgression of law, which is interpreted as the existence of false explanations or refutations that contradict what is evidenced: greater use in these combined instruments to promote social welfare and macro aggregates; or to react

to negative domestic shocks or the individual role of monetary policy and to explain the variability in the risk premium.

For example, the room for maneuver in terms of public indebtedness and inflationary reaction (to doubly active policies) can be mentioned. In fact, a positive innovation in the fiscal-monetary interaction (double active role), will have a positive effect on inflation. This will enable the needed reaction of intervention from the Central Bank, through the increase of interest rates; therefore, there may be a reverse action (negative) on the side of social welfare (in inflationary contexts or high level of public debt). In this case of restrictions when using the combined economic policy (fiscal deficit, public indebtedness or restrictions on external financing), it limits the possibility of interaction in the instruments; the source of counterfactual variation based on productivity shocks (productivity of firms) is evident.

It can be concluded that the role of interaction in the fiscal and monetary policy is conditioned by the presence of monetary rules and inter-temporal budgetary behavior in fiscal policy.

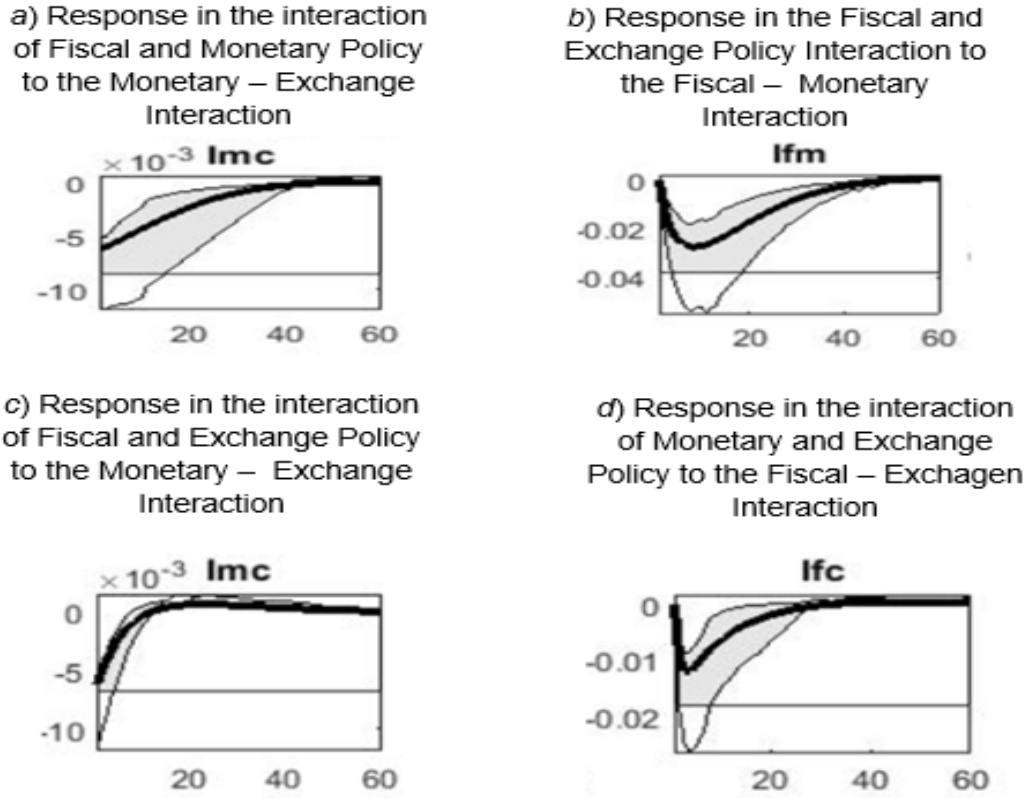

Figure 7. Impulse-Response Functions Trade-Offs and Substitutability between Economic Policy Interactions

Source: Own estimations

Consistent and significant responses are reported using 90% confidence bands in Bayesian parameter distributions. Consequently, the implications of Figure 7, would indicate that an active orientation of economic policy (for example), with a greater inclination towards fiscal-monetary interaction, would be related to a contractive combination of monetary-exchange rate or fiscal-exchange rate; conversely, greater use of monetary-exchange interactions should be reflected with less fiscal-monetary or fiscal-exchange combination, due to the dynamic relationships in economic policy instruments.

CONCLUSIONS

Based on a measurement and comparison approach in economic policy alternatives, this document quantified the impacts of different combinations in their respective instruments: i) *fiscal-monetary interaction,* interpreted as a greater increase in public investment with expansive monetary policy, ii) *fiscal-exchange interaction,* accompanied by real exchange depreciation and iii) *monetary-exchange interaction.* In comparison, a counterfactual model was evaluated without the presence of economic interaction *('island policies').*

The main focus was on social welfare, interpreted as the marginal change in consumer earnings and the disutility of the labor factor, as well as on the *risk premium* that represents a differential between national and foreign interest rates, in addition to reflecting an approximation in the sustainability of public policies and their interconnection with the open economy (e.g. variations in the level of external indebtedness).

By reviewing the *literature on economic coordination*, there is empirical evidence that policymakers tend to favor a particular combination of instruments for various purposes: to promote growth; to cope with negative economic shocks that might arise; or even with preferences for the use of policies interaction that change over time and circumstances.

The starting point was a position oriented towards appreciating the instruments with the greatest variability (explanatory), and their respective impacts. A dynamic and stochastic general equilibrium model (DSGE) was calibrated for the Bolivian economy with the incorporation of Bayesian structural autoregressive vectors (B SVAR); consequently, a theoretical economic structure approach was combined with a time series methodology (base modeling).

The findings contribute in the demonstration that the interaction of fiscal-monetary policy was a major source of variability in social welfare (79% of explanation), with positive incidences on the level of satisfaction of the consumers and decrease in the level of risk premium; on the other hand, in the absence of interaction in the economic policy, the importance of productivity shocks was reflected as the innovation of greater comparative importance on social welfare (82% of variation), as well as on other macro variables (Production, Investment and Consumption).

Consistently and robustly, the importance of the unilateral role (isolated effect) of the exchange rate policy on the level of risk premium (higher than 84% variability) was determined: positive exchange rate variations (exchange rate depreciation) were transferred to a greater differential between national interest rates and the foreign rate and even to the detriment of social welfare (dynamically).

On the other hand, the interaction of greater monetary growth with greater depreciation of the exchange rate generates additional increases in the country's risk premium.

Likewise, support was given to the hypothesis that the interaction of the economic policy instruments considered present trade-offs and substitutability in a consistent manner among themselves; therefore, the general rule involves that greater use of a particular combination will be reflected in the use of less interaction in the future (opportunity cost and sacrifice).

In such sense, an active orientation in the fiscal-monetary interaction is reflected with a contraction in the combination of monetary-exchange instruments and/or in the fiscal-exchange interaction; on the other hand, greater monetary-exchange interaction would be reflected with a contractive combination of fiscal-monetary or fiscal-exchange type, which reveals the choices in the decisions of the economic policy makers, based on the main macroeconomic objectives.

In conclusion, the basic suggestion is to evaluate economic policies through the complexity of economic coordination with the involvement of new challenges, in the understanding of *trade-offs*, with a multivariate lens on public policy preferences and their measurement of impacts.

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ANNEX 1: GENERAL, DYNAMIC AND STOCHASTIC EQUILIBRIUM

I Households and Social Welfare

There is a small, open economy characterized by a large number of representative households, which allocate resources and obtain profits from the consumption of goods and services(C_t), leisure hours $(1 - L_t)$and maintenance of real money balances(M_t/P_t), described by the following utility function: For representative consumers, the main objective is to maximize their intertemporal utility function when making decisions about consumption$(\mathrm{C_t})$, investment and leisure. In the case of savings-investment, two alternatives are presented: physical investment $(\mathrm{I_t})$ (tangible assets) and government bonds $(\mathrm{B_t})$ (assets with intrinsic value).

$$\max \mathrm{E_t} \sum_{t=0}^{\infty} \beta^t \mathrm{S_t^c} \left[\frac{\mathrm{C_t^{1-\sigma}}}{1-\sigma} - \frac{\mathrm{l_t^{1+\psi}}}{1+\psi} + \frac{\nu}{1-\sigma_q} \left(\frac{M_{t+s}^d}{P_{t+s}} \right)^{1-\sigma_q} \right] \qquad \text{(A1)}$$

Where $0 < \beta < 1$

Where: β is a subjective discount parameter; $E_t$is the expectations operator; σ corresponds to the risk aversion parameter; ν and ψ are utility weightings associated with work and the maintenance of real balances, respectively; M_t^dindicates nominal monetary balance and $P_t$indicates the prices of the final goods. In (1), there are disturbances in the intertemporal consumption ($\mathrm{S_t^c}$), normalized to a unit value, in addition to the following budgetary restriction:

$$\mathrm{P_t}(1+\tau_c)(\mathrm{C_t}+\mathrm{I_t}) + \mathrm{B_{t+1}}/\mathrm{R_t^b} = \mathrm{W_t l_t} + \mathrm{R_t K_t}(1-\tau_k) + \mathrm{B_t} \qquad \text{(A2)}$$

Where W_t corresponds to the nominal wage; B_t are the nominal bonds; R_t^b is the nominal interest; R_t is the average return of the physical capital$(\mathrm{K_t})$; τ_k corresponds to the profit share tax.

Solving the optimization problem of (A1) subject to (A2), first-order solutions C_t, L_t, M_t^d and Euler's equations were found(B_{t+1}, K_{t+1}):

$$\left(C_t{}^{\sigma} L_t{}^{\psi}\right)(1+\tau_c) = W_t/P_t \quad \text{(A3)}$$

$$L_t{}^{\psi} + \lambda_t W_t = 0 \quad \text{(A4)}$$

$$\lambda_t P_t = \nu \left(\frac{M_t^d}{P_t}\right)^{\sigma_q} \quad \text{(A5)}$$

$$\frac{S_t^c C_t{}^{-\sigma}}{P_t} = R_t^b \beta E_t \frac{S_{t+1}^c C_{t+1}{}^{-\sigma}}{P_{t+1}} = R_t^b \quad \text{(A6)}$$

$$S_t^c C_t{}^{-\sigma} = \beta \frac{S_{t+1}^c C_{t+1}{}^{-\sigma}}{P_{t+1}(1+\tau_c)}[(1-\delta)P_{t+1}(1+\tau_c) + R_t(1-\tau_k)] \quad \text{(A7)}$$

Whereλ_t corresponds to the Langrangian of the budgetary restriction in time t.

Given the previous intertemporal optimization decisions (A3) - (A7), families seek to reach the maximum level of social welfare (BS_t) according to their consumption and work decisions; because, there is greater welfare at higher levels of consumption (level of satisfaction) and more leisure time (lack of autonomy of the work factor);

$$BS_t = \left(C_t{}^{1-\sigma} - L_t{}^{1+\psi}\right) \quad \text{(A8)}$$

In (A8), the budgetary constraint of households is the dilemma between consumption and leisure: income is needed in order to consume goods and services.

II FIRMS

Intermediate Goods Producing Firms

The aggregate production of the economy depends on the production level of intermediate goods and an elasticity of substitution for intermediate goods:

$$y_t = \left(\int_0^1 y_{j,t}^{\frac{\varphi-1}{\varphi}} \mathrm{dj}\right)^{\frac{\varphi}{\varphi-1}} \quad \text{(A9)}$$

Where φ is related to the elasticity of substitution between intermediate goods: it also symbolizes the *mark-up* of prices; consequently, it is assumed that the price level of the economy depends on the price sensitivity of the intermediate goods:

$$P_t = \left(\int_0^1 P_{j,t}^{\frac{\varphi-1}{\varphi}} \mathrm{dj}\right)^{\frac{\varphi}{\varphi-1}} \quad \text{(A10)}$$

Final Goods Producing Firms

Based on the level of aggregate production, a set of representative firms is assumed to operate by a Cobb-Douglas-type production function with two types; the productive factors capital and labor, respectively:

$$Y_{j,t} = A_t K_{j,t}^{\alpha} L_{jt}^{1-\alpha} \quad \text{(A11)}$$

Where α is the participation of the capital in the product; A_t corresponds to the productivity that follows the notion:

$$\log A_t = (1-\rho_A)\log A_{ss} + \rho_A \log A_{t-1} + \epsilon_{A,t} \quad \text{(A12)}$$

$\rho_A$is the autoregressive component and $\epsilon_{A,t}$ is an exogenous shock of productivity.

In (A10), the future dynamics of the capital stock moves by:

$$k_{t+1} = i_t + (1+\delta)k_t \quad \text{(A13)}$$

Where the investment is composed of its private$(\varrho^{privada})$) and public proportion, respectively(ϱ^{gob}):

$$i_t = \varrho^{privada} + \varrho^{gob} \quad \text{(A14)}$$

In addition, A11 is liable to budgetary restriction:

$$W_t * L_{j,t} + R_t K_{j,t} \quad \text{(A15)}$$

The optimization problem focuses on minimizing the budgetary costs of production (A15) liable to the production function (A11).

Using the Lagrangiana function$(\mathcal{L})$:

$$\mathcal{L} = W_t * L_{j,t} + R_t K_{j,t} - mc_t\left(A_t K_{j,t}^{\alpha} L_{jt}^{1-\alpha}\right) \quad \text{(A16)}$$

In (15), you have the first order conditions: $\frac{\partial \mathcal{L}}{\partial L_{j,t}}; \frac{\partial \mathcal{L}}{\partial K_{j,t}}$

$$W_t = mc(1-\alpha)Y_{j,t}/L_{j,t} \quad \text{(A17)}$$

$$R_t = mc\alpha Y_{j,t}/K_{j,t} \quad \text{(A18)}$$

Alternatively, an optimization strategy consists of maximizing the profits by choosing the price of the good j:

$$max_{Pj,t} P_{j,t} Y_{j,t} - W_t * L_{j,t} - R_t K_{j,t} \quad \text{(A19)}$$

Assuming (A9) y (A10): $mc_t = \left(\frac{\varphi-1}{\varphi}\right) P_{j,t}$ (A20)

Replacing (A20) in (A17) and (A18):

$$W_t/P_t = \left(\frac{\varphi-1}{\varphi}\right)(1-\alpha)Y_t/L_t \quad \text{(A21)}$$

$$R_t/P_t = \left(\frac{\varphi-1}{\varphi}\right)\alpha Y_t/K_t \quad \text{(A22)}$$

Calvo Pricing (1983)

The Calvo pricing rule (1983) holds that the current price level is a composition between rigidity, in probabilistic θ terms, with the possibility of maintaining the same price from the previous period and the remaining probability $(1-\theta)$ with transition to an optimal price:

$$P_t = \left[\theta P_{t-1}^{1-\varphi} + (1-\theta)P_t^{*1-\varphi}\right]^{\frac{1}{1-\varphi}} \quad \text{(A23)}$$

Starting from (A22), it is specified as Phillips Curve function in its Neo-Keynesian version:

$$\pi_t = \gamma\pi_{t-1} + \beta\pi_{t+1} + \frac{(1-\theta)(1-\theta\beta)}{\theta} mc_t \quad \text{(A24)}$$

Defining marginal costs mc_t, is represented by:

$$mc_t = \frac{1}{A_t}\left(R_t^{\alpha} * W_t^{1-\alpha}\right) \quad \text{(A25)}$$

III GOVERNMENT

In government, the tax authority collects taxes, has oil revenues, conducts current public expenditure and government fixed investment. The government's current consumption expenditure is considered as a dependent factor on its own innovations by virtue of the absence of a fiscal rule.
Tax collection is endogenous to the following behavior:

$$Tax_t = P_t(\tau_c)(C_t + Ifp_t) + \tau_k R_t K_t + e_t \tau_m M_t \quad \text{(A26)}$$

$$BALf_t = Tax_t + Oil_t - P_t * (G_t + Ifg_t) \quad \text{(A27)}$$

$$\log Oil_t = (1-\rho_{oil})\log(\overline{OIL}) + \rho_{oil}\log Oil_{t-1} + \epsilon_{Oil,t} \quad \text{(A28)}$$

$$\log G_t = (1-\rho_G)\log(\overline{G}) + \rho_G \log G_{t-1} + \epsilon_{G,t} \quad \text{(A29)}$$

Where the values represent their respective stationary states: $\overline{M}, \overline{OIL}, \overline{G}$ y $\overline{IFG}$

The dynamics of public debt is a function of:

$$\frac{B_{t+1}}{R_{t+1}^b} - B_t = P_t(G_t + Ifg_t) - BALf_t - Tax_t \quad \text{(A30)}$$

Monetary Policy

The central bank is considered to be guided by an action of nominal and real growth in money balances with feedback from the *shock* in oil prices :$m_{t+1}^r = \frac{g_{m,t}}{\pi_{t+1}} m_t^r$ (A31)

$$\log g_{m,t} = (1 - \rho_{pm}) \log(\overline{g_{m,t}}) + \rho_{pm} \log g_{m,t-1} + \vartheta \epsilon_{Oil,t} + \epsilon_{pm,t} \quad \text{(A32)}$$

$$m_t^d = m_t^r \quad \text{(A33)}$$

Also, the decision of the Central Bank on the interest rate is a response to the product gap, and a function of inflation (similar to a Taylor scheme):

$$R_t^B = \gamma_a (y_t - y^*) + \gamma_b (\pi_t - \pi^*) + \varepsilon_{sm} \quad \text{(A34)}$$

IV EXTERNAL SECTOR

The objective of this section is to link basic relations between trade balance, sensitivity to the real exchange rate, different accounting equivalences of external savings or current account deficit and their relation to external debt, risk premium, interest rates and the level of economic activity. Net exports are understood by the difference between exports and imports, which is also called the trade balance (tb_t), plus the growth of exports (S_t^{tb}); in addition, with the consideration of an elasticity (η) to the variation of the real exchange rate (ΔS_t^{tcr}), whose estimate corresponds to the Marshall-Lerner coefficient, considering the variation in the interaction of the monetary and exchange rate policy ((ΔImc_t):

$$tb_t * S_t^{tb} = \eta * [S_t^{tcr} * Imc_t - S_{t-1}^{tcr} * Imc_{t-1}] \quad \text{(A35)}$$

Similarly, within the external sector there is the current account balance(ca_t), as the accounting difference between domestic savings $(S_{d,t})$ and aggregate investment: private $(ifp_t)$and public(Ifg_t), potentiated by their own respective innovations$(S_t^{ipr} \wedge S_t^{igob})$:

$$ca_t = S_{d,t} - ifp_t * S_t^{ipr} - Ifg_t * S_t^{igob} \quad \text{(A36)}$$

A further accounting definition of the current account is related to net exports, factor services (f_t) and remittances(r_e):

$$tb_t * S_t^{tb} + f_t + r_e = ca_t \quad \text{(A37)}$$

The other equivalence, related to the expression (A36) and (A37) is about the domestic savings: composed of household savings, external savings and government savings:

$$S_{d,t} = s_y * y_t + E_r * cab_t + Ifg_t * S_t^{igob} \quad \text{(A38)}$$

Where *y* represents the marginal propensity to save, and a numerary of nominal change type in the respective form. Effects are incorporated on the risk premium which is proportional to the level of indebtedness as a proportion of GDP, which is reflected in the local interest rate.$riskpremium_t = \psi' de_t$ (A39)

$$R_t^b = r_{world} + riskpremium_t \quad \text{(A40)}$$

Likewise, the economy can acquire external debt (de_t) to finance its consumption and investment that is not reflected by income (production), equivalent to a macro-added budgetary restriction:

$$de_t = (1 + r_{world,t-1}) de_{t-1} + P_t(-y_t + c_t + i_t + g_t) + \frac{\xi}{2}(k_{t+1} - k_t)^2 \quad \text{(A41)}$$

Where ξ represents the adjustment cost in the growth of the capital stock(K_t).

It incorporates the relationship with the rest of the world, through: the trade balance and the current account deficit:

$$tb_t = 1 - \frac{c_t + i_t + g_t}{y_t} \quad \text{(A42)}$$

The expression (42) is equivalent to:

$$y_t = c_t + g_t + ifp_t + ifg_t + tb_t \quad \text{(A43)}$$

On the other hand, the current account balance is linked to the level of external debt (de_t) the level of economic activity(y_t):

$$ca_t = \frac{1}{y_t} * (de_t) \quad \text{(A44)}$$

This section assumes three AR shocks: an exchange-rate self-regulatory shock, a trade shock and an import shock:

$$S_t^{tcr} = \rho_{tcr} S_{t-1}^{tcr} + \epsilon_{tcr} \quad \text{(A45)}$$

$$S_t^{tb} = \rho_{tb} S_t^{tb-1} + \epsilon_{tb} \quad \text{(A46)}$$

$$Import_t = \rho_{import} Import_{t-1} + \epsilon_{import} \quad \text{(A47)}$$

V ECONOMIC POLICY INTERACTION

Unrestricted Vector Autoregression (VAR)

The interactions between fiscal policy (on the investment side), monetary policy (monetary supply/ GDP) and exchange rate policy (real exchange rate), are established through a vector of three endogenous autoregressive variables (VAR):

$$Z_t = \{\text{Fiscal} - \text{Monet.}, \text{Fiscal} - \text{Cambiaria}, \text{ Monet} - \text{Camb.}\} \quad \text{(A48)}$$

Consequently, when considering the endogenous variable vector (A49), an unrestricted vector autoregression (VAR) model was expressed:

$$Z_t = \sum_{i=1}^{k} \phi_i Z_{t-i} + \varepsilon_t \quad \text{(A50)}$$

Or alternatively:

$$(ifg_{t+1} * m_{t+1}^s) = (1 - \phi_2)\overline{(ifg * m^s)} + \phi_2[(ifg_t * m_t^s)] + \phi_3[(ifg_t * tcr_t)] + \phi_4[m_t^s * tcr_t] + \varepsilon_{1,t+1} \quad \text{(A51)}$$

$$(ifg_{t+1} * tcr_{t+1}) = (1 - \phi_6)\overline{(ifg * tcr)} + \phi_6[(ifg_t * m_t^s)] + \phi_7[(ifg_t * tcr_t)] + \phi_8[(m_t^s * tcr_t)] + \varepsilon_{2,t+1} \quad \text{(A52)}$$

$$(m_{t+1}^s tcr_{t+1}) = (1 - \phi_{10})\overline{(m^s * tcr)} + \phi_{10}[(tcr_t * m_t^s)] + \phi_{11}[(ifg_t * tcr_t)] + \phi_{12}[(m_t^s * ifg_t)] + \varepsilon_{3,t+1} \quad \text{(A53)}$$

Structural restrictions

Long-term restrictions are incorporated from the traditional triangular identification mechanism:

- The interaction between fiscal and exchange rate policy is structural and strictly exogenous.
- The interaction between fiscal and monetary policy influences the interaction between fiscal and exchange rate policy.
- The interaction between monetary and exchange-rate policy responds to disturbances in fiscal and monetary policy and fiscal and exchange-rate policy.

The SVAR proposal attempts to recover the shock of structural vectors$(\mu_t^{Z_i})$, which is not directly observable, from the estimation of an unrestricted VAR. This VaR is invertible and generates the following moving average representation:

$$Z_t = A(L)\varepsilon_t^{Z_i} \quad \text{(A54)}$$

Where: $A(L)$ represents a parameter operator; $\varepsilon_t^{Z_i}$ indicates the vector in reduced form of the residues with the covariance matrix Σ. The expression (A55) establishes a linear relationship between the reduced form of the residues and the shocks of the long-term structural model:

$$\varepsilon_t^{Z_i} = \omega_0 \mu_t^{Z_i} \quad \text{(A55)}$$

Complementarily, if it is expressed (A55) in a matrix and unrestricted way, it is obtained:

$$\begin{bmatrix} \varepsilon_t^{Ifg*Monet} \\ \varepsilon_t^{Ifg*Camb} \\ \varepsilon_t^{Monet*Camb} \end{bmatrix} = \begin{bmatrix} \omega_{11} & \omega_{12} & \omega_{13} \\ \omega_{21} & \omega_{22} & \omega_{32} \\ \omega_{31} & \omega_{32} & \omega_{33} \end{bmatrix} * \begin{bmatrix} \mu_t^{Fisc-Monet} \\ \mu_t^{Fisc-Camb} \\ \mu_t^{Monet-Camb} \end{bmatrix} \quad \text{(A56)-(A58)}$$

Likewise, in (A56)-(A58), $n\,(n-1)/2$of additional restrictions are required to identify the model; that is, with three endogenous variables, three coefficients equal to zero are required $(\omega_{i,j} = 0)$ imposed through the economic

theory. For a long-term design, it consists of (cumulative) responses of ω from structural innovations, which are presented in the impulse-response properties and take the form of:

$\omega = \widehat{\psi}_{\infty} A^{-1} B$ (A59)

Consequently, it would be necessary to identify the matrix $\omega_0(3x3)$in order to recover the structural shock vector$(\mu_t^{Z_i})$, from the estimated error vector $(\varepsilon_t^{Z_i})$.

In a reduced form it is obtained:

$$\begin{bmatrix} \varepsilon_t^{Ifg*Monet} \\ \varepsilon_t^{Ifg*Camb} \\ \varepsilon_t^{Monet*Camb} \end{bmatrix} = \begin{bmatrix} \omega_{11} & 0 & 0 \\ \omega_{21} & \omega_{22} & 0 \\ \omega_{31} & \omega_{32} & \omega_{33} \end{bmatrix} * \begin{bmatrix} \mu_t^{Fisc-Monet} \\ \mu_t^{Fisc-Camb} \\ \mu_t^{Monet-Camb} \end{bmatrix} \qquad \text{(A60)-(A62)}$$

In (A60)-(A62) the (cumulative) responses to the observed shocks are estimated in their reduced form: $\widehat{\psi}_{\infty} = \left(I - \widehat{A}_1 - \cdots - \widehat{A}_p\right)^{-1}$. The identification of the restrictions is specified in terms of the Matrix ω (basically they are coefficients zero). The restriction $\omega_{i,j} = 0$ symbolizes that the (cumulative) response of variable "i" does not respond to structural shock "j" in the long term (although there may be short-term effects). On the contrary, $\omega_{i,j} \neq 0$ implies a response of "i" against a structural shock "j" in the long term. In this way, the structural shocks resulting from the intersection in economic policy were determined.

VI SUMMARY OF THE DSGE-SVAR MODEL

There are 41 endogenous variables of the model:

$$\left\{ \begin{array}{c} C_t, M_t^d, \lambda_t, R_t^b, R_t, Y_t, K_t, L_t, r\,world_t, i_t, ifp_t, ifg_t, A_t, mc_t, P_t, W_t, \pi_t, Tax_t, S_t^{sav}, BALf_t, \\ BS_t \\ M_t,\ Oil_t,\ G_t, B_t, m_t^d, m_t^r, g_t^m, de_t, S_t^C, S_t^{tcr} \\ tb_t, ca_t, risk\ premium_t, S_t^{tb} \\ Interacc.Fis - Mon_t, Interacc.Fis - Camb_t, Interacc.Monet.-Camb._t, \varepsilon_{fm,t}, \varepsilon_{fc,t}, \varepsilon_{mc,t} \end{array} \right\},$$

With 12 stochastic processes:

Structural shocks at the intersection of economic policy

$$\mu_t^{Fisc-Monet}, \mu_t^{Fisc-Camb}, \mu_t^{Monet-Camb}$$

Control disturbances (frictions)

B.1 Internal

$$\epsilon_{A,t},\ \epsilon_{priv,t}$$

B.2 Productivity and savings-private investment.

B.3 Unidirectional internal policy

C. B.2 $\epsilon_{G,t}, \epsilon_{pm,t}, \epsilon_{m,t}, \epsilon_{pol.camb,t}$

Government spending, monetary growth, central bank interest rate, real exchange rate.

B.2 External

$\epsilon_{oil,t}, \epsilon_{tb,t}, \epsilon_{import,t}$

Oil revenues, trade balance and imports

According to the parameters:

$$\text{DSGE}\left[\begin{array}{c} \overline{r_{world}}, \overline{de_{bar}}, \beta, \varepsilon, \nu, \sigma_q, \alpha, \delta, \varrho^{priv}, \varrho^{gob}, \varphi, \gamma, \theta, , \tau_c, \tau_k, \tau_M, \xi, \vartheta, \psi, \psi', \\ \gamma_a, \gamma_b, E_r, f_t, f_s, r_e, \eta, \chi, s_y \\ \sigma_{fisc-mon}, \sigma_{fisc-Camb}, \sigma_{Mon-Camb}, \sigma_A, \sigma_G, \sigma_{pm}, \sigma_m, \sigma_{Oil}, \sigma_{import}, \sigma_{tb,} \sigma_{sav} \sigma_{tcr} \end{array} \right]$$

$$\text{AR}\left[\rho_{pm}, \rho_A, \rho_g, \rho_m, \rho_{sav}, \rho_{tcr}, \rho_{oil}, \rho_{import}, \rho_{tb}\right]$$

$$\text{VAR}\left[\phi_{11}, \phi_{12}, \phi_{13}, \phi_{21}, \phi_{22}, \phi_{23}, \phi_{31}, \phi_{32}, \phi_{33}\right]$$

$$\text{SVAR}[\omega_{11}, \omega_{21}, \omega_{22}, \omega_{31}, \omega_{32}, \omega_{33}]$$

Which satisfies 41 equations:

(A3) (A4) (A5) (A6) (A8) (A10) (A11) (A12) (A13) (A14)
(A21) (A22) (A26) (A27) (A28) (A29) (A30) (A31) (A32) (A33)
(A34) (A35) (A36) (A37) (A36) (A38) (A39) (A40) (A41) (A42)
(A43) (A44) (A45) (A46) (A56) (A57) (A58) (A59) (A60) (A61)
(A62)

VII THE STATIONARY STATE

Through the calibrated parameters of the model, there is a stationary state $(SS - SteadyState)$ of the main theoretical variables of the economy, recursively, considering the world interest rate, the working hours of families (1/3) and external indebtedness as exogenous assumptions.

$$r_{world_{ss}} = \overline{r_{world}} \quad (A63)$$

$$h_{ss} = 1/3 \quad (A64)$$

$$g_{ss} = \overline{g_{bar}} \quad (A65)$$

$$mc_{ss} = \frac{\varepsilon - 1}{\varepsilon} \quad (A66)$$

$$de_{ss} = \overline{de_{bar}} \quad (A67)$$

$$g_{m,ss} = \overline{g_{m,trim}} \quad (A68)$$

$$\pi_{m,ss} = \overline{\pi_{trim}} \quad (A69)$$

$$R_{ss} = [(1/\beta) - (1 - \delta)] \quad (A70)$$

$$k_{ss} = h_{ss} * \left[\frac{R_{ss}}{(\alpha * mc_{ss})^{\frac{1}{\alpha - 1}}}\right] \quad (A71)$$

$$y_{ss} = {k_{ss}}^{\alpha} {h_{ss}}^{1-\alpha} \quad (A72)$$

$$i_{ss} = \delta k_{ss} \quad (A73)$$

$$i_{priv_{ss}} = \varrho^{priv} i_{ss} \quad (A74)$$

$$i_{gob_{ss}} = \varrho^{gob} i_{ss} \quad (A75)$$

$$c_{ss} = y_{ss} - i_{priv_{ss}} - i_{gob_{ss}} - de_{ss} * r_{world_{ss}} - g_{ss} \quad (A76)$$

$$t_{ss} = y_{ss - i_{priv_{ss}} - i_{gob_{ss}} - c_{ss} - g_{ss}} \quad (A77)$$

$$w_{ss} = (1 - \alpha) * mc_{ss} * \frac{y_{ss}}{h_{ss}} \quad (A78)$$

Bayesian Calibration

Parameter	*Symbol*	*Priori*	*A posteri-ori Mean*	*Interval 90%*		*Distribution*	*Post. St. Dev.*
Capital Participation in Product	α	0.39	0.40	0.38	0.42	Beta	0.040
Subjective Discount Parameter	β	0.99	0.98	0.98	0.99	Normal	0.001
Capital Depreciation Rate	δ	0.03	0.03	0.02	0.03	Beta	0.003
Frisch Reverse Elasticity	υ	2.17	2.18	2.01	2.32	Normal	0.100
Money-utility Weighting	σ_q	1.32	1.30	1.23	1.34	Normal	0.050
Reverse Mark up	φ	6.00	6.01	5.87	6.15	Normal	0.100
Risk aversión	σ	2.00	2.09	1.86	2.32	Normal	0.200
Disutility of work	ψ	1.50	1.53	1.48	1.58	Normal	0.300
Price Rigidity Probability	θ	0.39	0.39	0.36	0.43	Normal	0.030
Marginal Savings Ratio	s_y	0.07	0.07	0.07	0.08	Normal	0.010
AR Term of Productivity	ρ_a	0.50	0.46	0.40	0.51	Normal	0.050
AR Term of Public Expenditure	ρ_g	0.50	0.49	0.43	0.56	Normal	0.050
Ar Term of Private Savings	ρ_{aho}	0.50	0.51	0.46	0.56	Normal	0.050

AR Term of Interest Rate	ρ_m	0.50	0.48	0.42	0.58	Normal	0.050
AR Term of Real Exchange Rate	ρ_{tcr}	0.50	0.47	0.42	0.55	Normal	0.050
AR Term of Oil Prices	ρ_{oil}	0.50	0.47	0.41	0.52	Normal	0.050
AR Term of Imports	ρ_{import}	0.50	0.50	0.43	0.58	Normal	0.050
AR Term of the Trade Balance	ρ_{tb}	0.50	0.49	0.42	0.61	Normal	0.050
MarsharII-Lerner Coefficient	η	0.48	0.49	0.46	0.52	Normal	0.020
Sensitivity Yt Gap - Int. Rate	γ_a	0.50	0.52	0.19	0.73	Normal	0.200
Sensitivity Inflation - Int. Rate	γ_b	1.50	1.65	1.22	1.97	Normal	0.300
Coefficient Public Indebtedness - Risk premium	ψ'	0.001	0.001	0.001	0.001	Normal	0.0001
Capital Adjustment cost	ξ	0.20	0.20	0.19	0.21	Beta	0.010
VAR Coefficient	ϕ_{11}	0.87	0.86	0.83	0.88	Normal	0.100
VAR Coefficient	ϕ_{12}	(0.33)	(0.34)	(0.37)	(0.30)	Normal	0.030
VAR Coefficient	ϕ_{13}	(0.07)	(0.08)	(0.09)	(0.07)	Normal	0.010
VAR Coefficient	ϕ_{21}	(0.10)	(0.10)	(0.12)	(0.09)	Normal	0.010
VAR Coefficient	ϕ_{22}	0.55	0.53	0.46	0.59	Normal	0.060
VAR Coefficient	ϕ_{23}	(0.14)	(0.14)	(0.18)	(0.12)	Normal	0.020
VAR Coefficient	ϕ_{31}	(0.11)	(0.11)	(0.12)	(0.10)	Normal	0.010
VAR Coefficient	ϕ_{32}	(0.07)	(0.07)	(0.08)	(0.05)	Normal	0.010
VAR Coefficient	ϕ_{22}	0.88	0.79	0.71	0.91	Normal	0.100
Coefficient SVAR	ω_{11}	0.62	0.64	0.57	0.75	Normal	0.070
Coefficient SVAR	ω_{21}	0.23	0.23	0.17	0.29	Normal	0.030
Coefficient SVAR	ω_{31}	(0.33)	(0.34)	(0.37)	(0.28)	Normal	0.030
Coefficient SVAR	ω_{32}	(0.34)	(0.34)	(0.38)	(0.30)	Normal	0.030
Coefficient SVAR	ω_{33}	0.26	0.26	0.23	0.29	Normal	0.020

Source: Own calculations based on data from the National Statistics Institute of Bolivia (INE)

Annex 2: SVAR Model Specification Tests

Annex 2A. Gap Selection Size

Lag	LogL	LR	FPE	AIC	SC	HQ
0	145.2632	NA	3.12E-06	-4.164476	-3.759685	-4.005008
1	304.1438	283.0061*	2.89e-08*	-8.848245*	-8.139862	-8.569177*
2	308.3362	7.074556	3.38E-08	-8.698005	-7.686029	-8.299337
3	312.0242	5.877842	4.02E-08	-8.532007	-7.216438	-8.013738
4	320.6983	12.87606	4.14E-08	-8.519008	-6.899846	-7.881139

*Indicates lag order selected by the criterion.
LR: Sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hanna-Quinn information criterion

Annex 2B. Granger's Causality Test

Sample 200Q1 2015Q4

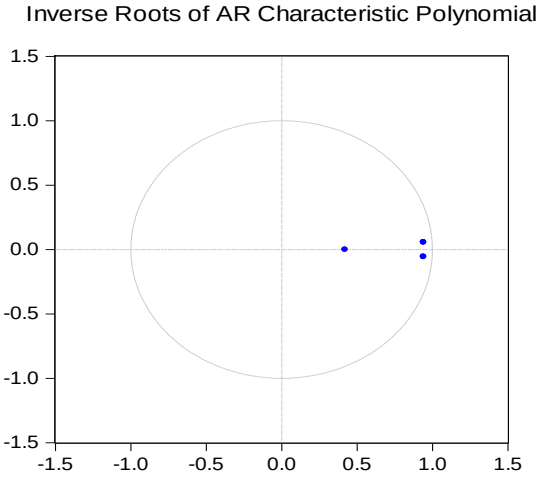
Dep. Var. Interaction Fiscal-Monetary		
Excluded	Chi-sq	*df*
Interaction Fiscal-Exchange	7.89***	1
Interaction Exchange-Monetary	0.74	1
Combined	7.89**	2
Dep. Var. Interaction Fiscal-Monetary		
Interaction Fiscal-Exchange	3.37*	1
Interaction Exchange-Monetary	4.03**	1
Combined	5.73*	2
Dep. Var. Interaction Fiscal-Monetary		
Interaction Fiscal-Exchange	6.94***	1
Interaction Exchange-Monetary	0.80	1
Combined	8.43**	2

Source: Own calculations based on data from the National Statistics Institute of Bolivia (INE)

Annex 2C. Multivariate Normality of Structural Residues SVAR

Component	*Asymmetry*	*Chi-sq*	*df*	*Prob*
1	0.43	2.01	1	0.16
2	0.38	1.53	1	0.22
3	0.64	4.33	1	0.04
Combined		7.87	3	0.05
Component	*Asymmetry*	*Chi-sq*	*df*	*Prob*
1	2.36	1.08	1	0.30
2	2.63	0.36	1	0.55
3	2.47	0.75	1	0.39
Combined		2.19	3	0.53
Component	*Jarque-Bera*		*df*	*Prob.*
1	3.08		2	0.21
2	1.89		2	0.39
3	5.08		2	0.08
Combined	10.05		6	0.12

Annex 2D. Inverse Ratios within the Unit Circle



Annex 2E. No Multivariate Serial Correlation

Lag	*LM-Stat*	*Prob.*
1	6.08	.073
2	2.90	.97

Source: Own calculations based on data from the National Statistics Institute of Bolivia (INE)